SoundEarth Strategies, Inc.
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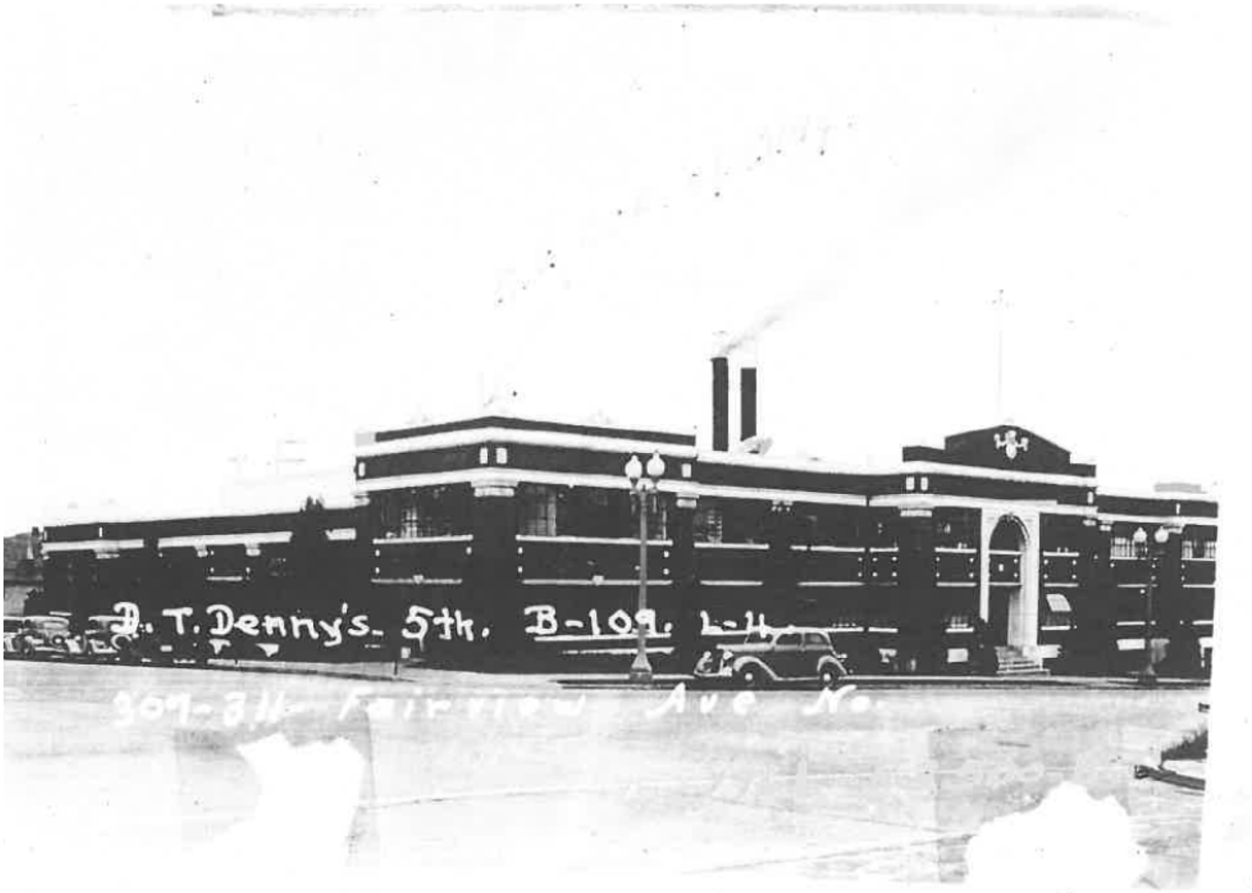
# DRAFT FEASIBILITY STUDY REPORT



**Property:**
Troy Laundry Property
307 Fairview Avenue North
Seattle, Washington

**Prepared for:**
Touchstone SLU LLC
2025 First Avenue, Suite 1212
Seattle, Washington

**Report Date:**
August 9, 2012

# Draft Feasibility Study Report

*Prepared for:*

**Touchstone SLU LLC**
2025 First Avenue, Suite 1212
Seattle, Washington 98121

Troy Laundry Property
307 Fairview Avenue North
Seattle, Washington 98121

Project No.: 0731-004

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| °F | degrees Fahrenheit |
| 1,2-DCE | 1,2-dichloroethelyne |
| µg/L | micrograms per liter |
| ARAR | applicable or relevant and appropriate requirement |
| AST | aboveground storage tank |
| bgs | below ground surface |
| BTEX | benzene, toluene, ethylbenzene, and total xylenes |
| CFR | Code of Federal Regulations |
| cis-1,2-DCE | cis-1,2-dichloroethylene |
| COC | chemical of concern |
| CSM | Conceptual Site Model |
| CVOC | chlorinated volatile organic compound |
| DHC | *Dehalococcoides* |
| DRPH | diesel-range petroleum hydrocarbons |
| Ecology | Washington State Department of Ecology |
| EDC | 1,2-dichloroethane |
| EOS | edible oil substrate |
| EPA | U.S. Environmental Protection Agency |
| ERH | electrical resistance heating |
| ESA | Environmental Site Assessment |
| FB | Friedman & Bruya, Inc. of Seattle, Washington |
| FS | feasibility study |
| GPR | ground-penetrating radar |
| GRPH | gasoline-range petroleum hydrocarbons |

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

| | |
|---|---|
| HSA | hollow-stem auger |
| LNAPL | light-non-aqueous phase liquid |
| Maryatt | Maryatt Industries |
| mg/kg | milligrams per kilogram |
| MTCA | Washington State Model Toxics Control Act |
| NCP | National Soil and Hazardous Substances Pollution Contingency Plan |
| NWTPH | Northwest Total Petroleum Hydrocarbon |
| O&M | operation and maintenance |
| ORPH | oil-range petroleum hydrocarbons |
| PAH | polycyclic aromatic hydrocarbons |
| PCE | tetrachloroethylene |
| PCU | Power Control Unit |
| PID | photoionization detector |
| PNOD | permanganate natural oxygen demand |
| PPP | public participation plan |
| the Property | 307 Fairview North, Seattle Washington |
| PVC | polyvinyl chloride |
| RAO | remedial action objective |
| RCRA | Resource Conservation and Recovery Act |
| RCW | Revised Code of Washington |
| REC | recognized environmental condition |
| RETEC | Remediation Technology |
| RI | remedial investigation |
| FS Report | Feasibility Study Report |

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

| | |
|---|---|
| ROW | right-of-way |
| SES | Sound Environmental Strategies Corporation |
| SI | subsurface investigation |
| the Site | soil, soil vapor, and/or groundwater contaminated with gasoline-, diesel-, and oil-range petroleum hydrocarbons; tetrachloroethylene; trichloroethylene; vinyl chloride; and/or cis-1,2-dichloroethylene beneath the Property and portions of the Boren Avenue North right-of-way. |
| SoundEarth | SoundEarth Strategies, Inc. |
| SPU | Seattle Public Utilities |
| SSI | supplemental subsurface investigation |
| SVE | soil vapor extraction |
| SVOC | semi-volatile organic compound |
| TCE | trichloroethylene |
| TEE | Terrestrial Ecological Evaluation |
| TMP | temperature monitoring points |
| Touchstone | Touchstone SLU LLC |
| TPH | total petroleum hydrocarbon |
| trans-1,2-DCE | trans-1,2-dichloroethylene |
| USGS | U.S. Geological Survey |
| UST | underground storage tank |
| UTS | Universal Treatment Standard |
| VI | vapor intrusion |
| VOC | volatile organic compound |
| WAC | Washington Administrative Code |

## EXECUTIVE SUMMARY

SoundEarth Strategies, Inc. has prepared this Draft Feasibility Study Report for the Troy Laundry Property located at 307 Fairview North in Seattle, Washington (the Property), on behalf of Touchstone SLU LLC. In accordance with the Washington State Model Toxics Control Act Regulation in Parts 120 and 350 of Chapter 340 of Title 173 of the Washington Administrative Code, Touchstone SLU LLC performed a remedial investigation sufficient to define the extent of contamination and characterize the Site (defined below) for the purpose of developing and evaluating cleanup action alternatives in this Draft Feasibility Study Report. Considerable effort was made between 2010 and 2012 to collect sufficient empirical data to define the extent of contamination in soil and groundwater. In areas where technical limitations were such that valuable empirical data could not be collected, a highly conservative modeling approach was selected and applied to Site-specific conditions, thereby providing worst-case scenarios for the extent of contamination and allowing for the development of cleanup alternatives that are protective of human health and the environment within a reasonable restoration time frame.

This Draft Feasibility Study Report was prepared under the authority of Agreed Order No. DE 8996 between Touchstone SLU LLC and Washington State Department of Ecology. The Draft Feasibility Study Report was developed to meet the general requirements of feasibility study as defined by the Washington State Model Toxics Control Act Regulation in Parts 350 through 390 of Chapter 340 of Title 173 of the Washington Administrative Code.

Based upon the findings of the investigations summarized herein, the Site includes soil, soil vapor, and groundwater contaminated with gasoline-, diesel-, and oil-range petroleum hydrocarbons; tetrachloroethylene; trichloroethylene; cis-1,2-dichloroethylene; and/or vinyl chloride beneath the Property, as well as beneath portions of the Boren Avenue North right-of-way. The impacts beneath the Site likely are associated with a release of chlorinated and Stoddard solvents from the industrial laundry and dry cleaning facility that operated on the Property from 1927 to 1985. The highest concentrations of chlorinated and Stoddard solvents are located in the center of the Property near the loading dock.

The Site is located on a topographically low-lying area within the downtown area of the City of Seattle. Elevations range from 68 feet (northwest corner of the Property) to 105 feet (southeast corner of the Property) above NAVD88 and slope toward the northwest. Lake Union is located approximately 0.4 miles to the north of the Site, and Elliot Bay is located approximately 1.5 miles to the west of the Site.

The Property was initially developed prior to 1893 with residences. Residences exclusively occupied the Property until 1925, when the David Smith building was constructed on the northwestern corner of the Property. The Troy Building was constructed between 1926 and 1927, and the Mokas Building was constructed in 1960. According to historical records, by 1948, the Property operated as one of the Pacific Northwest’s largest laundry and dry cleaning facilities. At least 15 underground storage tanks containing heating oil, fuel, and dry cleaning solvents, as well as several aboveground storage tanks containing propane, wash water, water-softening agents, dry cleaning solvents, and heating oil, were used on the Property.

Land use in the vicinity of the Property was primarily residential through the early 1900s, when the area transitioned toward commercial and light industrial use.

# EXECUTIVE SUMMARY (CONTINUED)

The results of previous subsurface investigations and the remedial investigation conducted at the Site suggest that the chlorinated solvent impacts confirmed in soil and groundwater beneath the Site are the result of a release from the laundry and dry cleaning facility that operated on the Property from 1927 through 1985. Although the type and location of dry cleaning operations conducted on the Property prior to 1964 could not be confirmed, historical building plans indicated that the bulk of the dry cleaning operations after the mid-1960s were conducted on the southwest portion of the Property. Consistent with this information, the highest concentrations of chlorinated solvents are located near the center of the Property by the loading dock.

Concentrations of tetrachloroethylene and its degradation products within the primary water-bearing zone, which is located at an approximate elevation of 16 feet above mean sea level, while above the applicable cleanup levels, are relatively low and fairly consistent across the Site. Tetrachloroethylene was detected in the monitoring well installed near the source area (MW11), as well as two of the wells completed within the Boren Avenue North right-of-way. Concentrations of cis-1,2-dichloroethylene were confirmed above the cleanup level only in deeper wells MW06 and MW09, and vinyl chloride was detected only in well MW06. Concentrations of trichloroethylene were detected above the cleanup level in groundwater samples collected from monitoring wells MW09 and MW12, which were screened 25 to 30 feet below the top of the primary water-bearing zone. The concentrations are consistent with those observed in other, shallower wells screened at the top of the primary water-bearing zone throughout the Site, and no chemical stratification is apparent.

Groundwater collected from the approximately 498-foot-deep supply well formerly located in the center of the Property did not contain detectable concentrations of chlorinated or Stoddard solvents. The results of sampling conducted at the well demonstrated that the deeper aquifer beneath the Site has not been impacted by a release from the former property operations.

The highest concentrations of tetrachloroethylene in soil are present beneath the center of the Property at depths ranging from 3 to 10 feet below ground surface. A very dense silt layer was encountered at depths between 12 and 20 feet below ground surface. The majority of the tetrachloroethylene contamination appears to be held up at the silt layer as evidenced by the significant drop in tetrachloroethylene concentrations within and beneath the silt (boring/sample P08-10 and P08-14). Considering the associated high concentration of tetrachloroethylene in the perched reconnaissance water sample collected from temporary boring B07 using push-probe technology, the presence of tetrachloroethylene as dense nonaqueous-phase liquid within the perched zone is probable.

Relatively consistent concentrations of tetrachloroethylene in soil appear to have migrated from the primary source area at the Property throughout the western half of the Property primarily through diffusion. Any migration upgradient of the source likely resulted from vapor-phase transport in the vadose zone over several years, as evidenced by the GORE Survey results and facilitated by the relatively loose sandy geology beneath those portions of the Site.

Tetrachloroethylene has migrated vertically through soil to depths of up to 65 feet below ground surface, or approximately 10 to 15 feet above the primary water-bearing zone, in the areas explored. Tetrachloroethylene contamination in soil extends east up to approximately the centerline of the Property, and it has migrated westerly up to the Property boundary. Based on the results of soil analytical data collected on and to the west of the Property, any soil contamination extending into the adjoining Boren Avenue North right-of-way is likely limited in extent.

The presence of a large development project, as well as both aboveground and belowground utilities, limited SoundEarth's ability to precisely define the exact western edge of groundwater contamination; however, data collected from wells completed along the west side of the Boren Avenue North right-of-way indicate that the concentrations of solvents in the groundwater are relatively low and limited in extent. To further validate this expectation, the Site data was input to a model that applied the most conservative, worst-case assumptions. As a result of the analysis, the contaminated groundwater plume extends a maximum of 40 feet up- to cross-gradient beneath the west-adjoining property. The remedial alternatives considered in this Draft Feasibility Study were designed to fully address this worst-case, maximum extent of groundwater contamination.

Gasoline-range petroleum hydrocarbons as Stoddard solvent were also observed in soil and groundwater beneath the Site. In all samples where concentrations of gasoline-range petroleum hydrocarbons exceeded the Washington State Model Toxics Control Act Method A cleanup level in soil and groundwater, chlorinated solvents were also present, indicating a similar historical use and/or storage of both chemicals.

Based on the results of the remedial investigation and completion of a conceptual site model, the feasibility study was conducted to develop and evaluate cleanup action alternatives that would facilitate selection of a final cleanup action for the Site in accordance with Part 350(8) of Chapter 340 of Title 173 of the Washington Administrative Code.

Three following cleanup alternatives were developed and evaluated in the course of this Feasibility Study:

- Cleanup Alternative 1—Excavation and Land Disposal of Soil with In Situ Chemical Oxidation of Groundwater
- Cleanup Alternative 2—Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater
- Cleanup Alternative 3—Excavation and Land Disposal of Soil with Electrical Resistance Heating and Vapor Extraction for Groundwater

The three alternatives differ only in the type of groundwater treatment technology. Due to the nature of the development plan, certain elements are common among all three cleanup alternatives. These common elements and assumptions include the following:

- Remediation Area. Essentially the entire Property will be excavated from lot-line to lot-line, as discussed in greater detail below. For the purposes of this feasibility study, the portions of the Property with soil containing concentrations of chemicals of concern in excess of their respective cleanup levels, which is a subarea within the Property boundaries, will be referred to as the Remediation Area. The Remediation Area is defined as the vertical and horizontal limit of the soil exhibiting contamination above cleanup levels within the Property boundary.

# EXECUTIVE SUMMARY (CONTINUED)

- Demolition. Because the remediation activities will be conducted as part of a larger redevelopment project, the alternatives discussed below assume that all buildings on the Property will be demolished prior to beginning shoring and excavation.
- Shoring. Shoring is required to protect the safety of personnel working in the excavation, as well as the surrounding properties, from damage due to slope failure. For the purpose of estimating the remedial cost for each alternative, it is assumed that shoring is a development-related cost and is therefore not included in the cost estimates provided in this report.

  For illustration purposes, it is anticipated that the shoring would be installed around the entire perimeter of the redevelopment. Footing drains will be completed along the exterior perimeter of the foundation to collect any groundwater that may come into contact with the structure; however, considering the anticipated depth of the shoring and excavation project (approximately 18 feet above NAVD88), and the primary water-bearing zone relative to the depth of the excavation (approximately 2 feet below the final grade), any groundwater collected at the footing drains is likely to be limited in volume.

  Excavation. The costs for each alternative include the removal and disposal of all soil within the Remediation Area to a maximum elevation of 19 feet above NAVD88 in accordance with a contained-in determination from the Washington State Department of Ecology. Although cleanup levels protective of direct contact are proposed for soil across the Site, on-Property soil containing known concentrations of tetrachloroethylene above the Model Toxics Control Act Method A cleanup levels will be overexcavated in an effort to remove the on-going source of contamination to groundwater.

  The Remediation Area covers approximately 1 acre of land. Assuming a remedial excavation depth of 19 feet above NAVD88, the volume of soil within the Remediation Area is approximately 97,540 tons. Based on soil analytical data collected through the remedial investigation phase of work, approximately 340 tons of soil would require land disposal as dangerous waste classified as U.S. Environmental Protection Agency Waste Code F002. The balance of the excavated material (approximately 97,200 tons) would be managed as nondangerous waste under a Contained-In Determination and contingent management option as determined by Washington State Department of Ecology. Soil will be excavated within the confines of the shoring as designed by the civil engineer and directly loaded into trucks for off-Property treatment and land disposal in accordance with the Contained-In Determination.
- Dewatering. As the excavation proceeds, it may encounter the discontinuous but contaminated perched groundwater that was observed near the center of the Property. The perched groundwater appears to be associated with a small vegetated slope that facilitates localized recharge. The excavation will be coordinated to address the center of the source area first in an effort to segregate the dangerous waste and remove the contaminated perched water prior to excavating through the underlying dense silt layer.
- Passive Vapor Mitigation. Each alternative includes the construction of a belowground concrete parking garage structure with an associated venting system. The removal of all soil contamination via excavation, the substantial thickness of the proposed foundation, as well as the belowground structure and venting system, will mitigate the potential for intrusion and/or collection of unsafe levels of chemicals of concern vapors into the parking garage and above-

grade building. In addition, the foundation floor and walls will be constructed of concrete to act as a barrier to recontamination via vapor and groundwater seepage.

- Natural attenuation of residual concentrations of chlorinated solvents in groundwater located within and beyond the active treatment area. While the active groundwater treatment area was designed to include the worst-case, maximum extent of the plume, natural attenuation would effective address any residual contamination located beyond and within the proposed conditional points of compliance. In accordance with the Washington State Model Toxics Control Act Regulation in Part 370 of Chapter 340 of Title 173 of the Washington Administrative Code, natural attenuation is an appropriate supplement to the active treatment approach for the following reasons: source control (excavation) will be conducted to the maximum extent practicable, the concentrations and locations of the contaminated groundwater do not pose an unacceptable risk to human health or the environment, and there is evidence that natural biodegradation is occurring and will continue to occur (and will increase following complete removal of the source area via excavation and implementation of active groundwater treatment) at a reasonable rate. In addition, the zone where natural attenuation will, if necessary, supplement active groundwater treatment is up- and cross-gradient of the treatment area (south and west of the proposed conditional points of compliance), and any generated cis-1,2-dichloroethylene and vinyl chloride would ultimately be consumed within the anaerobic dechlorination zone. If required to validate this assumption, empirical data will be collected via drawdown of the wells established as the points of compliance and quantitative laboratory analysis of extracted groundwater within the measured cone of depression.

Based on the results of the feasibility study, Cleanup Alternative 2 (Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater) is the recommended alternative for the Site because it ranks comparatively high in environmental benefit and is both technically feasible and cost effective. Cleanup Alternative 2 satisfies requirements of the Model Toxics Control Act and significantly reduces risk from contamination to the maximum extent practicable by using in situ treatment to reduce groundwater contamination within the active groundwater treatment area, which was designed to include the worst-case, maximum extent of the plume, to proposed cleanup levels fairly quickly following complete removal of all contaminated soil from the Site.

Cleanup Alternative 2 addresses the chemicals of concern at the Site in the media of concern: soil gas, soil, groundwater, surface water, and indoor air. Cleanup Alternative 2 is protective of the indoor air inhalation pathway and of direct contact exposure (dermal contact, ingestion) with soil and with groundwater. Excavation of the source area, subsequent active remediation of the contaminated groundwater, and coincident implementation of a groundwater treatment barrier between the source area and off-Property portions of the Site demonstrates that Cleanup Alternative 2 is also protective of groundwater and surface water. Elements of Cleanup Alternative 2 would be conducted in conjunction with redevelopment of the Property.

This executive summary is presented solely for introductory purposes, and the information contained in this section should be used only in conjunction with the full text of this report. A complete description of the project, Site conditions, investigative methods, and investigation results is contained within this report.

## 1.0 INTRODUCTION

SoundEarth Strategies, Inc. (SoundEarth, formerly Sound Environmental Strategies [SES]) has prepared this Draft Feasibility Study (FS) Report (FS Report) for the Troy Laundry Property located at 307 Fairview Avenue North in Seattle, Washington (the Property). The location of the Property is shown on Figure 1. This Draft FS Report was prepared under the authority of Agreed Order No. DE 8996 between Touchstone SLU LLC (Touchstone) and the Washington State Department of Ecology (Ecology) following the completion of an remedial investigation (RI) substantially equivalent to the Washington State Model Toxics Control Act (MTCA) regulation (SoundEarth 2012). In accordance with Parts 120 and 350 of Chapter 340 of Title 173 of the Washington Administrative Code (WAC 173-340-120[4][a] and 173-340-350[6]), Touchstone has performed an RI sufficient to define the extent of contamination and characterize the Site (defined below) for the purpose of developing and evaluating cleanup action alternatives. Considerable effort was made between 2010 and 2012 to collect sufficient empirical data to define the extent of contamination in soil and groundwater. In areas where technical and physical limitations were such that valuable empirical data could not be collected, a highly conservative modeling approach was selected and applied to Site-specific conditions, thereby providing worst-case scenarios for the extent of contamination and allowing for the development of cleanup alternatives that have been designed to address the worst-case scenarios as described within this Draft FS report, which was developed to meet the requirements defined by WAC 173-340-350 and 173-340-360.

Touchstone understands that, according to WAC 173-340-350(6), the scope of a remedial investigation/feasibility study varies from site to site, depending on the informational and analytical needs of a specific facility. This requires that the process remain flexible and be streamlined when possible to avoid the collection and evaluation of unnecessary information so that the cleanup can proceed in a timely manner. Exclusive of the high costs associated with overcoming the technical and physical limitations, attempting to do so would not meet the data quality objectives of the project (i.e., no access to meaningful drilling locations) beyond what has already been achieved and would delay the project sufficient to prohibit the completion of both the proposed cleanup activities and subsequent redevelopment, thereby contributing to ongoing, undue exposure risks to human health and the environment. In cases such as this, MTCA affords the option of flexibility to ensure that the cleanup action can occur.

As discussed in the Draft RI Report (SoundEarth 2012) and below, the Site is defined by the full lateral and vertical extent of contamination that has resulted from the former operation of a dry cleaning facility on the Property. Based on the information gathered to date, the Site includes soil, soil vapor, and/or groundwater contaminated with gasoline-, diesel-, and oil-range petroleum hydrocarbons (GRPH, DRPH, and ORPH, respectively); tetrachloroethylene (PCE); trichloroethylene (TCE); vinyl chloride; and/or cis-1,2-dichloroethylene (cis-1,2-DCE) beneath the Property and portions of the Boren Avenue North right-of-way (ROW) (Figure 2).

### 1.1 PUBLIC PARTICIPATION

Consideration of public concerns is mandated under the MTCA cleanup regulation for an Ecology-led or potentially liable person-led cleanup action under an Agreed Order. A public participation plan (PPP) will be prepared by Touchstone and Ecology prior to finalizing this FS Report. The PPP will describe the activities conducted at the Site. The public has the opportunity to provide comments on the work performed to date and the proposed final cleanup action in accordance with WAC 173-340-600. The typical comment period is 30 days, unless otherwise determined by Ecology.

## 1.2 DOCUMENT PURPOSE AND OBJECTIVES

The purpose of the FS Report is to develop and evaluate remedial alternatives for the Site and to select the most appropriate alternative based on future land use and the evaluation criteria listed below. According to MTCA, a cleanup alternative must satisfy all of the following threshold criteria as specified in WAC 173-340-360(2):

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

While these criteria represent the minimum standards for an acceptable cleanup action, WAC 173-340-360(2)(b) also recommends that the selected cleanup action:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration time frame.
- Consider public concerns on the proposed cleanup action alternative.

This FS Report is organized into the following sections:

- **Section 2.0, Background.** This section provides a description of the Site features and location; a summary of the current and historical uses of the Site and adjoining properties; and a description of the Site's environmental setting, including the local meteorology, geology, and hydrology.
- **Section 3.0, Previous Investigations.** This section provides a description of the sampling conducted at the Site between 1985 and 2011. Included is an outline of the field work performed, as well as a discussion of the findings, conclusions, and remaining data gaps following completion of each phase of investigation.
- **Section 4.0, Interim Remedial Action.** This section provides a summary of the interim remedial action that has been conducted at the Site, including the objectives of the action, the chemicals and media addressed by the action, and the results obtained through October 2011.
- **Section 5.0, Summary of the Remedial Investigation.** This section summarizes the scope of work, results, findings, and conclusions of the RI conducted at the Site in September and October 2011.
- **Section 6.0, Conceptual Site Model.** This section provides a summary of the conceptual site model (CSM) derived primarily from the results of the historical research and SIs performed at the Site. Included is a discussion of the confirmed and suspected source areas, the chemicals and media of concern, the fate and transport characteristics of the release of hazardous substances, and the potential exposure pathways.
- **Section 7.0, Technical Elements.** The section summarizes technical elements, including applicable or relevant and appropriate requirements (ARARs), chemicals of concern (COCs), media of concern, and proposed cleanup standards.

- **Section 8.0, Feasibility Study.** This FS includes screening of potentially feasible remedial technologies and development of cleanup alternatives intended to achieve the objectives described in Section 7.0. The cleanup alternatives are evaluated with respect to threshold and other requirements for cleanup actions set forth in MTCA. The FS evaluates the alternatives and identifies those that are not effective, not technically possible, or whose costs are disproportionate under the provisions of WAC 173-340-360(3)(e), and the FS provides the basis for identifying a preferred cleanup alternative.
- **Section 9.0, Preferred Cleanup Alternative.** This section summarizes the findings of the FS and identifies the preferred cleanup alternative based on technical feasibility, effectiveness, protectiveness, and cost.
- **Section 10.0, Bibliography.** This section lists sources used to create this FS Report.
- **Section 11.0, Limitations.** This section discusses document limitations.

# 2.0 BACKGROUND

This section provides a description of the Site features and location; a summary of historical Site use; and a description of the local geology, hydrology, and land use pertaining to the Site. Historical documentation referenced in this section is provided in the Draft Remedial Investigation Report (SoundEarth 2012).

## 2.1 SITE LOCATION AND DESCRIPTION

The Site is comprised of two tax parcels and a portion of the Boren Avenue North ROW in the South Lake Union neighborhood of Seattle, Washington (Figure 1). The Site is defined by the extent of contamination caused by the releases of hazardous substances at the Property, as discussed in Section 1.0 above.

The Property and adjoining properties, including the ROW, affected by the release(s) from the Property are described in the following subsections and presented on Figure 2.

### 2.1.1 The Property

The Property is comprised of two tax parcels (King County parcel numbers 198620-0480 and -0515) that cover approximately 108,571 square feet (2.5 acres) of land. The Property is listed as 307 Fairview Avenue North in Seattle, Washington. Touchstone currently owns the Property.

The Property is improved with three buildings. The 1925-vintage, single-story masonry warehouse building listed at 334 Boren Avenue North (David Smith Building) is used as a sales floor and storage for David Smith Antiques, a home furnishings retailer and wholesaler. The masonry-framed structure has a tar and gravel roof and is heated by space heaters.

The original 1927-vintage building at 307 Fairview Avenue North (Troy Building) is presently used as storage space for Integrity Interior Solutions, as well as storage for David Smith Antiques. The current, expanded structure was formerly the main location of the Troy Laundry and commercial dry cleaning operations. The masonry-framed structure has a tar and gravel roof and is heated by a hot water furnace. Troy Building additions, which were constructed between 1943 and 1966, were formerly used for industrial laundry, fur storage (Fur Vault), a tumbling and cleaning area on the western portion of the Property, and a two-story reinforced concrete parking garage on the southwestern portion of the Property. The reinforced concrete structure is heated using space heaters.

The 1960-vintage, single-story masonry-framed structure located at 329 Fairview Avenue North (Mokas Building) is currently occupied by Mokas Café and Coffee Bar.

Potable water and sewer service are provided to the Property by Seattle Public Utilities. According to side sewer cards maintained by the Seattle Engineering Department, the sanitary sewer was initially connected to the Property between 1899 and 1903. Puget Sound Energy provides natural gas and Seattle City Light provides electricity to the Property. Solid waste disposal and recycling services are provided by CleanScapes.

Property features are presented in plan view on Figure 3.

### 2.1.2 West-Adjoining Property

The west-adjoining property, located across the Boren Avenue North ROW at 301 and 345 Boren Avenue North, includes three tax parcels (King County parcel numbers 198620-0410, 198620-0418, and 198620-0420) that cover approximately 42,890 square feet (0.98 acres). A mixed-use development occupies the superblock bound by Terry and Boren Avenues North, and Harrison and Thomas Streets. The development was constructed in 2010 and includes two 12-story office/retail buildings and a 6-story underground parking garage, known as the Phase IV Buildings for the Amazon headquarters. Approximately half of this development extends farther west beyond the west-adjoining property. City Place IV LLC is the current owner of the west-adjoining property.

### 2.1.3 Boren Avenue North Right-of-Way

According to City of Seattle's Arterial Classifications Zoning Map, the ROW is zoned as an access street. Boren Avenue North is recently paved with concrete panels and runs north-south. The ROW is comprised of two through lanes and parallel parking lanes on the west and east sides.

## 2.2 LAND USE HISTORY OF THE SITE

The historical usage of each affected property, as defined in Section 2.1, is briefly summarized in the following subsections. A more detailed discussion, as well as selected aerial photographs, available King County Archived Records, City of Seattle archived building permit files, and files provided by the former Property owner (Seattle Times) are provided in the Draft Remedial Investigation Report (SoundEarth 2012). Relevant historical features of the Property are depicted on Figures 3 and 4.

### 2.2.1 The Property

The Property was initially developed prior to 1893 with residences. Residences exclusively occupied the Property until 1925, when the David Smith building was constructed on the northwestern corner of the Property. The Troy Building was constructed between 1926 and 1927 and expanded in the 1940s and the 1960s. The Mokas Building was constructed in 1960. According to historical records, by 1948, the Property operated as one of the Pacific Northwest's largest laundry and dry cleaning facilities. At least 15 underground storage tanks (USTs) containing heating oil, fuel, and dry cleaning solvents, as well as several aboveground storage tanks containing propane, wash water, water-softening agents, dry cleaning solvents, and heating oil, were used on the Property. The dry cleaning and laundry facility was decommissioned in 1985, when the Property was sold to the Seattle Times. During site closure, most of the associated fixtures and waste material were removed from the Property and at least eight USTs were closed in place. Many of the USTs appear to have been removed after 1985, although the dates of their removal could not be confirmed. Seattle Times sold the Property to Touchstone in 2011. Current and historical Property features are presented on Figure 3.

### 2.2.2 West-Adjoining Property

The west-adjoining property was originally occupied by residences until around 1906, when a Feather Mill was constructed on the southern parcel of the property and then was subsequently used as a metal cleaning shop. The remaining residences were demolished by 1951, and the property was redeveloped with warehouses. All aboveground structures were demolished by 2009. The property was subsequently excavated and the existing Amazon Phase IV building, which includes six floors of belowground parking, was constructed on the property by 2010. No evidence of any releases of solvents to soil or groundwater was reported during due diligence or construction activities.

### 2.2.3 Boren Avenue North

Boren Avenue North was constructed prior to 1893 as an ungraded dirt road. Between 1893 and 1920, the ROW was regraded to elevations above the surrounding properties, sidewalks were constructed, and the street was paved with concrete. The ROW remained relatively unchanged until between 2007 and 2010, when Boren Avenue North was narrowed and repaved with concrete.

## 2.3 FUTURE LAND USE

The Property will be redeveloped into two 12-story office towers. The project will include the construction of a mixed-use development that will extend lot-line to lot-line. Development plans include two multi-story towers that have approximately 770,000 square feet of office space, 30,000 square feet of retail space, and belowground parking to accommodate up to 1,100 vehicles. The development also includes approximately 1 acre of public open space between the two towers.

SoundEarth reviewed available online permit information for the Property and adjoining properties; the records did not indicate any permitted future land development projects. SoundEarth is unaware of any future land use plans for the adjoining properties or ROWs.

## 2.4 ENVIRONMENTAL SETTING

This section provides a summary of the environmental setting of the Site.

### 2.4.1 Meteorology

Climate in the Seattle area is generally mild and experiences moderate seasonal fluctuations in temperature. Average temperatures range from 60s in the summer to 40s in the winter. The warmest month of the year is August, which has an average maximum temperature of 74.90 degrees Fahrenheit (°F), while the coldest month of the year is January, which has an average minimum temperature of 36.00 °F.

The annual average rainfall in the Seattle area is 38.25 inches, with the wettest month of the year being December, when the area receives an average rainfall total of 6.06 inches (IDcide 2011).

### 2.4.2 Topography

The Site and vicinity lie within the Puget Trough or Lowland portion of the Pacific Border Physiographic Province (USGS 2011). The Puget Lowland is a broad, low-lying region situated between the Cascade Range to the east and the Olympic Mountains and Willapa Hills to the west. In the north, the San Juan Islands form the division between the Puget Lowland and the Strait of Georgia in British Columbia. The province is characterized by roughly north-south-oriented valleys and ridges, with the ridges that locally form an upland plain at elevations of up to about 500 feet above sea level. The moderately to steeply sloped ridges are separated by swales, which are often occupied by wetlands, streams, and lakes. The physiographic nature of the Puget Lowland was prominently formed by the last retreat of the Vashon Stade of the Fraser Glaciation, which is estimated to have occurred between 14,000 and 18,000 years before present (Waitt Jr. and Thorson 1983).

The Site is located on a topographically low-lying area within the downtown area of the City of Seattle. Elevations range from 68 feet (northwest corner of the Property) to 105 feet (southeast corner of the Property) above mean sea level and slope toward the northwest (King County iMAP 2011b). Lake Union is located approximately 0.4 miles to the north of the Site, and Elliot Bay is located approximately 1.5 miles to the west of the Site (USGS 1983).

### 2.4.3 Groundwater Use

An approximately 498-foot-deep groundwater supply well historically operated on the Property in the vicinity of the water softening equipment in the Troy Building (Figure 3). This well was used to supply the laundry facility with water used in cleaning operations on the Property and was never used as a potable water source. After groundwater samples were collected and analyzed from the well to verify that the deeper aquifer was free from contamination, the supply well was decommissioned by Richardson Well Drilling of Puyallup, Washington, on July 26, 2011.

According to the Ecology Water Well Logs database (Ecology 2011c), two water supply wells are located at 100 Fourth Avenue North, approximately 0.6 miles east-southeast of the Site. The two supply wells were installed on the property owned by Fisher Broadcasting in 1999 and 2001. The wells were drilled to depths of 148 and 155 feet below ground surface (bgs). Each well was fitted with 10 feet of screen from the well bottom. These water supply wells encountered static water levels between 77 and 80 feet bgs, but appear hydrologically cross-gradient from the water-bearing zone encountered in the monitoring wells installed at the Site. The purpose of the wells is unknown, but it is unlikely that they are presently used as a potable water source.

Seattle Public Utilities (SPU) provides the potable water supply to the City of Seattle. SPU’s main source of water is derived from surface water reservoirs located within the Cedar and South Fork Tolt River watersheds. According to King County’s Interactive Map for the County’s Groundwater Program, there are no designated aquifer recharge or wellhead protection areas within several miles of the Site.

## 2.5 GEOLOGIC AND HYDROGEOLOGIC SETTING

The following sections summarize the geologic and hydrogeologic conditions encountered beneath the Site.

### 2.5.1 Site Geology

Based on the results of the investigations summarized in later sections of this report, subsurface soil beneath the site consists primarily of Vashon-age glacial deposits, pre-Fraser nonglacial deposits, and possible pre-Fraser glacial deposits. The locations of the borings and wells advanced at the Site are shown in Figure 5. Cross-sections depicting subsurface soil characteristics and geologic units encountered in the explorations are presented as Figures 6 and 7. Detailed boring logs with well construction details are included as Appendix E of the Draft RI Report (SoundEarth 2012).

The subsurface soil beneath the Site is interpreted to consist of the following geologic units from youngest to oldest: Vashon recessional outwash deposits; ice-contact deposits of either Vashon age or pre-Fraser age; and pre-Fraser nonglacial deposits. These units are described in the following sections.

#### 2.5.1.1 Vashon Recessional Outwash (Qvr)

Vashon recessional outwash deposits were encountered in many of the explorations located in the western and northern portions of the Site. The recessional outwash consists primarily of loose to medium dense, gray to brown, poorly-graded fine to medium-grained sands and sands with silt, with varying amounts of gravel. Intervals of silty sand and silt of varying thicknesses were observed throughout several of the borings advanced at the Site. Discontinuous deposits of dense to very dense gravel and sand with gravel were also encountered.

The recessional outwash deposits were encountered at the surface in borings located in the central, northern, and western portions of the Site, with thicknesses ranging from less than 10 feet to about 50 feet. The extent and thickness of the recessional outwash deposits appear to define a pre-existing northeast-southwest oriented erosional surface or channel located along the western margin of the Property. The recessional outwash deposits are absent at the surface along the eastern margin of the Site and increase in thickness along the western and northwestern portions of the Site (Figures 6 and 7).

#### 2.5.1.2 Ice-Contact Deposits (Qi)

The dense to very dense, predominantly poorly-graded silty fine sands with varying gravel contents encountered above the pre-Fraser nonglacial deposits in the southern and eastern portions of the Site are interpreted to be ice-contact deposits (Figures 6 and 7). The ice-contact deposits were encountered at the surface, or immediately beneath a thin layer of recessional outwash deposits, and overly the pre-Fraser nonglacial deposits. The ice-contact deposits ranged from about 10 to 25 feet thick, where encountered, in the borings located along the northern and eastern margins of the Site.

The corresponding age for these deposits could not be confirmed using the available subsurface data. Associated Earth Sciences, Inc., the geotechnical consultant for Touchstone, observed that some of the samples of the ice-contact deposits were effervescent in hydrochloric acid, which is often indicative of a pre-Fraser age for ice-contact deposits or glacial till.

#### 2.5.1.3 Pre-Fraser Nonglacial Deposits (Qpfa)

A thick sequence of undifferentiated pre-Fraser deposits, interpreted to consist primarily of nonglacial alluvial deposits, was encountered beneath the recessional outwash and ice-contact deposits (Figures 6 and 7). The soil associated with the nonglacial alluvial deposits consists of very dense/hard, light brown to gray-brown, predominantly poorly-graded fine to medium sands and sands with silts interbedded with silty fine sands. The gravel content in the samples was highly variable, with some discontinuous layers of gravel with sand. The color of these deposits is typically brown to light brown or gray-brown, with distinct, localized horizons of reddish-brown oxidation that are semi-continuous across the Site. The physical characteristics observed in the samples indicate that individual layers within these pre-Fraser nonglacial deposits are discontinuous and grade laterally within specific depth intervals across the Site (Figures 6 and 7).

A bed of dark brown to orange to reddish brown silt and silty sand, with local organic-rich zones, was encountered at or near the top of the nonglacial deposits. This layer of organic-rich silt/silty sand is semi-continuous across the Site and appears to mark the interface with the overlying ice-contact or recessional outwash deposits.

The pre-Fraser deposits are at least 80 feet thick beneath the southern portion of the Site. The thickness decreases toward the north and northwest, corresponding to the increased thickness of the overlying recessional outwash deposits (Figure 7). The pre-Fraser nonglacial deposits extend to depths greater than about -21 feet NAVD88 based on the maximum depth explored (boring B31).

### 2.5.2 Site Hydrology

Two water-bearing zones were encountered in the Site explorations and are discussed below. Considering the significant elevation changes—and associated relative depths bgs—across the Site, discussions regarding elevation and depth are presented in elevations above NAVD88.

#### 2.5.2.1 Perched Interval

An upper discontinuous water-bearing zone, referred to as the perched interval, was encountered in only four of the 59 borings advanced at the Property and is generally associated with coarser permeable zones overlying the uppermost dense silt layer in the pre-Fraser nonglacial deposits at elevations of approximately 75 feet above NAVD88. Recharge to the perched interval likely occurs within the vegetated slope in the center of the Property, the bottom elevation of which is similar to the elevation of the perched water encountered during drilling.

#### 2.5.2.2 Primary Water-Bearing Zone

A deeper continuous water-bearing zone, referred to as the primary water-bearing zone, occurs within the recessional outwash deposits and the pre-Fraser nonglacial deposits. The primary water-bearing zone comprises the water table aquifer beneath the Property at elevations ranging from 15.5 to 16 feet above NAVD88 and beneath the Site at elevations of ranging from 15.5 to 18 feet above NAVD88, and it extends to the maximum depth explored. The bottom of the primary water-bearing zone was not encountered in the explorations, although a silt-rich zone was observed at the bottom of monitoring wells MW08, MW09, and MW12, which were screened 30 to 35 feet below the water table.

Synoptic depth-to-water measurements for the primary water-bearing zone were collected on May 25, 27, and 31, 2011, and October 20, 2011. Groundwater contour maps for these two monitoring episodes are presented as Figures 8 and 9.

The general direction of groundwater flow in the primary water-bearing zone was toward the southeast (Figures 8 and 9), although the water table is relatively flat beneath much of the Site. In October 2011, groundwater elevations ranged from 15.59 to 15.87 feet above NAVD88 across the Site, except in the vicinity of wells MW01, MW04, and MW07, which are located at the northwestern corner of the Site (Figure 9). These three monitoring wells, whose groundwater elevations ranged from 17.65 to 17.87 feet above NAVD88, are screened within the saturated interval of the permeable recessional outwash deposits; the remaining wells appear to be screened within the pre-Fraser non-glacial deposits. Elevated water levels within the recessional outwash are interpreted to indicate a transient condition of preferential recharge through the recessional outwash deposits, which is likely more permeable than the adjacent and underlying pre-Fraser nonglacial deposits in which the remaining wells are screened.

While groundwater gradients across the Site were measured to be approximately 0.005 feet per foot toward the southeast during the October 2011 monitoring event, higher gradients of about 0.022 to 0.018 feet per foot were observed in the recessional outwash deposits in the northwestern portion of the Site in May and October 2011, respectively (Figures 8 and 9). Excluding groundwater elevations measured in MW01, MW04, and MW07, the groundwater gradient across the Site is essentially flat (approximately 0.0005 feet per foot toward the southeast).

A slight downward vertical gradient of approximately 0.005 feet per foot in the pre-Fraser nonglacial deposits is indicated by the water levels measured in wells MW06 and MW12, which were completed approximately 10 feet apart at two different depth intervals within the primary water-bearing zone.

## 3.0 PREVIOUS INVESTIGATIONS

The following subsections summarize the results of previous investigations conducted at the Site. Sample locations and relevant Property features are presented on plan view on Figure 5. Analytical results are presented in plan and cross section view in Figures 10 through 16.

### 3.1 1986 SEATTLE CLOSURE REPORT

Seattle Times prepared a Closure Report to document the decommissioning of the former dry cleaning facility in accordance with Washington's Dangerous Waste Standards for facility closure and post-closure, as described under WAC 173-303-610(a). The purpose of the report was to describe the methods Seattle Times would use to remove or decontaminate the dangerous waste that remained on the Property as a result of the former dry cleaning and laundry operations (Appendix D of the Draft RI Report, SoundEarth 2012).

The report identified the following chemicals stored on the Property: Stoddard solvents, wastewater and sludge, gasoline, and heating oil. At the time the report was prepared, approximately 5,000 gallons of new and used Stoddard solvents were pumped from the four solvent USTs. The interior USTs were filled with sand and closed in place and the exterior 8,000-gallon UST was removed in 1985.

The concrete floors on both the first (basement) and second stories of the Troy Building contained shallow drainage channels. These channels were used as catchments for fresh water when the Property operated as a dry cleaner and were reportedly connected to a separator pit. Both the first- and secondstory channels were sampled. The first-story channels contained dangerous waste residue. The channels were reportedly cleaned and the hazardous material was disposed of at an approved facility.

In addition, the following storage vessels were sampled and/or decommissioned as part of the facility closure:

- Two concrete pits. The first concrete pit was presumably the pit that formerly housed the pressurized water tank and contained standing water. The second concrete pit was a separator pit that was used as a laundry wastewater pit and that contained standing water and solid residue. The results of analytical testing indicated that the water present in both pits was not considered dangerous waste and could be disposed of into the sewer system. The solid residue within the separator pit was determined to be nonhazardous and was disposed of at a landfill.
- A sump, presumably the 6-foot-deep sump inside the 1964-vintage garage addition. The sump contained an oily residue that was sampled and determined to be a “toxic dangerous waste.” The sump and its associated piping were reportedly cleaned and the hazardous material disposed of at an approved facility. The sump was subsequently checked for leaks by Northwest Enviroservices, who reportedly confirmed that no leaks were present.
- A fiberglass aboveground storage tank (AST) measuring 12 feet in diameter and 6 feet tall. At the time the Closure Report was prepared, the AST contained approximately 5,000 gallons of metal-contaminated water and sludge. The AST was reportedly accepted for disposal at IPEC International of Vancouver. The report did not specify where the AST was located.
- Four USTs. Maryatt Industries (Maryatt) decommissioned two 12,000-gallon USTs and one 1,000-gallon UST containing heating oil, which were located in the parking lot to the north of the boiler room; Maryatt also decommissioned an 8,000-gallon UST containing gasoline, located in the parking lot of the Mokas building.

Because no evidence of leaks was observed during the decommissioning of the USTs, ASTs, or sumps discussed above, the report concluded that it was unlikely that a release to the subsurface had occurred; therefore, soil and groundwater sampling was unwarranted. A June 25, 1986, letter from Ecology concurred with the report’s conclusions.

**Data Gaps.** No soil or groundwater samples were collected to evaluate whether former dry cleaning operations conducted at the Property had resulted in impacts to the subsurface.

### 3.2 1994 RETEC GROUNDWATER SUPPLY WELL SAMPLING

In October 1994, Remediation Technology (RETEC) sampled the groundwater supply well located inside the Troy Building. The purpose of the sampling event was to evaluate if the well was acting as a conduit for contamination into the subsurface. Prior to purging, water was observed at a depth of 73 feet below the top of the well casing, which extended approximately 1.5 feet above the floor of the building. The total depth of the well was measured at approximately 490 feet bgs. RETEC purged approximately 2,450 gallons of groundwater from the well at a rate of 3.5 gallons per minute. The purge water was discharged through a floor drain at the Property. At the time of sampling, pH was measured to be 9.88. The groundwater sample was submitted to the laboratory for analysis of volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); total petroleum hydrocarbons (TPH); metals, including arsenic, barium, cadmium, chromium, lead, selenium, silver; and polycyclic aromatic hydrocarbons (PAHs).

**Groundwater Results.** Concentrations of the VOCs, SVOCs, and PAHs were below the applicable 1989 MTCA Method A Cleanup Levels. A concentration of TPH of 420 micrograms per liter (µg/L) exceeding the 1989 MTCA Method A cleanup level was detected in the groundwater sample.

**Data Gaps.** Analytical methods and MTCA cleanup levels have since been modified.

## 3.3 2010 PHASE I ENVIRONMENTAL SITE ASSESSMENT

SoundEarth conducted a Phase I Environmental Site Assessment (ESA) of the Property in 2010 (SES 2010a). The purpose of the Phase I ESA was to identify recognized environmental conditions (RECs) associated with the use, manufacture, storage, and/or disposal of hazardous or toxic substances at the properties in question. SoundEarth performed the following activities as part of the Phase I research:

- A review of selected historical sources, where reasonably ascertainable and readily available, was conducted in an attempt to document obvious past land use of the Property and adjoining properties back to 1940 or when the Property was initially developed, whichever is earlier. This included interviews with persons having some knowledge of current and past use of the Property; review of historical aerial photographs and topographic maps of the Property and surrounding area; review of city directories, Sanborn Fire Insurance Maps, county assessor's records, building department records, and information at various local agencies, as available.
- A review of current state and federal databases that list the registered sites with known or potential releases of toxic substances within a 0.5- to 1-mile radius from the Property (including the adjoining US Marine Bayliner site).
- A reconnaissance of the Property and vicinity to observe current Property conditions and practices to search for evidence of possible contamination in the form of soil discoloration, odors, vegetative stress, discarded drums, discarded industrial debris, building construction materials, underground storage tanks, etc.

SoundEarth identified the following RECs associated with the Property:

- The former operation of a dry cleaning facility and large laundry plant on the Property from 1926 until 1985.
- The likely historical use and storage of heating oil in ASTs or USTs at the residences formerly located on the Property.
- The current and historical operation of automotive repair facilities to the south, southeast, and east of the Property.
- The current and historical operation of a large newspaper facility adjoining the south of the Property.

## 3.4 AUGUST 2010 GPR SURVEY, SOIL VAPOR, AND GROUNDWATER SAMPLING EVENTS

Based on the findings of the Phase I ESA, SoundEarth conducted additional investigations on the Property. These investigations included a ground-penetrating radar (GPR) survey to evaluate the current status of the USTs identified during the Phase I ESA, a sampling event for the on-Property supply well located inside the Troy Building, and a GORE soil vapor survey to evaluate the potential for a release of petroleum hydrocarbons and/or VOCs to the subsurface (SES 2010a). The field activities and results of the investigations are summarized in the following subsections.

### 3.4.1 GPR Survey

On August 11, 2010, SoundEarth and Underground Detection Services, Inc. completed a GPR survey of the Property. The results of the GPR survey confirmed that the 8,000-gallon UST near the loading dock, the four 2,000-gallon gasoline USTs reportedly removed in 1965, the two 12,000-gallon heating oil USTs, and one 1,000-gallon heating oil UST associated with the Troy Building had been removed, as well as the second 8,000-gallon UST in the parking lot of the Mokas Building, However, the GPR survey identified two anomalies indicative of USTs; the first anomaly was located adjoining the southwest corner of Mokas Building. The second anomaly was located in the parking lot between the David Smith and Mokas buildings, in the vicinity of the former residence listed at 1119 Harrison Street and historically heated by an oil-burning furnace. Subsurface piping was observed beneath the parking lot outside of the boiler room of the Troy Building. No apparent USTs were observed, but asphalt patching in the area was indicative of a former UST excavation. The GPR survey confirmed the size of the UST beneath the sidewalk along Boren Avenue North. The fill port was opened and dipped; approximately 1 inch of heating oil was observed floating on approximately 1 foot of water. A second apparent fill port was observed farther south, but while conducting the GPR survey in the vicinity, fiber optic lines obscured the readings.

Two apparent excavation areas were identified north of the Mokas Building. The first excavation area was directly north of the building, and the second was beneath the parking spots to the northwest of the building. The northwesternmost area appears to be subsiding, which may be the result of poor backfill and compaction following excavation activities.

### 3.4.2 Groundwater Sampling Event

On August 26, 2010, a SoundEarth hydrogeologist collected groundwater grab samples from the supply well. Prior to bailing, water was observed at a depth of 75.25 feet below the top of the well casing, which extended approximately 1.5 feet above the floor of the building. The total depth of the well was approximately 498 feet bgs. Groundwater grab samples were collected using bailers at the top and bottom of the water column (75 and 490 feet, respectively). The groundwater samples were submitted to the laboratory for analysis of VOCs, PAHs, pH, GRPH, DRPH, oil-range petroleum hydrocarbons (ORPH), and Resource Conservation and Recovery Act (RCRA) 8 metals.

**Groundwater Results.** Laboratory analytical results indicated that the groundwater samples collected from the well did not contain detectable concentrations of PAHs, VOCs, or GRPH. Slightly elevated concentrations of DRPH and ORPH were detected in the 490-foot sample, but they were below the applicable MTCA Method A cleanup levels for groundwater. Concentrations of arsenic, lead, chromium, cadmium, and mercury were representative of background levels. Barium and pH were elevated slightly but their concentrations did not represent a risk to human health or the environment. The results of sampling conducted at the well demonstrated that the deeper aquifer beneath the Site has not been impacted by a release from the former Property operations.

**Data Gaps.** None.

### 3.4.3 GORE Soil Vapor Survey

A GORE Soil Vapor Survey was conducted in August 2011 to provide preliminary data regarding the type and sources of contamination suspected to be present beneath the Property. SoundEarth installed 67 passive-sampling GORE-Sorber modules at the Property within 2.5-foot-deep soil borings. The borings were advanced on a predetermined 40-foot grid using hand-held rotary hammer drills. After seven days of passive sampling, the modules were collected and submitted to GORE for laboratory analysis of VOCs, including PCE; 1,2-dichloroethene (1,2-DCE); TCE, and TPH. Concentrations of the chemicals were plotted on isoconcentration maps for the Property. A copy of the GORE Soil Vapor Survey is provided in Appendix F of the Draft RI Report (SoundEarth 2012).

**Soil Vapor Results.** Detectable concentrations of PCE were observed to extend across much of the western half of the block, as shown in Figure 10. Concentrations that correlate with MTCA exceedances in soil observed at other, similar properties covered an area of the Property that measures approximately 60,000 square feet. Highly elevated PCE concentrations (hot spots) were observed near the former loading dock to the dry cleaning area, beneath the Fur Vault, and within the David Smith building, as shown on Figure 10. However, the elevated concentrations observed beneath the Fur Vault were in part due to overlap from extremely high concentrations observed near the loading dock; the model interpreted the highest concentrations to extend to the next sampling point.

TCE and 1,2-DCE, both of which are degradation products of PCE, were also observed on the western half of the block. The highest concentrations were likewise observed near the former loading dock, further indicating that the loading dock area represents the primary source area for the release of chlorinated solvents.

Concentrations of TPH and associated carbon chains were also highest in the vicinity of the former loading dock, and a second potential source area for TPH was identified to the northeast of the Mokas Building.

**Data Gaps.** The results of the GORE Soil Vapor Survey indicated that both the dry cleaner operations and the use and storage of hazardous materials at the Property had resulted in a release of VOCs and petroleum hydrocarbons beneath much of the Property and may extend beyond the Property boundaries. Additional investigations were necessary to evaluate potential soil and shallow groundwater impacts in the vicinity of soil vapor anomalies identified in the GORE isoconcentration maps.

## 3.5 SUBSURFACE INVESTIGATIONS

Three SIs have been conducted at the Site since 2010. The locations of soil borings, monitoring wells, and other Property features are shown on Figure 5. The soil and groundwater analytical results are summarized on Figures 10 through 16 and in Tables 1 and 2. For evaluation purposes, those concentrations that exceed the current MTCA Method A or Method B cleanup levels for soil and groundwater are presented in bold red font in the tables. The remainder of this report includes references to cleanup levels; unless otherwise specified, these refer to the 2001 MTCA Method A or 2011 MTCA Method B Cleanup Levels for Unrestricted Land Use for soil and groundwater.

### 3.5.1 2010 Limited Phase II ESA

SoundEarth conducted a Limited Phase II ESA at the Property in October 2010 (SES 2010b). The purpose of the Phase II ESA was to evaluate the potential source areas identified during the GORE Soil Vapor Survey and Phase I ESA research, as well as the shallow lateral extent of contamination of COCs as indicated by the soil vapor isoconcentration maps provided by GORE. SoundEarth advanced 14 soil borings (P01 through P14) on the Property near the potential source areas to a maximum depth of 23 feet bgs (Figure 5). SoundEarth collected a reconnaissance groundwater sample from boring P10 during drilling activities on October 7, 2010, using a temporary screen installed from 19 to 21 feet bgs.

Selected soil samples and the reconnaissance groundwater sample were submitted for laboratory analysis of chlorinated VOCs (chlorinated volatile organic compounds [CVOCs] including vinyl chloride, cis-1,2-DCE and trans-1,2-dichloroethylene [trans-1,2-DCE], 1,2-dichloroethane [EDC], TCE, and PCE) by U.S. Environmental Protection Agency (EPA) Method 8260C; DRPH and ORPH by Northwest Total Petroleum Hydrocarbon (NWTPH) Method NWTPH-Dx; GRPH by Method NWTPH-Gx; and benzene, toluene, ethylbenzene, and total xylenes (BTEX) by EPA Method 8260C.

**Soil Results.** Fill material composed of brick debris was encountered in boring P05 at ground surface to a depth of 2.5 feet bgs. PCE concentrations exceeding the applicable cleanup level were detected in soil samples collected from borings P03 and P05 through P11 at depths ranging from 2.5 feet bgs to the maximum depth explored of 23 feet bgs. The PCE concentrations detected in the soil sample collected from P05 at 5 feet bgs also exceeded Washington State's Dangerous Waste criteria (WAC 173-303). The PCE concentrations detected in soil samples collected from boring P08 at depths between 0 and 10 feet bgs exceeded ten times the Universal Treatment Standard (UTS) for PCE (60 milligrams per kilogram [mg/kg]), defined in Title 40, Chapter 1, Part 268, Subpart D of the Code of Federal Regulations (40 CFR Ch.1 §268.40-48). Soil that contains concentrations of PCE exceeding ten times the UTS is banned from land disposal without first being treated (land ban). Soil samples collected from P08 also contained concentrations of TCE exceeding the cleanup level at depths of 3, 7.5, and 10 feet bgs and DRPH and ORPH concentrations exceeding their respective cleanup levels at a depth of 10 feet bgs. GRPH was detected at concentrations exceeding the cleanup level in soil collected from boring P07 at a depth of 11 feet and boring P08 at 3, 7.5, and 10 feet bgs.

Concentrations of COCs were below cleanup levels and/or laboratory reporting limits in soil samples collected from borings P01, P02, P04, P12, P13, and P14. However, concentrations of PCE generally increased with depth in borings P01 and P02. BTEX, vinyl chloride, cis-1,2-DCE, trans-1,2-DCE, and EDC were not detected at concentrations exceeding applicable cleanup levels or laboratory detection limits.

**Groundwater Results.** Perched groundwater was encountered in only one boring advanced during the SI. Analytical results indicated that DRPH, TCE, and PCE were present in the reconnaissance groundwater sample collected from P10 at concentrations exceeding applicable cleanup levels. All other COCs were below applicable cleanup levels and/or laboratory detection limits.

**Summary.** The results of the Limited Phase II ESA confirmed that the former use of the Property as a dry cleaning facility resulted in a release of solvents and petroleum hydrocarbons to the subsurface. The highest concentrations of PCE were confirmed near the loading dock for the

Troy Building; soil concentrations in this area exceeded the land ban criteria, and perched groundwater, which was encountered in only one soil boring, also contained elevated concentrations of PCE.

**Data Gaps.** The extent of contamination was not bound vertically or horizontally.

### 3.5.2 2010 Subsurface Investigation

AECOM conducted an SI on December 8, 2010, in an effort to further delineate the lateral extent of the dangerous waste concentrations of PCE observed during the October 2010 investigation (AECOM 2011a). AECOM oversaw the advancement of seven soil borings (B01 through B07) during the SI (Figure 5). Borings B01 and B07 were advanced outside of the Troy Building in the vicinity of the loading dock, borings B02 through B05 were advanced in the north interior portion of the 1964-vintage addition of the Troy Building, and B06 was advanced inside the Fur Vault. Borings B01 through B05 were advanced to depths between 18 and 20 feet. Boring B06 was advanced to a depth of 11.5 feet, and B07 was advanced to a depth of 40 feet bgs. AECOM collected a reconnaissance groundwater sample from boring B07 using a temporary screen installed from 23 to 24 feet bgs. Select soil samples from borings B01, B02, and B04 through B07, as well as the reconnaissance groundwater sample, were submitted to the laboratory for analysis of VOCs (including benzene, cis-1-2,-DCE, TCE, and PCE) by EPA Method 8260C, DRPH and ORPH by Method NWTPH-Dx, and GRPH by Method NWTPH-Gx.

**Soil Results.** Soil samples collected from boring B01 through B07 contained concentrations of PCE exceeding the cleanup level at every interval sampled to the maximum depth of 40 feet bgs. Concentrations of PCE detected in soil samples collected from boring B02 at depths between 7 and 11 feet and from boring B04 at depths between 8 and 10 feet bgs also exceeded Washington State's Dangerous Waste criteria (WAC-173-303).

Concentrations of TCE, cis-1-2-DCE, and/or benzene were detected in borings B01 through B05 and B07, but were below the applicable cleanup levels. GRPH, DRPH, and ORPH were not detected in any of the borings.

**Groundwater Results.** Perched groundwater was encountered in only one boring advanced during the SI. Analytical results indicated that concentrations of GRPH, DRPH, TCE, cis-1,2-DCE, and PCE in the reconnaissance groundwater sample collected from B07, which was advanced near the loading dock, exceeded applicable cleanup levels. The concentrations of ORPH and trans-1,2-DCE were below applicable cleanup levels and/or laboratory detection limits. The results for additional analytes were not provided for SoundEarth's review.

**Summary.** Data collected during the December 2010 SI were consistent with the data collected during the October 2010 SI.

**Data Gaps.** Soil and groundwater contamination were not bound vertically or horizontally in any direction during the investigation. In addition, as with the previous investigations, the presence of only chlorinated solvents and petroleum hydrocarbons was evaluated. Additional potential COCs may include semi-volatile VOCs and other VOCs not included within the list of chlorinated VOCs previously analyzed.

### 3.5.3 May 2011 Supplemental Subsurface Investigation

In May 2011, SoundEarth conducted a supplemental subsurface investigation (SSI) at the Site (SoundEarth 2011a). The purpose of the SSI was to evaluate (1) if the release of dry cleaning solvents and petroleum hydrocarbons confirmed in previous investigations had impacted soil and/or groundwater beyond the Property boundaries, (2) whether any additional constituents contaminated soil or groundwater beneath the Property beyond what was analyzed in previous investigations, and (3) the vertical extent of contamination beneath the Site.

A total of eight soil borings were advanced during the investigation: three within the Harrison Street ROW (B08 through B10), three within the Boren Avenue North ROW (B11, B12, and B15), and two on the Property (B13 and B14) to depths ranging from 61 to 90 feet bgs. Conductor casing was used in borings B13 and B14 at intervals deeper than 20 feet bgs to prevent the vertical migration of contamination from overlying soil. Borings B08 through B13 and B15 were completed as permanent monitoring wells MW01 through MW07, respectively.

On May 26, 2011, SoundEarth collected a reconnaissance groundwater sample from boring B14 using a disposable bailer. On May 25, 26, and 27, 2011, groundwater samples were collected from monitoring wells MW01 through MW07. Select soil and groundwater samples were submitted for laboratory analysis of full-suite VOCs (including vinyl chloride, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, EDC, benzene, TCE, PCE, and BTEX) by EPA Method 8260C; DRPH and ORPH by Method NWTPH-Dx; GRPH by Method NWTPH-Gx; and SVOCs by EPA Method 8270D. Soil samples were also submitted for analysis of total metals, including arsenic, cadmium, chromium, lead, mercury, selenium, barium, and silver (RCRA 8 Metals) in accordance with EPA Methods 200.8 and 1631E; and, for the purposes of waste characterization, composite soil samples were submitted for analysis of chlorinated VOCs and RCRA 8 Metals.

**Soil Results.** The concentration of PCE detected in boring B12 at 60 feet bgs slightly exceeded the cleanup level. Soil collected from boring B13, which was advanced on the Property to the south of the David Smith building, contained a concentration of GRPH in excess of the cleanup level at a depth of 49 feet bgs. Soil collected from boring B13 at depths of 24 and 49 feet bgs contained concentrations of PCE in excess of the cleanup level. Soil collected from boring B14, which was advanced approximately 60 feet north of the loading dock on the Property, contained concentrations of PCE in excess of the cleanup level at depths of 30 and 58 feet bgs and concentrations of GRPH in excess of the cleanup level at depths of 30, 33.5, and 58 feet bgs.

Soil samples collected from borings B08 through B11 and boring B15 did not contain detectable concentrations of COCs. Soil collected from boring B12 contained detectable concentrations of PCE at depths between 55 and 70 feet bgs, where groundwater was encountered. The borings (B13 and B14) installed on the Property exhibited two zones of contamination—the first was encountered between 24 and 33.5 feet bgs, and the second was observed between 44 and 61 feet bgs. Soil samples collected above and below these depths did not contain detectable concentrations of chlorinated solvents or petroleum hydrocarbons.

**Groundwater Results.** Perched groundwater was not encountered during the SSI. Groundwater samples collected from each of the monitoring wells were considered to be representative of the primary water-bearing zone beneath the Site. Concentrations of TCE ranged from nondetect (<1 microgram per liter [µg/L] in monitoring wells MW01 and MW03) to 16 µg/L (monitoring well MW05). PCE was detected at concentrations exceeding the MTCA Method A cleanup level in the reconnaissance sample collected from B14 (35 µg/L) and the groundwater sample collected from MW05 (39 µg/L). Vinyl chloride and cis-1,2-DCE also were detected above the cleanup level in the groundwater sample collected from MW06.

**Summary.** Based on the data gathered during the SSI, soil contamination generally appears to be limited to within the Property boundaries; none of the soil samples collected from borings installed within the ROWs contained concentrations of PCE that exceeded the MTCA Method A cleanup level, with the exception of B12/MW05, where a sample collected at a depth of 60 feet contained a concentration of PCE of 0.057 mg/kg.

Groundwater beneath the western half of the Property and within Boren Avenue North exhibited elevated concentrations of PCE, TCE, cis-1,2-DCE, and/or vinyl chloride, indicating that natural attenuation of the contaminants is occurring. The highest concentration of PCE was 39 µg/L, which was detected in groundwater collected from MW05. Monitoring well MW05 was advanced in the Boren Avenue North ROW. With the exception of groundwater collected from well MW05, only TCE was detected above the cleanup level in groundwater collected from the wells in the ROW.

**Data Gaps.** The lateral and vertical extent of impacts in soil and groundwater to the south and east of the source area, as well as the western extent of contamination in groundwater, remained undefined.

### 3.6 SUMMARY OF DATA GAPS

The results of previous investigations indicate that lateral and vertical extents of PCE-contaminated soil meeting Washington State's Dangerous Waste criteria had been defined and appeared to be limited to the vicinity of the loading dock north of the Troy Building near borings B02, B04, B07, P05, and P08 at depths between 3 and 11 feet bgs. The lateral and vertical extent of PCE contamination in soil exceeding land ban criteria appeared to be limited to the vicinity of boring P08 at depths between 3 and 10 feet bgs.

The lateral extent of PCE- and/or TCE-contaminated soil and groundwater had been defined to the north. PCE impacts to soil and groundwater beneath the Boren Avenue North ROW were confirmed, but the lateral extent was not bound due to access limitations. The lateral and vertical extent of impacts, if any, to the south and east of the source area has not been evaluated.

## 4.0 INTERIM REMEDIAL ACTION

In February 2011, AECOM, on behalf of Seattle Times and Century Pacific, LP, designed and installed a soil vapor extraction (SVE) system at the Property to address the concentrations of PCE in soil that exceeded the dangerous waste threshold of 1.9 mg/kg. A summary of the interim remedial objectives, system design, and results of system operation are described in the following sections.

### 4.1 INTERIM REMEDIAL ACTION OBJECTIVES

The objective of the SVE system was to eliminate or reduce the generation of dangerous waste as defined by the State of Washington Dangerous Waste Regulations (WAC-173-303) by reducing the concentrations of COCs in unsaturated zone soil to below MTCA Method B cleanup levels. Reducing the concentrations of COCs below MTCA Method B cleanup levels would enable the excavation and offsite disposal of the soil as non-hazardous waste.

## 4.2 CHEMICALS AND MEDIA OF CONCERN

The chemicals of concern in addressed by the interim remedial action include PCE and its degradation products TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride in unsaturated (vadose) zone soil and soil vapor.

## 4.3 SYSTEM DESIGN AND INSTALLATION

The system utilized a 500 standard cubic feet per minute positive displacement blower to apply a vacuum to the network of 4-inch-diameter, Schedule 40 polyvinyl chloride (PVC) SVE wells. Five SVE wells were located outside of the Troy Building (wells SVE-1 through SVE-5); and two wells were located inside the building (wells SVE-7 and SVE-8). The interior wells were installed to 23 feet bgs with a 0.010-inch slotted screen section running from 10 feet to 22 feet bgs. The exterior wells were installed to 20 feet bgs with a 0.010-inch slotted screen section running from 7 feet to 19 feet bgs. The vacuum pressure created by the blower drew air into the well casing from the vadose zone. The extracted vapor traveled aboveground to the remediation compound through horizontal 2-inch-diameter header pipes. Inside the remediation compound, the vapor stream passed through a 50-gallon vapor/liquid separator (knockout tank) to remove moisture and particulates. Liquids and particulates were pumped from the knockout tank into a 5,000-gallon holding tank. The vapor then passed through 1,000-pound capacity primary and secondary granular activated carbon canisters to remove VOCs, and was then discharged into the atmosphere. Both the knockout and holding tanks were equipped with secondary containment controls. The SVE wells were equipped with sample ports to allow field personnel to collect performance vapor samples. The SVE system as-built diagrams are presented in Appendix G of the Draft RI Report (SoundEarth 2012).

## 4.4 OPERATION AND MAINTENANCE ACTIVITIES

AECOM conducted monthly operation and maintenance (O&M) activities for the SVE system between February and December 2011. AECOM provided SoundEarth with a summary of monthly O&M results conducted between February and October 2011. The available reported data includes the flow rate, loading rate, estimated mass of total VOCs extracted, and laboratory analytical results of vapor samples collected from each of the seven SVE wells analyzed by modified EPA Method TO-15. The results of the analyses were summarized by AECOM in tabular and graphic form, a copy of which is provided in Appendix H of the Draft RI Report (SoundEarth 2012). Monthly O&M reports were prepared by AECOM and submitted to Century Pacific, LP, and Seattle Times under separate cover.

## 4.5 SYSTEM OPERATION AND REMEDIATION TREND

The system was started in mid-February 2011. AECOM operated the system through December 2011. Confirmational soil samples were collected in January 2012 to evaluate the effectiveness of the system in reducing concentrations of COCs in the vadose zone.

AECOM collected vapor samples from each of the seven SVE wells on a monthly basis since February 2011. The analytical results showed that a significant mass (285 pounds) of PCE and other volatile organic compounds were recovered during the first month of operation. This removal rate decreased significantly in the subsequent months ranging from 3 to 13 pounds of VOCs per month. However, while the mass removal of PCE initially declined, the mass removal of degradation products, including TCE and cis-1,2-DCE, initially increased before dropping, likely as a result of generating an anaerobic environment near the perched water zone. The rapid decline and stabilization of the mass removal rate is typically observed in SVE systems; the initial high vapor concentrations in soil pore spaces are quickly removed by the system at startup. Following startup, the vapor concentrations slowly stabilize to levels that are representative of the slower recovery generated by the mass transfer rate limitations of VOCs from dissolved concentrations in pore water to soil vapor. These liquid to vapor transfer rates are a function of the physical and chemical properties of individual VOCs. Those chemicals with a higher Henry's Law constant will more rapidly transfer from the aqueous to the vapor phase. As soil vapor extraction continues, the mass of VOCs in the recovered soil vapor eventually reaches an asymptotic recovery rate, indicating that the majority of the mass of VOCs that are able to be recovered in the vapor phase have been recovered.

### 4.6 POST-INTERIM ACTION CONFIRMATIONAL SOIL SAMPLING

On January 16, 2012, AECOM oversaw the decommissioning of the SVE wells and the installation of ten soil borings (B39 through B48) within the anticipated radius of influence of the SVE system (Figure 17). Soil samples collected from borings B39 through B45 were analyzed for the presence of solvents in accordance with EPA Method 8260C. The results of the confirmational soil sampling event indicated that concentrations of PCE in soil that previously exceeded the land ban criteria (60 mg/kg) had dropped to below the land ban criteria; however, the analytical results of soil samples collected from borings B39, B44, and B45 indicated that concentrations of PCE in excess of the dangerous waste criteria of 1.9 mg/kg remained beneath a small portion of the Site (Figure 17, Table 1). A copy of the data set provided by AECOM is provided in Appendix H of the Draft RI Report (SoundEarth 2012).

## 5.0 SUMMARY OF THE REMEDIAL INVESTIGATION

SoundEarth conducted an RI at the Site in September and October 2011. The objectives of the RI included the following:

- Address on-Property data gaps for soil and groundwater.
- Evaluate, to the extent possible, the extent of groundwater contamination to the south, east, and west of the source area.
- Evaluate whether any stratigraphic pattern of contaminant distribution is present in groundwater.
- Analyze standing water remaining within pipes, sumps, and trenches inside the Troy Building for waste characterization purposes.
- Collect sufficient data to conduct an FS and ultimately develop a cleanup action plan for the Site.

As indicated above, soil boring and monitoring well locations were selected to address the data gaps identified during previous investigations. Properties adjoining the ROWs include lot-line to lot-line buildings, structures with up to six levels of belowground parking, and ongoing construction activities. The physical limitations associated with drilling west of the groundwater contamination previously confirmed in Boren Avenue North precluded additional investigation of the western bound of contamination.

### 5.1 SOIL BORING ADVANCEMENT AND SAMPLING

The drilling and well installation activities conducted as part of this RI were performed from September 26 to October 19, 2011. Drilling activities were conducted under the supervision of a SoundEarth geologist. Twenty-three borings (B16 through B38) were advanced at the Site to a maximum depth of 110 feet bgs. The borings were advanced by Cascade Drilling, LP, of Woodinville, Washington, using either full-size, truck-mounted hollow-stem auger (HSA) or limited-access HSA drill rigs. Conductor casing was installed in two borings (B30/MW11 and B31/MW12). Conductor casing was installed from 0 to 20 feet bgs in B30/MW11 to prevent the downward migration of contaminated perched groundwater encountered at 18 feet bgs. Casing also was installed from 0 to 70 feet bgs in B31/MW12 to provide a barrier between the top of the primary water-bearing zone and the lower portion of the primary water-bearing zone in an effort to mitigate downward migration of contamination through the water table.

After the maximum depth was achieved in each sample interval, relatively undisturbed, discrete soil samples were collected from each soil boring at 5-foot intervals throughout the maximum depth explored. Soil samples were collected from the center of the core sample to avoid cross-contamination. The soil was classified using the Unified Soil Classification System. Soil characteristics, including moisture content, relative density, texture, and color, were recorded on boring logs, provided in Appendix E of the Draft RI Report (SoundEarth 2012). The depths at which changes in soil lithology were observed and where groundwater was first encountered are also included on the boring logs. Selected portions of recovered soil core samples were placed in a plastic bag so the presence or absence of volatile organic compounds could be quantified using a photoionization detector (PID). Soil samples were selected for analysis based on previous data, field indications of potential contamination, including visual and olfactory notations, PID readings, and/or the location of the sample proximate to the soil-groundwater interface.

After collection, soil samples were labeled with a unique sample ID, placed on ice in a cooler, and delivered to Friedman & Bruya, Inc. of Seattle, Washington, under standard chain-of-custody protocols for laboratory analysis. Select soil samples were submitted for laboratory analysis of CVOCs by EPA Method 8260C. In addition, samples exhibiting elevated PID readings and odor indicative of Stoddard solvents were analyzed for GRPH by Method NWTPH-Gx and BTEX by EPA Method 8021B.

Photographs taken during the RI pre-field and field activities are included as an attachment to this report.

## 5.2 MONITORING WELL INSTALLATION

Borings B26, B27, B28, B30, B31, B37, and B38 were completed as monitoring wells MW08 through MW14, respectively. Each monitoring well was constructed of 2-inch-diameter blank PVC casing, flush-threaded to 0.010-inch slotted well screen. The bottom of each of the wells was fitted with a threaded PVC bottom cap, and the top of each well was fitted with a locking compression-fit well cap. The annulus of the monitoring wells was filled with #10/20 silica sand to a minimum height of 1 foot above the top of the screened interval. A bentonite seal with a minimum thickness of 1 foot was installed above the sand pack. The wells were completed at the surface with a flush-mounted, traffic-rated well box set in concrete. The well completion details are presented in Table 2 of the Draft RI Report and in the boring logs, which are provided in Appendix E of the Draft RI Report (SoundEarth 2012).

Two water-bearing zones were identified during drilling activities: a discontinuous perched zone at depth of approximately 18 to 25 feet bgs (depending on location on the Site) and a laterally continuous, deeper zone at depths between 60 and 95 feet bgs (depending on the location of the well/boring on the Site); the Property elevation drops approximately 35 feet from the southeast corner to the northwest corner of the Property. During drilling activities, the perched zone was only encountered in borings B20, B21, and B30/MW11 and, with the exception of B30/MW11, did not produce sufficient water to sample. Because the perched zone is discontinuous, all monitoring wells installed during the RI were screened in the primary water-bearing zone. As with the wells installed at the Site in May 2011, monitoring wells MW10, MW11, MW13, and MW14 (shallow wells) were constructed with 15 feet of screen set at approximately 5 feet above the water table (as observed during drilling) and 10 feet below the water table.

Monitoring wells MW08, MW09, and MW12 (deep wells) were completed to between 30 and 35 feet below the water table (as observed during drilling) and constructed with 5 feet of screen at the bottom of the well in an effort to assess any vertical differences in groundwater chemistry 30 to 35 feet below the top of the primary water-bearing zone.

## 5.3 GROUNDWATER MONITORING EVENT

A groundwater monitoring event was conducted on at the Site in October 2011, and included the collection of groundwater measurements and samples from monitoring wells MW01 through MW14. Due to street use limitations, wells located within the City of Seattle's ROWs had to be sampled in three phases so as not to disrupt traffic flow surrounding the Property. Groundwater samples were collected from monitoring wells MW01, MW02, and MW03 on October 11; monitoring wells MW04 through MW07 and MW10 on October 12; monitoring wells MW08, MW09, and MW11 on October 13; monitoring well MW12 on October 17; and monitoring wells MW13 and MW14 on October 20, 2011. Groundwater samples were collected from each monitoring well in accordance with EPA's Low Flow (Minimal Drawdown) Ground-Water Sampling Procedures (April 1996) at least 24 hours following well development. Groundwater measurements were collected from all of the wells on October 20, 2011, relative to the top of well casings to an accuracy of 0.01 feet using an electronic water meter. Purging and sampling of each well was performed using a bladder pump and dedicated polyethylene tubing. During purging, water quality parameters that were monitored and recorded included temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential. Each well was purged until, at a minimum, pH, specific conductivity, and turbidity or dissolved oxygen stabilized. Samples were placed directly in to clean, laboratory-prepared containers.

After collection, groundwater samples were labeled with a unique sample ID, placed on ice in a cooler, and delivered to Friedman & Bruya under standard chain-of-custody protocols for laboratory analysis. Groundwater samples were submitted for laboratory analysis of CVOCs by EPA Method 8260C (unpreserved sample containers were used for vinyl chloride analyses), GRPH by Method NWTPH-Gx, DRPH and ORPH by Method NWTPH-Dx, and BTEX by EPA Method 8021B.

## 5.4 REMEDIAL INVESTIGATION RESULTS

Analytical results for soil and groundwater samples collected during the RI are presented on Figures 10 through 16 and in Tables 1 and 2. Laboratory analytical reports are included as Appendix I of the Draft RI Report (SoundEarth 2012).

### 5.4.1 Soil Results

The following is a summary of the soil analytical data generated during the RI conducted by SoundEarth in September and October 2011:

### Troy Building

- Concentrations of PCE exceeding the cleanup level were detected in soil samples collected from boring B16, which was advanced within the 1964-vintage addition, at depths of 6, 16, 23.5, 25, and 50 feet bgs. Concentrations of PCE below the cleanup level were detected to the maximum depth explored of 70 feet bgs.
- PCE concentrations exceeding the cleanup level were detected in the soil boring B17, which was advanced within the 1964-vintage addition, at depths of 11, 16, 40, 45, 50, 55, 60, and 65 feet.
- PCE was detected at concentrations exceeding the cleanup level in boring B18, which was advanced within the 1964-vintage addition, at depths between 25 and 65 feet bgs. PCE was also detected in the soil sample collected from boring B18 at a depth of 70 feet, but the concentration was below the cleanup level.
- Concentrations of PCE exceeding the cleanup level were also detected in soil samples collected from borings B19 at 25 feet, B20 at 15 feet, and B21 at 5 feet, each of which were advanced within the 1964-vintage addition, and B36 at 40 feet bgs. Samples collected from boring B36 at depths of 15 and 30 feet bgs contained low but detectable concentrations of PCE.
- With the exception of borings B16 and B18, concentrations of PCE did not exceed the laboratory detection limits in samples collected from any of the borings at depths greater than 65 feet bgs.
- Concentrations of GRPH and total xylenes exceeding the cleanup level were detected in the soil sample collected from boring B20 at depths of 15 and 25 feet bgs. Boring B20 was advanced in the 1964-vintage addition.

### David Smith Building

- A low but detectable concentration of PCE was observed in boring B34 at a depth of 50 feet bgs.
- Soil samples collected from borings B33 and B35 did not contain detectable concentrations of any COCs.

### Exterior Borings

- Concentrations of PCE were detected in soil samples collected from boring B30, which was advanced to the north of the loading dock, at a depth of 18 feet bgs. However, the concentrations were below the applicable cleanup level.
- A concentration of GRPH exceeding the cleanup level was detected in the soil sample collected from boring B30 at a depth of 40 feet bgs. The 40-foot sample collected from boring B30 also contained detectable concentrations of ethylbenzene and total xylenes, but the concentrations were below the applicable cleanup levels. The GRPH exceedances are attributed to Stoddard solvent contamination (Figure 13).
- Benzene, toluene, vinyl chloride, cis-1,2-DCE, trans-1,2-DCE, EDC, and TCE were not detected at concentrations above their respective laboratory detection limits in any

of the soil samples collected as part of the RI. Soil samples collected from borings B22 through B29, B31, B33, B35, B37, and B38 did not contain any detectable concentrations of COCs.

### 5.4.2 Groundwater

The following is a summary of the groundwater analytical results generated during the RI:

**Shallow Wells**

- Concentrations of PCE exceeded the cleanup level in groundwater samples collected from monitoring wells MW05 (29 µg/L), MW11 (21 µg/L), and MW13 (5.1 µg/L, which is only 0.1 µg/L above the cleanup level). Concentrations of PCE that did not exceed the cleanup level were detected in groundwater samples collected from monitoring wells MW06 and MW07.
- Concentrations of TCE exceeding the cleanup level were detected in groundwater samples collected from monitoring wells MW04 (15 µg/L), MW05 (14 µg/L), MW06 (11 µg/L), and MW07 (11 µg/L). TCE concentrations were also detected in groundwater samples collected from monitoring wells MW02, MW11, and MW13, but were below the cleanup level. These data suggest that natural attenuation of the PCE is occurring at the Site.
- Concentrations of vinyl chloride (0.76 µg/L) and cis-1,2-DCE (120 µg/L) exceeded the applicable cleanup levels in the groundwater sample collected from MW06. Detectable concentrations of cis-1,2-DCE were observed in groundwater samples collected from monitoring wells MW05 and MW11 but were below cleanup levels. Vinyl chloride was not detected in groundwater samples collected from MW01 through MW05, and MW07 through MW14. These data suggest that natural attenuation of the PCE is occurring at the Site.
- Concentrations of DRPH below the cleanup level were detected in groundwater samples collected from monitoring wells MW06, MW07, MW09, MW10, MW11, MW13, and MW14. The concentrations of DRPH observed in these groundwater samples were flagged by the laboratory, indicating that the DRPH concentrations detected in the groundwater samples were likely a result of overlap from another fuel type (e.g., aged Stoddard solvents). DRPH was not detected in groundwater samples collected from monitoring wells MW01 through MW05.
- Concentrations of ORPH, benzene, toluene, trans-1,2-DCE, and EDC were not detected in any of the groundwater samples collected as part of the RI.
- Groundwater samples collected from monitoring wells MW01 and MW03, which are located in the Harrison Street ROW to the north of the Property, did not contain any detectable concentrations of COCs.

**Deep Wells**

- Concentrations of GRPH (1,400 µg/L), TCE (16 µg/L), and cis-1,2-DCE (22 µg/L) exceeding the applicable cleanup levels were detected in the groundwater sample collected from monitoring well MW09.

- Concentrations of DRPH, ethylbenzene, and total xylenes were detected in the groundwater sample collected from monitoring well MW09 but were below the applicable cleanup levels. The DRPH result was flagged as overlap from another fuel type (e.g., aged Stoddard solvents).
- Groundwater collected from monitoring well MW12 contained a concentration of TCE (19 µg/L) that exceeded the cleanup level.
- Groundwater samples collected from monitoring well MW08 did not contain any detectable concentrations of COCs.

### 5.5 REMEDIAL INVESTIGATION CONCLUSION

The borings and monitoring wells advanced and/or installed as part of this RI represent SoundEarth's reasonable efforts to evaluate the Site under the access limitations typical of a dense urban environment. However, following the completion of the RI, empirical data gaps remain for the Site and include the following:

- The lateral extent of groundwater contamination beyond Boren Avenue North to the west of the Site; however, data collected from wells completed along the west side of the Boren Avenue North right-of-way indicate that the concentrations of solvents in the groundwater are relatively low and limited in extent. To further validate this expectation, the Site data was input to a model that applied the most conservative, worst-case assumptions. As a result of the analysis, the contaminated groundwater plume appears to extend a maximum of 40 feet up- to cross-gradient beneath the west-adjoining property.
- The lateral extent of groundwater contamination to the south of monitoring well MW09; however, data collected from MW09 indicate that the concentrations of contaminants in the groundwater are relatively low and limited in extent. To further validate this expectation, the Site data was input to a model that applied the most conservative, worst-case assumptions. As a result of the analysis, the contaminated groundwater plume does not appear to extend beneath the south-adjoining property.

The objective of addressing the data gaps is to provide empirical data to the extent possible to demonstrate an accurate site boundary to the south and west. However, as discussed in the Draft RI Report and summarized on Figures 18A through 18C and Figure 19, the physical limitations, costs, and risks associated with addressing the data gaps far outweigh the benefits. Furthermore, despite the substantial costs and low value of any data associated with conducting additional investigations, no additional empirical data would result in a modification to the cleanup action proposed herein. All technically feasible approaches to acquiring empirical data for the Site were conducted, and a detailed, Site-specific mathematical model was developed to address the data gaps in areas where empirical data could not be collected (SoundEarth 2012) and in an effort to ensure that the cleanup proceeds in a timely manner (WAC 173-340-350[6]). Considering the volume and quality of data gathered during the RI, the conceptual site model developed as a result of the RI is considered sufficient to develop and evaluate permanent and practicable cleanup alternatives, which will include full source removal and large-scale groundwater treatment, as discussed in later sections of this report. Therefore, Touchstone has completed an RI substantively equivalent to MTCA.

## 6.0 CONCEPTUAL SITE MODEL

This section provides a conceptual understanding of the Site derived primarily from the results of the historical research and subsurface investigations performed at the Site. Included is a discussion of the confirmed and suspected source areas, the chemicals and media of concern, the fate and transport characteristics of the release of hazardous substances, the potential exposure pathways, and the definition of the Site. The CSM serves as the basis for developing technically feasible cleanup alternatives and selecting a final cleanup action. The CSM is considered to be dynamic and may be refined throughout the cleanup action process as additional information becomes available.

This section discusses the components of the CSM developed for the Site based on the completion of multiple phases of investigation conducted by SoundEarth and others. Figures 20 and 21 provide visual representations of the information presented below.

### 6.1 CONFIRMED AND SUSPECTED SOURCE AREAS

The results of the investigations conducted at the Site suggest that the solvent impacts confirmed in soil and groundwater beneath the Site are the result of a release from the laundry and dry cleaning facility that operated on the Property from 1927 through 1985. Dry cleaners began using Stoddard solvents in 1928, and it was the predominant dry cleaning solvent used in the United States through the late 1950s (State Coalition for the Remediation of Drycleaners 2009). By 1962, however, PCE surpassed Stoddard solvents as the primary dry cleaning agent. At the time, 90 percent of PCE consumed in the United States was used for dry cleaning (Chemical Engineering News 1963). Considering the scale of the laundry and dry cleaning operations conducted at the Property, it is reasonable to expect that the use of dry cleaning solvents at the Property reflected that of the rest of the country.

Although the type and location of dry cleaning operations conducted on the Property prior to 1964 could not be confirmed, historical building plans indicated that the bulk of the dry cleaning operations after the mid-1960s were conducted on the southwest portion of the Property (Figure 3). Consistent with this information, the highest concentrations of chlorinated solvents are located near the center of the Property by the loading dock; the highest concentrations of Stoddard solvents were observed to the south of the three closed-in-place USTs inside the building. The distribution of solvents in soil and groundwater suggest that the primary source of the release is located in these two areas, although additional, smaller releases may have contributed to shallow solvent contamination elsewhere on the Property.

### 6.2 CHEMICALS OF CONCERN

Based on the findings of the RI, the primary COCs at the Site are PCE and TCE (a natural degradation product of PCE) located beneath the western half of the Property and the Boren Avenue North ROW. Although an elevated concentration of TCE (5.2 µg/L) was detected in groundwater collected from monitoring well MW02 in Harrison Street in May 2011, the concentration in groundwater has since dropped below the cleanup level.

Secondary COCs identified for the Site include cis-1,2-DCE, vinyl chloride, GRPH (as Stoddard solvents), DRPH, ORPH, and associated compounds located beneath the Property.

## 6.3 MEDIA OF CONCERN

Soil, soil vapor, and groundwater have been confirmed as affected media at the Site. Indoor air has been retained as potential media of concern based on the elevated concentrations of PCE in soil and groundwater beneath the Site.

## 6.4 CONTAMINANT FATE AND TRANSPORT OF CHLORINATED SOLVENTS

This section includes a discussion of the transport mechanisms and environmental fate of chlorinated solvents in the subsurface.

Chlorinated solvents present beneath the Site include PCE, TCE, cis-1,2-DCE, and vinyl chloride, which are confirmed to be present at levels requiring further action under MTCA in both soil and groundwater. The PCE-related compounds are likely present as a result of chemical or biological degradation of PCE. Because both PCE and the degradation products share similar environmental fate and transport characteristics and are present in the same media, PCE is the focus of the contaminant fate and transport discussion.

The RI activities conducted at the Site have demonstrated the following:

- Perched water was encountered in only four of the 59 borings advanced at the Site. The discontinuous perched interval was generally located in the center of the Property above a dense silt layer (Figure 21). Recharge to the perched zone likely occurs via percolation of rainwater into the vegetated slope located near the center of the Property between the loading dock and the courtyard and between the Fur Vault and the David Smith Building. The bottom of the vegetated slope is located just above the elevation of the perched interval (Figure 21).
- Concentrations of PCE and its degradation products within the primary water-bearing zone, while above the applicable cleanup levels, are relatively low and consistent across the Site, which suggests that any previously undetected hotspots are unlikely to be present. Concentrations of cis-1,2-DCE were confirmed above the cleanup level only in wells MW06 and MW09, and vinyl chloride was detected only in well MW06. Groundwater in both wells contained significantly lower concentrations of dissolved oxygen (<1.00 milligrams per liter [mg/L]) relative to the other wells located throughout the Site, which is consistent with ongoing natural anaerobic degradation.
- Concentrations of TCE were detected above the cleanup level in groundwater samples collected from monitoring wells MW09 and MW12, which were screened 30 to 35 feet below the top of the primary water-bearing zone. The concentrations (16 and 19 μg/L, respectively) are consistent with those observed in other, shallower wells screened at the primary water-bearing zone throughout the Site. The silt content of the soil samples collected at the bottom of both borings increased relative to the overlying zones (20 percent silt approximately 10 feet above the bottom of the boring for MW09 and at the bottom of the boring in MW12, up from approximately 5 percent silt in shallower samples). During development, groundwater recharge was slower in MW09, which was screened within the siltier layer, suggesting the potential presence of an aquitard. MW12 did not extend as far into the silt layer/potential aquitard, so significant differences in recharge in that well during development could not be confirmed.
- Groundwater collected from the approximately 498-foot-deep supply well formerly located in the center of the Property did not contain detectable concentrations of chlorinated or Stoddard

solvents. The results of sampling conducted at the well demonstrated that the deeper aquifer beneath the Site has not been impacted by a release from the former property operations.

- Relatively consistent concentrations of PCE in soil appear to have migrated from the primary source area at the Property throughout the western half of the Property primarily through dispersion. Any migration upgradient of the source was likely facilitated by vapor-phase transport in the vadose zone over several years, as evidenced by the GORE Soil Vapor Survey results and the relatively loose sandy geology beneath those portions of the Site (Appendices E and F of the Draft RI Report [SoundEarth 2012]; Figures 6 and 7). In addition, detectable concentrations of PCE have been confirmed in deeper soil samples (within the primary water-bearing zone) beneath the Property and in one sample collected at a depth beneath the Boren Avenue North ROW, likely as a result of advective transport and subsequent adsorption of PCE via contaminated groundwater.
- The highest concentrations of PCE in soil are present beneath the center of the Property at depths ranging from 3 to 10 feet bgs (Figures 20 and 21). A very dense silt layer was encountered at depths between 12 and 20 feet bgs. Vertical migration of PCE contamination appears partially restricted by this silt layer as evidenced by the significant drop in PCE concentrations within and beneath the silt (boring/sample P08-10 vs. P08-14). Considering the associated high concentration of PCE in the perched reconnaissance water sample collected from temporary boring B07, the presence of PCE as dense nonaqueous-phase liquid within the perched zone is possible.
- PCE has migrated vertically through soil to depths of up to 65 feet bgs, or approximately 10 to 15 feet above the primary water-bearing zone, in the areas explored (Figures 20 and 21). PCE contamination in soil extends east up to approximately the centerline of the Property, and it has migrated west to the Property boundary. Based on the results of soil analytical data collected on and to the west of the Property, any soil contamination extending into the adjoining Boren Avenue North right-of-way is likely very limited in extent (Figures 11, 12, and 20 and Table 1).

### 6.4.1 Transport Mechanisms Affecting Distribution of Chlorinated Solvents in the Subsurface

The lateral, crossgradient, and upgradient distribution of PCE concentrations in the vadose zone likely are a result of vapor-phase transport via diffusion from source areas and transport over time. In addition to vapor-phase transport, PCE and its degradation products in the subsurface can be transported in the dissolved-phase via groundwater or other water that comes into contact with the contaminated soil. PCE, TCE, and cis-1,2-DCE in groundwater generally follows horizontal and vertical groundwater gradients, assuming some degree of seasonal fluctuation in groundwater flow direction. Groundwater beneath the Site is generally flat, with the exception of groundwater gradients measured in the far northwest corner of the Site (Figures 8 and 9). The mobility of the highest concentrations of COCs is limited by the presence of a dense silt layer beneath the main source area that significantly restricted the vertical migration of high concentrations of COCs. Concentrations of PCE, TCE, and cis-1,2-DCE in groundwater within the primary water bearing zone are relatively low and distributed fairly evenly across the Site, consistent with advective transport, long-term diffusion, and subsequent dispersion of the solvents in the subsurface.

As discussed previously, physical and technical limitations preclude additional investigation of the remaining data gaps at the Site. Considering the relatively low concentrations of COCs observed in groundwater collected from off-Property wells, applying a mathematical model to evaluate the worst-case distribution of the COCs in groundwater appeared to represent the most cost-effective and technically feasible approach to evaluate the Site as a whole.

The analytical groundwater modeling code ATRANS (version 1.06) was selected to evaluate the Site. ATRANS is a Microsoft Excel-based modeling system that uses a closed-form analytical solution to model dissolved-phase contaminant transport. The ATRANS modeling code can incorporate the following contaminant transport processes: advection, dispersion, absorption, and first-order transformation reactions; the predictive estimates do not account for mass distribution from vapor phase transport. Figures and tables illustrating the model input parameters and associated output are provided in Appendix K of the Draft RI Report (SoundEarth 2012). The ATRANS spreadsheet, user's manual, analytical solutions, and test problems are included as Appendix L of the Draft RI Report (SoundEarth 2012).

Based on chemical partitioning calculations, the vertical distribution of the COCs dissolved in groundwater will generally correspond to the vertical distribution of adsorbed-phase PCE in soil near the source area, and it will also generally follow the lateral migration of dissolved PCE spreading vertically and controlled by mechanical dispersion ($\alpha_z$), downward gradient(s), and heterogeneous geology. Because no Site-specific data regarding the sorptive and degradation capacity of the subsurface environment (e.g., fraction organic carbon or first order decay coefficient) are presently available, credible literature references (including the U.S. Geological Survey (USGS), EPA, and peer-reviewed scientific papers) were utilized to mathematically model a highly conservative/worst-case downgradient distribution scenario (i.e., assumed no degradation and no significant limit to transport; Scenario 1) and a best-case distribution scenario (Scenario 2), as presented in Figures K-1 through K-3 and Tables K-1 and K-3 (Appendix K of the Draft RI Report [SoundEarth 2012]). The transport model for Scenario 1 used the observed gradient (i), a low first-order decay coefficient ($\lambda$), a low estimated fraction organic carbon (foc) and thus a calculated low retardation factor (Rf), and a low organic carbon partitioning coefficient (Koc) for each of the chlorinated solvents (PCE, TCE, and cis-1,2-DCE). Scenario 2 incorporated many of the same inputs as Scenario 1 but importantly included a high first-order decay coefficient ($\lambda$). The same applies to modeling the extent of GRPH contamination in groundwater, which is discussed in Section 6.5.1, below.

Considering the inherent assumptions made using a mathematical model to evaluate complex natural systems, the plumes generated by the model do not necessarily match the empirical data at the Site. However, if seasonal fluctuations in groundwater flow direction are incorporated into the presentation, in combination with the understanding that the model is evaluating transport from a central line instead of a volume of media, the modeled plumes begin to show a greater degree of consistency with actual site conditions. This consistency between the model and the empirical data provides the basis for our discussion, which is presented in the Draft RI Report (SoundEarth 2012) and repeated below.

#### 6.4.1.1 Results—Modeled Extent of PCE

The shape of the PCE plume generated by the model approximates that observed using empirical data. The differences in the modeled and empirically measured extent of contamination are fairly insignificant be can likely be a result of fluctuation in groundwater flow direction and the location of the line source used by the model. Therefore, the extent of PCE was modeled not just from the source area, but also from MW05. Applied in combination with the empirical data generated for the Site, the conservative, maximum western extent of the PCE plume is estimated to be approximately 40 feet cross- to upgradient of MW05; the extent of the dissolved-phase PCE plume to the north, south, and east has been confirmed using empirical data (Figure K-1, Table K-5; Appendix K of the Draft RI Report [SoundEarth 2012]).

#### 6.4.1.2 Results—Modeled Extent of TCE

The results of the modeling exercise for TCE are consistent with the empirical data generated at the Site, especially if potential seasonal groundwater flow direction fluctuations are considered. Applied in combination with the empirical data generated for the Site, the northwestern extent of the TCE plume is estimated to be approximately 110 feet upgradient of the source area. The conservative, maximum western extent of the TCE plume is estimated to be approximately 100 feet cross-gradient of the source area. The extent of the dissolved-phase PCE plume to the north, south, and east has been confirmed using empirical data (Figure K-2, Table K-5; Appendix K of the Draft RI Report [SoundEarth 2012]).

#### 6.4.1.3 Results—Modeled Extent of cis-1,2-DCE

The differences in the model outputs between Scenario 1 and Scenario 2 are most significant for cis-1,2-DCE, largely as a result of the values used for half-life and first order decay coefficients (Table K-3 of the Draft RI Report [SoundEarth 2012]), which are orders of magnitude apart for each scenario. However, empirical data suggest that the actual Site conditions affecting the distribution of cis-1,2-DCE are closer to those presented in Scenario 2; assuming a slight seasonal shift in groundwater flow direction, the conservative, maximum southern extent of the cis-1,2-DCE plume is estimated to be approximately 30 feet downgradient of MW09. The extent of the dissolved-phase cis-1,2-DCE plume to the north, east, and west has been confirmed using empirical data (Figure K-3, Table K-5; Appendix K of the Draft RI Report [SoundEarth 2012]).

### 6.4.2 Environmental Fate of Chlorinated Solvents in the Subsurface

The primary COC at the Site is PCE. Once PCE enters the subsurface, chemical attenuation processes such as hydrolysis, direct mineralization, and reductive dehalogenation may affect the PCE in soil and groundwater, resulting in a natural reduction or breakdown into nontoxic components such as chloride and carbon dioxide. Biological attenuation processes such as reductive dechlorination and cometabolic degradation also may affect the reduction of PCE in soil and groundwater under conducive subsurface conditions. If reductive biodegradation of PCE is occurring, the first indication is the presence of degradation compounds that include TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. The soil and groundwater analytical data indicate that concentrations of TCE and cis-1,2-DCE have been detected in the in the vadose zone, the discontinuous perched interval, and the primary water-bearing zone beneath the Site, suggesting that some biological and possibly chemical attenuation processes are occurring at the Site, the level of which is consistent with data generated from the borings and wells completed throughout the Site.

PCE is a volatile compound that will volatilize into a gaseous state from soil and/or groundwater. In areas of the Site where an impermeable cover is not present, some PCE in vapor will escape to the atmosphere. Once in the atmosphere, it will rapidly attenuate via photodegradation.

## 6.5 CONTAMINANT FATE AND TRANSPORT OF PETROLEUM HYDROCARBONS

This section includes a discussion of the transport mechanisms and environmental fate of petroleum hydrocarbons in the subsurface.

### 6.5.1 Transport Mechanism Affecting Distribution of Petroleum Hydrocarbons in the Subsurface

The environmental transport mechanisms of petroleum hydrocarbons are related to the separate phases in the subsurface. The three phases of petroleum contamination in the subsurface at the Site are vapor (in soil vapor), residual contamination (sorbed contamination on soil particles), and aqueous phase (contaminants dissolved in groundwater). Each phase is in equilibrium in the subsurface with the other phases, and the relative ratio of total subsurface contamination by petroleum hydrocarbons between the four phases is controlled by dissolution, volatilization, and sorption.

GRPH as Stoddard solvent observed in soil and groundwater beneath the Site have been transported from source areas and distributed throughout the Site primarily by dispersive and advective transport mechanisms within the saturated zone. As with other chemicals, petroleum hydrocarbons tend to spread out as groundwater flows away from the source area. The extent of the hydrocarbon plume depends on the volume of the release, soil density, particle size, and seepage velocity. In all samples where concentrations of GRPH exceeded the MTCA Method A cleanup level in soil and groundwater, chlorinated solvents were also present, indicating a similar historical use and/or storage of both GRPH and chlorinated solvents.

Volatilization of the contaminant plume can result in mass removal of hydrocarbons by releasing vapor into the vadose zone, where soil hydrocarbon vapor can be biodegraded to an extent not possible in light nonaqueous-phase liquids (LNAPL) or dissolved phases, depending on environmental conditions. Sorption of contaminants onto soil particles or interstitial soil spaces can immobilize contaminants. Contaminants sorbed onto soil particles are not free to transport via aqueous transport or LNAPL advection. Residual contamination, although not necessarily broken down quickly over time, is generally immobile.

### 6.5.2 Environmental Fate in the Subsurface

The most significant fate process for petroleum hydrocarbons is biodegradation (i.e., natural attenuation). Biological degradation of contaminants in LNAPL, dissolved, residual, and vapor phases is possible under a variety of environmental conditions, although it occurs predominantly in the aqueous, residual, and vapor phases. Degradation products of gasoline constituents are generally less toxic than their parent species. Petroleum hydrocarbons that are the most mobile (having the least viscosity and most solubility in water) are also the most easily biodegraded (e.g., aromatics). Because petroleum constituents contain thousands of carbon compounds, there is a vast array of biochemical transformations that occur in situ in the soil and groundwater media. For example, hydroxylation can alter hydrocarbon compounds to ketone or alcohol products that are less toxic or more biologically available; aromatic reduction can convert aromatic groups to naphthenes; ring cleavage can destroy aromatic functional group species; and reduction can alter olefin functionality. The alteration and destruction of petroleum hydrocarbon constituents occur both by microbial enzyme catalytic reactions on the contaminant substrate or by direct digestion of contaminants as an electron donor or acceptor.

Any number of reactions can occur within the subsurface by microorganisms that can change the chemical distribution and concentrations of the contaminants.

## 6.6 EXPOSURE PATHWAYS

This section discusses the confirmed and potential human health and ecological exposure pathways at the Site with the goals of: (1) identifying those pathways requiring remediation to reduce or eliminate unacceptable risks to human health or the environment and (2) applying the findings to the development of potentially feasible remedial technologies. A CSM highlighting the complete pathways is presented on Figure 21.

### 6.6.1 Soil Pathway

Potential exposure pathways for soil contamination include volatilization into soil vapor and subsequent exposure through the vapor pathway discussed in Section 6.6.3 or via the direct contact pathway, which comprises direct contact via dermal contact with and/or ingestion of soil beneath the Site. Protection from direct contact exposure to affected soil would require capping or excavation. At present, soil with concentrations of PCE that exceed the MTCA Method B soil cleanup level of 1.9 mg/kg, which is considered protective of the direct contact pathway for dermal contact and/or ingestion, are covered with concrete, asphalt, and/or building structures, which minimize the risk of direct contact. While future development activities at the Site could result in exposure to contaminated soil above direct contact levels during construction, this pathway will be mitigated by virtue of the plan to remove soil containing concentrations of COCs in excess of their respective cleanup levels during redevelopment activities.

### 6.6.2 Groundwater Pathway

Groundwater is affected by releases directly into a groundwater-bearing zone or by unsaturated soil contamination desorbed from the soil particles by infiltrating surface water or seasonally high groundwater conditions. Potential exposure pathways for groundwater contamination include volatilization into soil vapor and subsequent exposure through the vapor pathway discussed in Section 6.6.3 or via the direct contact pathway, which comprises both the dermal contact and ingestion pathways. No groundwater supply wells at or in the vicinity of the Site are used for potable water supply. The primary water-bearing zone underlying the Site may qualify as a potential future source of potable water; however, because of the availability of municipal water supplies in the Site vicinity, there is a low probability that groundwater in the primary water-bearing zone at the Site or adjoining parcels would be used as a potable water source. Because there is no practical use of groundwater in the Site vicinity and the groundwater is at least 60 feet bgs, excavation activities would be required for direct contact with groundwater to become a potential risk to human health. Future development activities at the Site within the discontinuous perched interval could result in exposure to contaminated groundwater during construction.

### 6.6.3 Vapor Pathway

The air-filled pore space between soil grains in the unsaturated zone or partially saturated zone is referred to as soil gas or soil vapor. Soil vapor can become contaminated from volatilization of a PCE source, specifically from PCE as a non-aqueous phase liquid but also from PCE adsorbed to soil mineral surfaces and, to a lesser degree, dissolved in groundwater. Ecology guidance for evaluating soil vapor intrusion (VI) risks into structures provides generic chemical-specific screening levels for both groundwater and soil vapor that are protective of human health (Ecology 2009a). Because the planned future land use at this Property involves excavating the bulk of the soil contamination exceeding applicable cleanup levels, soil and soil vapor are not considered to be future media of concern. Therefore, generic screening levels for soil gas/vapor medium are not considered applicable for use in a screening level evaluation of future VI risk. It is appropriate, however, to use available soil vapor concentration data to conduct a screening level VI evaluation for existing structures and land use. The soil vapor data collected from the operational SVE system were used as worst-case potential concentrations for this screening evaluation. The maximum detected COC soil vapor concentrations from the SVE system and the associated screening levels protective of indoor air from the guidance are summarized in the following table.

| **COC** | **Maximum Detected Concentration in Soil Vapor (μg/m$^3$)** | **Soil Gas Screening Level Protective of the VI Pathway (μg/m$^3$) (Ecology 2009a, Appendix B)** |
|---|---|---|
| PCE | 910,000 | 4.2 |
| TCE | 6,100 | 1 |
| Cis-1,2-DCE | <5,000 | 160 |
| Vinyl chloride | <5,000 | 2.8 |
| GRPH | Not Measured | 1,400 – 27,000[1] |

μg/m$^3$ = micrograms per cubic meter

< = less than

[1] The screening levels vary by fraction for petroleum hydrocarbons (air-phase petroleum hydrocarbons):

The standard for EC9-12 aliphatics is 1,400 μg/m$^3$.

The standard for EC9-10 aromatics is 1,800 μg/m$^3$.

The standard for EC5-8 aliphatics is 27,000 μg/m$^3$.

A comparison of the maximum detected COC concentrations in soil vapor with the respective VI screening level indicates that there is a VI risk under a standard exposure scenario involving a slab-on-grade, crawl space, or full basement construction. As previously stated, these risks are have been partially mitigated by an interim remedy involving SVE and will be further mitigated in the future by virtue of removing the contaminated soil above the cleanup levels during Property redevelopment.

Because the groundwater contamination plume will remain at least temporarily following soil removal, the groundwater screening levels for VI are appropriately used for a screening level evaluation of the risk of vapor intrusion for future land use. The referenced guidance indicates that when conducting a Tier 1 evaluation of VI risk, the maximum measured groundwater concentrations should be compared to the screening levels. The maximum detected COC concentrations and the associated groundwater screening level protective of indoor air from the guidance are summarized in the following table.

| COC | Maximum Detected Concentration in Groundwater (µg/L) | Groundwater Screening Level Protective of the VI Pathway (µg/L) (Ecology 2009a Appendix B) |
|---|---|---|
| PCE | 29 | 1 |
| TCE | 19 | 0.42 |
| Cis-1,2-DCE | 120 | 160 |
| Vinyl chloride | 0.76 | 0.35 |
| GRPH | 1,400 | 2.9 – 1,300[1] |

µg/L = micrograms per liter

[1] The screening levels vary by fraction for volatile petroleum hydrocarbons (volatile petroleum hydrocarbons):

The standard for EC8-10 aliphatics + EC10-12 aliphatics is 2.9 µg/L.
The standard for EC5-6 aliphatics + EC6-8 aliphatics is 140 µg/L.
The standard for C8-10 aromatics + EC10-12 aromatics is 1,300 µg/L.

A comparison of the maximum detected COC concentrations in groundwater with the respective VI screening level indicates that there would be a potential VI risk from all of the COCs except cis-1,2-DCE under the standard exposure scenarios involving a slab-on-grade, crawl space, or full basement construction; however, because these standard exposure scenarios do not apply to the planned future land use (multiple levels of below grade parking located beneath an occupied structure), it is unlikely that the VI pathway would be complete. This future pathway is therefore excluded from further consideration.

## 6.7 TERRESTRIAL ECOLOGICAL EVALUATION

A Terrestrial Ecological Evaluation (TEE) is required by WAC 173-340-7940 at locations where a release of a hazardous substance to soil has occurred. The TEE is intended to assess potential risk to plants and animals that live entirely or primarily on affected land. A simplified TEE was required under MTCA to assess the potential ecological risks posed by contamination at the Site, and to evaluate whether a more detailed investigation of potential ecological risk would be required. SoundEarth conducted a simplified TEE in accordance with Table 749-1 of WAC 173-340-900 and the protocols established in WAC 173-340-7492 to assess the potential ecologic risk associated with the presence of COCs at the Site.

The Site qualifies for a TEE exclusion based on WAC 173-340-7491. The results of ranking for the simplified TEE under Table 749-1 of WAC yields a score of 12, which qualifies the Site for the TEE exclusion per WAC 173-340-7492(2)(a)(ii) on the basis that land use at the Site and surrounding area makes substantial wildlife exposure unlikely (Appendix J of the Draft RI Report [SoundEarth 2012]). The TEE considers Site area, Site land use, Site habitat quality, likelihood that the Site will attract wildlife, and COCs occurring in Site soil. No further consideration of ecological impacts is required under MTCA.

## 6.8 CONCEPTUAL SITE MODEL SUMMARY

A summary of the geologic, hydrogeologic, and laboratory analytical data are presented on Figures 20 and 21, which display a conceptual model of Site conditions. As shown on Figures 6 and 7, the stratigraphy at the Site is distinguished by three distinct geologic units (Vashon recessional outwash deposits [Qi], ice-contact deposits [Qvr], and pre-Fraser nonglacial deposits [Qpfa]). In addition, a discontinuous perched groundwater interval occupies portions of the center of the Site, and the primary water-bearing zone is present beneath the Site at elevations of approximately 15 to 18 feet above NAVD88.

The soil analytical data collected during the investigations conducted at the Site indicate that GRPH as Stoddard solvents and chlorinated solvent concentrations were highest in the center of the Property near the loading dock, which is the probable source area. The high concentrations of PCE in soil and perched groundwater in the vadose zone are inferred to be evidence of a release from the former dry cleaning facility that operated on the Property. Concentrations of COCs in the soil decrease rapidly—both horizontally and vertically—with distance from the source area. Beyond the high source area concentrations, which are to be limited vertically by a dense silt layer that appears to have restricted vertical contaminant migration, the vertical and lateral distribution of PCE concentrations is relatively consistent throughout the southwestern portion of the Property. The widespread extent of PCE in soil exhibiting relatively low concentrations is indicative of a long-term release via vapor-phase diffusion. The soil contamination appears to be limited to within the Property boundaries.

Impacts to groundwater within the primary water-bearing zone extend approximately 350 north-south and up to 240 feet east-west, generally trending west-southwest from the source area. Concentrations of chlorinated solvents within the groundwater are relatively low; the highest on-Property concentration of PCE in groundwater (21 µg/L) was collected from MW11, which was installed near the source area. With the exception of groundwater collected from wells MW07 and MW13, groundwater collected from wells installed beyond the Property boundary exhibited only TCE exceedances, also observed at relatively low concentrations. Likewise, groundwater collected from the two impacted deep wells (MW09 and MW12) also did not contain detectable concentrations of PCE, which is consistent with the peripheral degradation of chlorinated solvents within the primary water-bearing zone.

Data collected from wells north of the Property confirm that no risks to surface water or sediment exist as a result of the release at the Property, and that ongoing risks to human health and the environment as a result of vapor intrusion will be mitigated following excavation of the source area, as discussed in the proceeding sections. Empirical evaluation of the lateral distribution of groundwater contamination, which is present at relatively low concentrations in the primary water-bearing zone, was limited to the south and west as a result of physical and technological constraints and was therefore supplemented by a conservative mathematical model approach that allowed for the definition of the worst-case extent of groundwater contamination. The evaluation of the vertical distribution of contamination in groundwater was conducted by sampling the former supply well on the Property, which was installed to a depth of approximately 498 feet below ground surface. The results of sampling conducted at the well demonstrated that the deeper aquifer beneath the Site has not been impacted by a release from the former property operations.

As indicated in Section 6.7, the Site qualifies for a TEE exclusion based on WAC 173-340-7491. Section 6.6 discusses potential exposure pathways that could affect human health at the Site. In summary, the following exposure pathways are of concern for future human health exposure at the Site:

- **Soil Pathway**. Direct contact via dermal contact and/or ingestion by construction workers encountering contaminated soil during future construction activities on the Site. However, the soil pathway is not considered complete under the planned future use of the Property. Additional discussion of soil pathways is included in Section 6.6.1.
- **Groundwater Pathway.** Direct contact via dermal contact and/or ingestion by construction workers encountering contaminated perched groundwater during future construction activities on the Site. Human health exposure via ingestion of groundwater as a potable drinking water

supply is not considered to be a complete exposure pathway. Additional discussion of groundwater pathways is included in Section 6.6.2.

- **Vapor Pathway.** A screening level VI evaluation suggests that there is the potential for an unacceptable VI risk from contaminants in soil and/or groundwater intruding into existing structures at the Site, as well as short-term inhalation of volatilized contaminants by construction workers during future construction activities on the Site. However, the VI pathway is not considered complete under the planned future use of the Property. Additional discussion of the vapor pathway is included in Section 6.6.3.

## 7.0 TECHNICAL ELEMENTS

Remedial action objectives (RAOs) are used to define the technical elements for the screening evaluation and to select remedial alternatives. The technical elements include ARARs, COCs, media of concern, and cleanup standards.

### 7.1 REMEDIAL ACTION OBJECTIVES

RAOs are statements of the goals that a remedial alternative should achieve in order to be retained for further consideration as part of the FS. The purpose of establishing RAOs for a site is to provide remedial alternatives that protect human health and the environment (WAC 173-340-350). In addition, RAOs are designated in order to:

- Implement administrative principles for cleanup (WAC 173-340-130).
- Meet the requirements, procedures, and expectations for conducting an FS and developing cleanup action alternatives as discussed in WAC 173-340-350 through 173-340-370.
- Develop cleanup levels (WAC 173-340-700 through 173-340-760) and remedial alternatives that are protective of human health and the environment.

In particular, RAOs must address the following threshold requirements from WAC 173-340:

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

The overall RAO for this FS is to identify a remedial alternative(s) that will treat the primary source area and reduce COC concentrations in groundwater to below the applicable cleanup levels at the points of compliance proposed in Section 7.4.3 and the worst=case downgradient extent of the groundwater plume as determined by conservative numerical modeling. In addition to mitigating risks to human health and the environment, achieving the RAO ultimately will allow Ecology to issue a Covenant Not to Sue for the Site.

In consideration of the anticipated future use of the Property, specific objectives for the preferred remedy include the following:

- Excavate all on-Property soil containing PCE and other COCs at concentrations that present a risk to human health and the environment.
- Use in-situ treatment methods to reduce COCs in groundwater across the entire Site to avoid conflicts with adjoining and future land use.
- Prevent further off-Property migration of COCs in groundwater at concentrations exceeding cleanup levels.
- Provide engineering controls to prevent the unacceptable risks to human health posed by COCs in groundwater until cleanup levels are achieved.
- Acquire a Covenant Not to Sue for the Site.

## 7.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Under WAC 173-340-350 and 173-340-710, ARARs include regulatory cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that specifically address a contaminant, remedial action, location, or other circumstances at a site.

MTCA defines relevant and appropriate requirements as:

> those cleanup action standards, standards of control, and other human health and environmental requirements, criteria or limitations established under state and federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstances at a site, the department determines address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. The criteria specified in WAC 173-340-710(3) shall be used to determine if a requirement is relevant and appropriate.

Remedial actions conducted under MTCA must comply with the substantive requirements of the ARARs but are exempt from their procedural requirements (WAC 173-340-710[9]). Specifically, this exemption applies to state and local permitting requirements under the Washington State Water Pollution Control Act, Solid Waste Management Act, Hazardous Waste Management Act, Clean Air Act, State Fisheries Code, and Shoreline Management Act.

ARARs were screened to assess their applicability to the Site. The following table summarizes the preliminary ARARs.

**Preliminary ARARs for the Site**

| Preliminary ARAR | Citation or Source |
|---|---|
| MTCA | Chapter 70.105 of the Revised Code of Washington (RCW) |
| MTCA Cleanup Regulation | WAC 173-340 |
| Ecology, Toxics Cleanup Program – Guidance To Be Considered | *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*, Review DRAFT, October 2009, Publication |

| Preliminary ARAR | Citation or Source |
|---|---|
| | No. 09-09-047 |
| State Environmental Policy Act | RCW 43.21C |
| Washington State Shoreline Management Act | RCW 90.58; WAC 173-18, 173-22, and 173-27 |
| The Clean Water Act | 33 United States Code [USC] 1251 et seq. |
| Comprehensive Environmental Response, Compensation, and Liability Act of 1980 | 42 USC 9601 et seq. and Part 300 of Title 40 of the CFR [40 CFR 300]) |
| The Fish and Wildlife Coordination Act | 16 USC 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401) |
| Endangered Species Act | 16 USC 1531 et seq.; 50 CFR 17, 225, and 402 |
| Native American Graves Protection and Repatriation Act | 25 USC 3001 through 3013; 43 CFR 10 and Washington's Indian Graves and Records Law (RCW 27.44) |
| Archaeological Resources Protection Act | 16 USC 470aa et seq.; 43 CFR 7 |
| Washington Dangerous Waste Regulations | WAC 173-303 |
| Solid Waste Management Act | RCW 70.95; WAC 173-304 and 173-351 |
| Occupational Safety and Health Administration Regulations | 29 CFR Parts 1910, 1926 |
| Washington Department of Labor and Industries Regulations | WAC 296 |
| Water Quality Standards for Surface Waters of the State of Washington | RCW 90.48 and 90.54; WAC 173-201A |
| Water Quality Standards for Ground Water | WAC 173-200 |
| Department of Transportation Hazardous Materials Regulations | 40 CFR Parts 100 through 185 |
| Washington State Water Well Construction Act | RCW 18.104; WAC 173-160 |
| City of Seattle regulations, codes, and standards | All applicable or relevant and appropriate regulations, codes, and standards |
| King County regulations, codes, and standards | All applicable or relevant and appropriate regulations, codes, and standards |

## 7.3 MEDIA AND CHEMICALS OF CONCERN

The Site development plan currently includes excavating to an elevation of approximately 18 feet above NAVD88 for multi-level subgrade parking. The depth of the planned excavation is expected to incorporate all soil that exhibits COC concentrations exceeding applicable cleanup levels. The soil will be transported offsite for disposal at an appropriate land disposal site. Although soil is currently the primary media of concern, upon the excavation and removal of the contaminated soil, groundwater will become the primary media of concern. Secondary media of concern include soil vapor and indoor air by virtue of vapor transport from groundwater. The primary and secondary media and associated chemicals of concern are shown in the table below:

| Media of Concern | Chemicals of Concern |
|---|---|
| **Soil** | PCE, TCE, and GRPH (Stoddard Solvent constituents) |
| **Groundwater** | PCE; TCE; cis-1,2-DCE; vinyl chloride; and GRPH (Stoddard Solvent constituents) |
| **Soil Vapor, Indoor Air** | PCE; TCE; cis-1,2-DCE; vinyl chloride; and GRPH (Stoddard Solvent constituents) |

## 7.4 CLEANUP STANDARDS

The selected cleanup alternatives must comply with the MTCA cleanup regulations specified in WAC 173-340 and with applicable state and federal laws. The cleanup levels selected for the Site are consistent with the RAOs, which state that the remedial objective is to reduce concentrations of COCs in soil and/or groundwater to below the MTCA Method A (or B, as applicable) cleanup levels. In addition to mitigating risks to human health and the environment, achieving the RAOs will allow Ecology to issue a Covenant Not to Sue under Ecology's formal program mechanism. The associated media-specific cleanup levels for the identified COCs are summarized in Sections 7.4.1 through 7.4.3 below.

### 7.4.1 Cleanup Levels

The cleanup levels for the media and chemicals of concern are tabulated below, including the source of the standard. The proposed cleanup levels for the Site are the MTCA Method B Cleanup Levels for PCE and TCE in soil, which are protective of the direct-contact pathway, and the MTCA Method A cleanup levels for GRPH in soil. The MTCA Method A cleanup levels are proposed for COCs in groundwater. If no promulgated MTCA Method A cleanup level exists for a given chemical, the proposed cleanup level is the MTCA Method B Standard Formula Value for carcinogenic or noncarcinogenic compounds, depending upon the carcinogenic properties of the compound.

**Proposed Cleanup Levels for Soil**

| COC | Cleanup Level (mg/kg) | Source |
|---|---|---|
| PCE | 1.9 | MTCA Method B Calculation; WAC 173-340-740 (3)(b)(iii)(B)(II) Equation 740-2 |
| TCE | 11 | MTCA Method B Calculation; WAC 173-340-740(3)(b)(iii)(B)(II) Equation 740-2 |
| GRPH | 100 | MTCA Method A, Unrestricted; WAC 173-340-740(2)(b)(i) |

### Proposed Cleanup Levels for Groundwater

| COC | Cleanup Level (µg/L) | Source |
|---|---|---|
| GRPH | 1,000 | MTCA Method A, Table Value; WAC 173-340-720(3)(b)(i) |
| PCE | 5 | MTCA Method A, Table Value; WAC 173-340-720(3)(b)(i) |
| TCE | 5 | MTCA Method A, Table Value; WAC 173-340-720(3)(b)(i) |
| Cis-1,2-DCE | 16 | MTCA Method B, Standard Formula; WAC 173-340-720(4)(b)(iii)(A) (NC) |
| | | MTCA Method A, Table Value; WAC 173-340-720(3)(b)(i) |
| Vinyl chloride | 0.2 | |

NC = noncarcinogenic

### Proposed Cleanup Levels for Soil Gas

| COC | Cleanup Level[1] (µg/m$^3$) | Source |
|---|---|---|
| GRPH[2] | 1,400/14,000 | "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action", Review DRAFT, October 2009, Publication No. 09-09-047; Appendix B, Method B |
| PCE | 4.2/42 | |
| TCE | 1/10 | |
| Cis-1,2-DCE | 160/1,600 (NC) | |
| Vinyl chloride | 2.8/28 | |

NC = noncarcinogenic

[1] The first value is the screening level for sub-slab measurements; the second value is the screening level for deep (> 15 feet below ground surface) soil gas measurements.

[2] This is the lowest (most conservative) of the three screening level values for air-phase petroleum hydrocarbon fractions.

### Proposed Cleanup Levels for Indoor Air

| COC | Cleanup Level (µg/m$^3$) | Source |
|---|---|---|
| GRPH[1] | 140 | *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*, Review DRAFT, October 2009, Publication no. 09-09-047; Appendix B, Method B |
| PCE | 0.42 | |
| TCE | 0.1 | |
| Cis-1,2-DCE | 16 (NC) | |
| Vinyl chloride | 0.28 | |

[1] This is the lowest of the three screening level values for air-phase petroleum hydrocarbon fractions.

NC = noncarcinogenic

### 7.4.2 Points of Compliance

The point of compliance is the location where the enforcement limits that are set in accordance with WAC 173-200-050 will be measured and cannot be exceeded (WAC 173-200-060). Once the cleanup levels have been attained at the defined points of compliance, the impacts present beneath the Property will no longer be considered a threat to human health or the environment. In situations where achieving the standard point of compliance is not practicable, conditional points of compliance can be implemented under the expectation that the persons responsible for undertaking the cleanup action shall demonstrate that all practical methods of treatment will be used in the Site cleanup and will not result in a greater overall threat to human health and the environment (WAC 134-340-720).

#### 7.4.2.1 Point of Compliance for Groundwater

In accordance with WAC 173-340-720(8)(a)(b), the point of compliance for groundwater is defined as the uppermost level of the saturated zone extending vertically to the lowest depth that potentially could be impacted by the COCs throughout the Site; however, conditional points of compliance are proposed for the Site as a result of the significant technical and practical limitations to collecting additional groundwater data near the periphery of the western and southern extents (SoundEarth 2012, Figures 18A though C and Figure 19).

Considering the technical limitations associated with accessing meaningful locations for installing additional monitoring wells, in combination with measured flow direction, empirical data that suggest the lateral and vertical periphery of the plume is sufficiently understood to design an effective remediation of the worst-case extent of contamination, and the application of a conservative mathematical model to delineate the worst-case extent of contamination, the existing well network is proposed as conditional points of compliance to evaluate the effectiveness of any remedy applied at the Site. Based on the results of the feasibility study summarized herein, it is also anticipated that the proposed groundwater treatment alternative will present a barrier to any ongoing off-Site migration of contaminated groundwater, while at the same time enhancing natural attenuation of groundwater that has been occurring.

#### 7.4.2.2 Point of Compliance for Soil

In accordance with WAC 173-340-740 (6) (b-d), the point of compliance for direct contact exposure is throughout the Property from the ground surface to 15 feet bgs, which is a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of development activities. All soil containing concentrations of COCs above the direct-contact threshold will be over-excavated and removed from the Site.

In order to be protective of groundwater, on-Property soil containing known concentrations of PCE above the MTCA Method A cleanup level of 0.05 mg/kg (Table 740-1 of WAC 173-340) will be overexcavated. Contaminated soil will be disposed of at a permitted facility in accordance with a Contained-Out Determination issued by Ecology.

#### 7.4.2.3 Point of Compliance for Soil Gas

Cleanup standards and points of compliance for soil gas have not been promulgated as of the date of this document, although soil gas screening levels have been published as draft guidance by Ecology (Ecology 2009a) and are included as ARARs for this document. The points of compliance for soil gas are identified in the referenced guidance for both sub-slab gas (soil gas encountered just beneath a building) and deeper soil gas (defined as equal to, or greater than, 15 feet bgs).

#### 7.4.2.4 Point of Compliance for Indoor Air

Cleanup standards and points of compliance for indoor air have not been promulgated as of the date of this document, although indoor air cleanup levels have been published as draft guidance (Ecology 2009a) and are included as ARARs for this document. The points of compliance will be the standard point of compliance per WAC 173-340-750(6), which is ambient air throughout the Property.

## 8.0 FEASIBILITY STUDY

The purpose of this Draft FS is to develop and evaluate cleanup action alternatives to facilitate selection of a cleanup action at the Site in accordance with WAC 173-340-350(8). The FS is intended to provide sufficient information to enable Ecology and the Property owner to reach concurrence on the selection of a cleanup action. Details regarding the implementation of the selected cleanup action for the Site will be documented in a Cleanup Action Plan.

This Draft FS includes screening of potentially feasible remedial technologies and development of cleanup alternatives intended to achieve the objectives described in Section 7.1. The cleanup alternatives are evaluated with respect to threshold and other requirements for cleanup actions set forth in MTCA. This FS evaluates the alternatives and identifies those that are not effective, not technically possible, or whose costs are disproportionate under the provisions of WAC 173-340-360(3)(e), and it provides the basis for identifying a preferred cleanup alternative.

In accordance with WAC 173-340-350(8)(c)(ii), an FS generally will include at least one permanent cleanup action alternative, as defined in WAC 173-340-200, to serve as a baseline against which other alternatives will be evaluated for the purpose of determining whether the cleanup action selected is permanent to the maximum extent practicable. For the purposes of achieving the RAOs and facilitating redevelopment activities, each of the alternatives discussed below incorporates excavation and removal of the source area, which fulfills the requirements of a permanent cleanup action alternative. In addition, the results of pilot-scale testing, where applicable, are used to evaluate the most advantageous remediation technologies and to support selection of a preferred alternative for the Site in conformance with WAC 173-340-360 through 390.

### 8.1 EVALUATION OF FEASIBLE REMEDIATION TECHNOLOGIES

Remedial components (technologies) were evaluated with respect to the degree to which they comply with the cleanup requirements set forth in MTCA. According to MTCA, a cleanup alternative must satisfy all of the following threshold criteria as specified in WAC 173-340-360(2):

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

These criteria represent the minimum standards for an acceptable cleanup action.

WAC 173 340-360 (2)(b) also requires the cleanup action alternative to:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration time frame.
- Consider public concerns on the proposed cleanup action alternative.

Using the above criteria, several remedial technologies were evaluated and screened for effectiveness, implementability, and relative cost to produce a short list for further inclusion in the development of alternatives. Table 3 summarizes the remedial component screening process. The remedial components that passed the screening process include the following:

- **Excavation and Land Disposal of Contaminated Soil (Source Removal).** For the purposes of this FS, the excavation of contaminated soil from the Property will result in the complete removal of the ongoing source of COCs to the groundwater (Figures 22 through 25). Land disposal is the act of removing contaminated soil from an uncontrolled condition and placing it in a controlled condition where it will produce fewer adverse environmental impacts. A controlled condition generally refers to engineered landfills that feature low permeability liners, witness systems, and leachate collection systems to prevent the disposed soil from leaching into the environment and mitigate future liability associated with the contamination.

- **Dewatering during Excavation (Source Removal).** As the excavation proceeds, it may encounter the discontinuous but contaminated perched groundwater that was observed near the center of the Property. Dewatering is the process of pumping the perched water prior to excavating through the dense silt layer, which will prevent contamination of underlying soil by eliminating the potential for soil contact with the contaminated water.

- **Soil Vapor Extraction.** SVE is the process of inducing a pressure and concentration gradient in the subsurface to cause volatile compounds, including PCE, TCE, and GRPH, to desorb from the soil and flow with the vapor stream to a common collection point for discharge or treatment. SVE was applied at the Site in an effort to meet the interim remediation levels proposed for soil prior to excavation and land disposal.

- **Resistive Thermal Heating with Vapor Extraction.** Contaminated groundwater is heated using electrical resistance to a temperature sufficient to cause the contaminants in groundwater to volatilize to the vapor phase, where they are recovered by vapor extraction. Recovered vapor and water are treated to remove contaminants before disposal.

- **In Situ Chemical Oxidation with Permanganate.** Permanganate has proven to be an effective chemical oxidant for the treatment of chlorinated solvents (PCE, TCE, cis-1,2-DCE, and vinyl chloride) in soil and groundwater. A solution of permanganate as a salt of either potassium or sodium is injected into the groundwater to chemically oxidize these target COCs.

- **Reductive Dechlorination (Anaerobic Bioremediation).** Reductive dechlorination is a proven remedial technology for chlorinated solvents. The fermentation of edible oil by indigenous microorganisms injected into the groundwater produces a rapid and significant reduction in dissolved oxygen concentrations in the saturated zone. This provides the strongly negative oxidation/reduction potential necessary to treat the target COCs by reductive dechlorination. The anaerobic zone extends far beyond the radius of influence of the edible oil itself, enhances attenuation of contaminants both up- and cross-gradient of the active treatment zone, and serves as a barrier around the periphery of the treatment system/groundwater plume, which mitigates the migration of contaminated groundwater beyond Site boundaries. Reductive dechlorination is a biotic process completed by anaerobic bacteria. Complete dechlorination of PCE produces nontoxic chloride, ethene, and ethane gas.

- **Passive Vapor Barrier.** Passive vapor barriers are materials that exhibit very low gas flow permeability and that can prevent the intrusion of vapor-phase VOCs into the interior of the building. The foundation of the future development will include the floor and walls of a multi-level, belowground parking garage. The foundation will be comprised of several feet of concrete, which will be constructed to act as a permanent vapor barrier to contaminant migration.

- **Monitored Natural Attenuation.** Monitored natural attenuation refers to the methods used to evaluate whether natural attenuation processes are effectively remediating a contaminant plume, and if so, at what rate. Contaminants released to the environment in concentrations that pose risks to human health or the environment are subject to natural degradation processes such as volatilization, diffusion, biotic and abiotic reactions, and dilution. These naturally occurring attenuation processes are distinguished from an engineered remedy employed to increase the rate of remediation above the rate observed through these “natural” processes. In many cases, natural attenuation is the most cost effective means for achieving cleanup levels.

  Monitored natural attenuation is retained as a complimentary remedial component to other engineered remedial components rather than as a stand-alone or sole remedial component to be consistent with the expectations for natural attenuation stipulated under MTCA. Under MTCA, monitored natural attenuation can be considered an active remedial measure if site conditions conform to the expectations listed in WAC 173-340-370(7), as follows:

  - Source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable.
  - Leaving contaminants in place during the restoration time frame does not pose an unacceptable threat to human health or the environment.
  - There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site.
  - Appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected.

## 8.2 ALTERNATIVE DEVELOPMENT AND DESCRIPTION

The development of cleanup alternatives considered only those remedial components that effectively treat the COCs in the affected media of concern and that are conducive to the future Property development plan. The development plan involves installing several levels of belowground parking and constructing a mixed-use (office/retail) commercial building. Preliminary site plans indicate that the entire Property will be excavated to a final grade depth of 18 feet above NAVD88, or approximately 2 feet above the top of the primary water-bearing zone. Excavating the entire Property to this depth will remove all soil exhibiting COCs above the respective cleanup levels, thereby eliminating the principal source of groundwater contamination.

Three cleanup alternatives have been developed that are comprised of various combinations of the remedial components retained from the component screening step. Common to all alternatives is the excavation and off-site land disposal of soil exceeding the cleanup levels. The alternatives differ only in the type of treatment employed to remediate groundwater.

Because of the significant elevation changes—and associated relative depths bgs—across the Site, discussions regarding elevation and depth are hereafter presented in elevations above NAVD88.

The three alternatives, which are described in more detail in the following subsections, include the following:

- Cleanup Alternative 1, Excavation and Land Disposal of Soil with In Situ Chemical Oxidation of Groundwater
- Cleanup Alternative 2, Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater
- Cleanup Alternative 3, Excavation and Land Disposal of Soil with Electrical Resistance Heating and Vapor Extraction for Groundwater

### 8.2.1 Common Components and Basic Assumptions

The three alternatives differ only in the type of groundwater treatment technology used. Due to the nature of the development plan, the following elements are common among all three cleanup alternatives.

**Remediation Area.** Essentially the entire Property will be excavated from lot-line to lot-line, as discussed in greater detail below. For the purposes of this Draft FS, the portions of the Property with soil containing concentrations of COCs in excess of their respective cleanup levels will be referred to as the Remediation Area. The Remediation Area is defined as the vertical and horizontal limit of the soil exhibiting contamination above cleanup levels within the Property boundary (Figures 22 through 25).

**Demolition.** Because the remediation activities will be conducted as part of a larger redevelopment project, the alternatives discussed below assume that all buildings on the Property will be demolished prior to beginning shoring and excavation.

**Shoring.** Shoring is required to protect the safety of personnel working in the excavation, as well as the surrounding properties, from damage due to slope failure. For the purpose of estimating the remedial cost for each alternative, it is assumed that shoring is a development-related cost and is therefore not included in the cost estimates provided in this Draft FS.

For illustration purposes, it is anticipated that the shoring would be installed around the entire perimeter of the redevelopment. Footing drains would be completed along the exterior perimeter of the foundation to collect any groundwater that may come into contact with the structure; however, considering the anticipated depth of the shoring and excavation project (approximately 50 to 85 feet bgs northwest to southeast, or 18 feet above NAVD88) and the primary water-bearing zone relative to the depth of the excavation (approximately 2 feet below the final grade), any groundwater collected at the footing drains would likely be limited in volume.

**Excavation.** The costs for each alternative include the removal and disposal of all soil within the Remediation Area to an approximate elevation of 19 feet above NAVD88 (Figures 22 through 25). Although cleanup levels protective of direct contact are proposed for soil across the Site, on-Property soil containing known concentrations of PCE above the MTCA Method A cleanup level will be overexcavated in an effort to remove the on-going source of contamination to groundwater and provide a reasonable restoration timeframe.

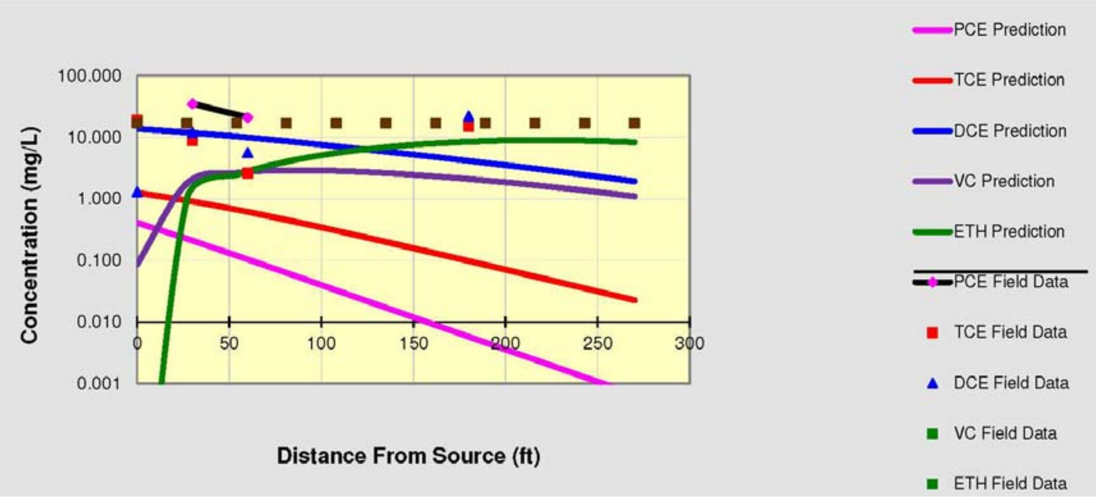
The Remediation Area covers approximately 1 acre of land. Assuming an excavation elevation of 19 feet above NAVD88, the volume of soil within the Remediation Area would be approximately 97,540 tons. Based on soil analytical data collected through the RI phase of work, approximately 340 tons of soil would require land disposal as dangerous waste classified as EPA Waste Code F002. The actual amount of material requiring disposal as land-ban or dangerous waste would ultimately be based on additional soil confirmational sampling conducted prior to and during excavation. The balance of the excavated material (approximately 97,200 tons) would be managed as nondangerous waste under a contained-in determination and contingent management option as determined by Ecology. Soil would be excavated within the confines of the shoring as designed by the civil engineer and would be directly loaded into trucks for off-Property treatment and land disposal in accordance with the contained-in determination.

**Dewatering.** As the excavation proceeds, the discontinuous but contaminated perched groundwater that was observed near the center of the Property may be encountered. The perched groundwater appears to be associated with a small vegetated slope that facilitates localized recharge (Figure 21). The excavation will be coordinated to first address the contaminated soil near the center of the source area in an effort to segregate the dangerous waste and remove the contaminated perched water prior to excavating through the dense silt layer.

**Passive Vapor Mitigation.** Each alternative includes the construction of a belowground concrete parking garage structure with an associated venting system. The removal of all soil contamination via excavation, the substantial thickness of the proposed foundation, as well as the belowground structure and venting system, would mitigate the potential for intrusion and/or collection of unsafe levels of COC vapors into the parking garage and above-grade building. In addition, the foundation floor and walls would be constructed of concrete, which would create a barrier to recontamination via vapor and groundwater seepage.

**Natural attenuation of residual concentrations of chlorinated solvents in groundwater located within and beyond the active treatment area.** While the active groundwater treatment area was designed to include the worst-case, maximum extent of the plume, natural attenuation would effective address any residual contamination located beyond and within the proposed conditional points of compliance. In accordance with WAC 173-340-370, natural attenuation is an appropriate supplement to the active treatment approach for the following reasons: source control (excavation) will be conducted to the maximum extent practicable, the concentrations and locations of the contaminated groundwater do not pose an unacceptable risk to human health or the environment, and there is evidence that natural biodegradation is occurring and will continue to occur (and will increase following complete removal of the source area via excavation and implementation of active groundwater treatment) at a reasonable rate.

To evaluate the long-term impacts on chlorinated solvent concentrations assuming no active groundwater remediation, the Site-specific data was entered into the BIOCHLOR model, a copy of which is provided in Appendix A. Because the model output, which assumes a decaying single planar source, suggests that natural attenuation will occur over a longer period of time (25 years), it is reasonable to expect that, following complete source removal and groundwater treatment, PCE and TCE concentrations will decrease more rapidly than the model prediction.



**Graph 1. BIOCHLOR Model of natural attenuation of chlorinated solvents at the Site after 25 years. Model assumptions require an ongoing source; however, because the source will be excavated and removed from the Site, it is reasonable to anticipate a more rapid degradation rate than modeled, with or without treatment.**

Concentrations of 1,2-cis-DCE and VC would be expected to increase slightly, but not to the magnitude predicted by the model. However, the zone where natural attenuation will, if necessary, supplement active groundwater treatment is up- and cross-gradient of the treatment area (south and west of the proposed conditional points of compliance), and any generated cis-1,2-dichloroethylene and vinyl chloride would ultimately be consumed within the anaerobic dechlorination zone. If required to validate this assumption, empirical data will be collected via drawdown of the wells established as the points of compliance and quantitative laboratory analysis of extracted groundwater within the measured cone of depression.

### 8.2.2 Cleanup Alternative 1—Excavation and Land Disposal of Soil with In Situ Chemical Oxidation of Groundwater

Figures 26 through 28 provide a conceptual plan of how Cleanup Alternative 1 might be implemented. This alternative involves excavating contaminated soil within the Remediation Area and transporting the excavated material off the site for land disposal. Shoring consisting of soldier piles, lagging, and tie backs would be installed as the excavation proceeds. Existing soil analytical data would be used to direct the real-time segregation and loading of haul trucks based on the following categories:

- **Dangerous Waste Soil Suitable for Land Disposal**. Soil exhibiting PCE concentrations greater than 1.9 mg/kg but less than 60 mg/kg is designated as dangerous waste that is suitable for land disposal in an approved RCRA Subtitle C facility without further treatment. The 1.9 mg/kg value is considered protective of the direct contact pathway (Appendix B). The estimated quantity of this material based on existing analytical data is 340 tons (Figure 20).
- **Nondangerous Soil.** Soil exhibiting PCE concentrations below the MTCA Method B cleanup level of 1.9 mg/kg but above the laboratory detection limit (0.025 mg/kg) as sourced from an F-listed waste material requires disposal as problem waste. In accordance with Ecology's concurrence, the soil could potentially be disposed of as nondangerous waste following Ecology's Contained-In Determination. The

estimated quantity of this material based on existing analytical data and incorporating approximate clean overburden calculations is 97,200 tons (Figure 20).

- **Clean Fill.** Soil that does not contain detectable concentrations of PCE would be considered clean fill material and is excluded from the remedial cost estimates.

Soil would be initially segregated using existing data. A mobile laboratory would be used to document that the soil containing PCE concentrations in excess of 1.9 mg/kg has been removed from the Property before proceeding to the removal of the remaining soil subject to a contained-in determination. The segregated soil would be loaded on haul trucks and transported to the appropriate treatment and disposal facility. The unit cost per ton for transportation and disposal for each category of waste was estimated by Waste Management and is summarized below. Actual costs may vary.

- $220 per ton for dangerous waste soil.
- $75 per ton for nondangerous waste soil.

After excavating all soil exceeding cleanup levels within the boundary of the Remediation Area, excavation of the remainder of the Property to the final vertical and lateral extents could commence under the supervision of the on-site construction contractor.

After the final grades are achieved and prior to installing the building foundation, the remedial infrastructure required to treat the groundwater contamination plume using in situ chemical oxidation would be installed. As illustrated on Figures 26 through 28, angled borings/injection wells would be installed under the Boren Avenue North ROW for the purpose of injecting permanganate solution to oxidize the COCs in groundwater and treat the extent of the confirmed solvent plume.

Vertical injection wells would be installed on the Property at a spacing of 15 feet along transects to approximately 35 feet into the saturated zone. The relatively wide spacing of the injection wells along each transect is based on a comparatively low Permanganate Natural Oxidant Demand (PNOD) of 0.8 grams, as well as the relatively permeable soil texture (Appendix C). The PNOD is a laboratory test performed to determine the amount of permanganate required to oxidize the naturally occurring organic carbon in the soil. Because permanganate is a strong chemical oxidizer that will oxidize all organic carbon in the soil, including naturally occurring carbon as well as carbon sourcing from the COCs, it is important to accurately estimate the amount of permanganate necessary to oxidize the solvents remaining in groundwater beneath the Site. The PNOD test suggested that 0.8 grams of permanganate is required to oxidize 1,000 grams of dry soil at the Site, assuming the organic carbon content of the soil within the injection target area is homogenous. Based on the PNOD analytical results, approximately 102 tons of permanganate would be required to oxidize the organic carbon source. Calculations for estimating the permanganate dose are provided in Appendix D.

Injection transects would be spaced 25 feet apart and oriented perpendicular to the groundwater flow direction in a barrier-type design. To reduce drilling costs but provide adequate treatment of the plume, transects would be spaced at a distance equivalent to the distance travelled by groundwater in 1 year. Using data generated during the RI, groundwater seepage velocity was calculated by:

$$V = \frac{Ki}{n}$$

Where:

V = velocity (distance/time)

K = hydraulic conductivity (distance/time)

i = hydraulic gradient (feet/feet)

n = effective porosity (decimal)

Based on an estimated hydraulic conductivity of 1 x $10^{-3}$ centimeters per second, a hydraulic gradient of 0.007 feet/feet, and an effective porosity of 30 percent, this distance is estimated to be approximately 25 feet per year.

Manifold piping would be used to introduce a permanganate solution into each of the injection wells. After the initial injection of permanganate solution, the construction of the foundation and parking garage could commence. The injection well network would remain in place under the parking garage base floor slab so that additional injections of permanganate solution could be introduced into the groundwater in the future, if determined to be necessary. For planning purposes, SoundEarth estimated that a total of three injection events would be conducted to address the groundwater contamination beneath the Site.

In the event that confirmational groundwater sampling will be required beyond the proposed conditional points of compliance for groundwater, analysis of groundwater surrounding the conditional points of compliance will be conducted via enhanced fluid extraction. As a result of the extraction activities, significant drawdown will be implemented and a cone of depression will be created. Empirical data will be obtained by conducting quantitative laboratory analysis of extracted groundwater within the measured cone of depression to verify the effectiveness of the proposed remedy.

The estimated timeframe to implement this cleanup alternative is approximately 6 years based on the following assumptions:

- Ecology approval of the RI, FS, and Cleanup Action Plan—6 months.
- Ecology Contained-Out Determination—4 to 6 months (conduct concurrent with above task).
- Engineering Design—4 to 6 months (conduct concurrent with above task).
- Project and permit review for the redevelopment project—6 to 12 months (conduct concurrent with above tasks).
- Remedial construction.
  - Mobilization and setup—1 month.
  - Shoring installation—2.5 months.
  - Remedial excavation and contaminated soil disposal—3 months (conduct partially concurrent with shoring installation).
  - Injection well installation and initial permanganate injection—3 months.

- Post-closure monitoring—5 years.

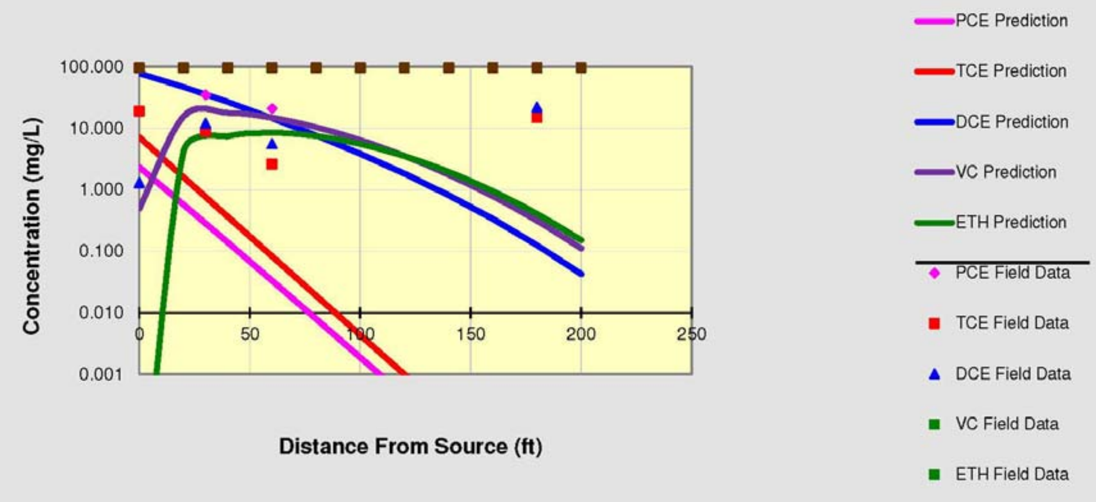
The feasibility study level cost estimate for this alternative is presented in Table 4. The estimated present worth cost is $11,327,000.

### 8.2.3 Cleanup Alternative 2—Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater

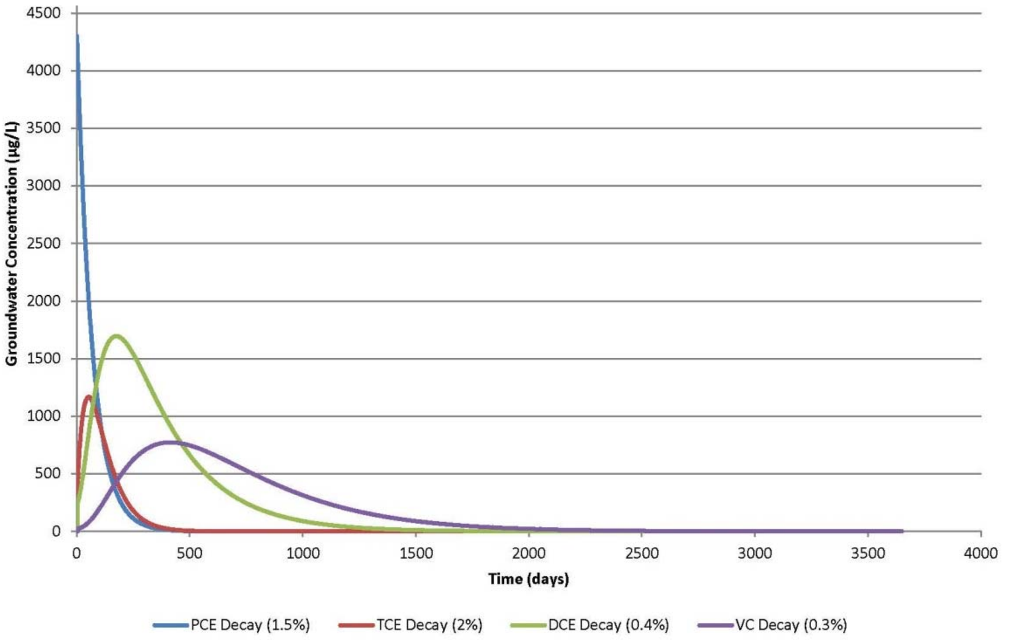
The excavation and land disposal component of Cleanup Alternative 1 would also be implemented for Cleanup Alternative 2. After the final grades are achieved and prior to installing the building foundation, the remedial infrastructure required to treat the groundwater contamination plume using in situ reductive dechlorination would be installed. As illustrated on Figures 29 through 31, angled borings/injection wells would be installed under the Boren Avenue North ROW that could provide access for the purpose of injecting an edible oil substrate (EOS) and *Dehalococcoides* genus bacteria (DHC) to treat the extent of the confirmed solvent plume. EOS would be used as a carbon source to deplete dissolved oxygen present in the aquifer, generate free hydrogen, and sustain a robust anaerobic dechlorinating microbial population. The indigenous microbial population will consume oxygen and generate an anaerobic environment, which is needed for DHC-mediated reductive dechlorination to occur. Reductive dechlorination of chlorinated VOCs occurs under strictly anaerobic conditions; unlike in aerobic conditions, where bacteria obtain energy by oxidizing reduced compounds (i.e., petroleum) while utilizing oxygen as the electron acceptor, reductive dechlorination is mediated by anaerobic bacteria (e.g., DHC), which obtain energy by oxidizing hydrogen ($H_2$) and utilizing the chlorinated VOC as the electron acceptor. Through this process, chlorine atoms within the solvent molecules are replaced by hydrogen one by one. As such, PCE is reduced to TCE, which is reduced to cis-1,2-DCE, which is reduced to VC, and VC is reduced to ethane as a detoxified final degradation product. The presence of degradation products in groundwater across the Site confirms that Site conditions are conducive to reductive dechlorination, and enhancing this naturally occurring process with EOS and DHC will significantly reduce the remedial timeframe.

Vertical injection wells would be installed on the Property on 15-foot centers along transects to a depth of approximately 35 feet below the saturated zone. The relatively wide spacing of the injection wells along each transect is based on soil bulk density estimates developed by EOS Remediation, as well as the relatively permeable soil texture. This information was used to develop the approximate volume of EOS necessary to support a zone of anaerobic dechlorination sufficient to degrade the chlorinated solvents within groundwater beneath the Site (Appendix E).

In addition to modeling natural attenuation rates, BIOCHLOR was used to model the reduction of chlorinated solvent concentrations after 5 years for EOS. The model assumes a decaying single planar source, when in reality, the source will be removed. This assumption required by the model results in the concentration at 0 ft from the source decreasing slowly, where in reality, it would decrease sharply.



**Graph 2. BIOCHLOR Model of attenuation of chlorinated solvents at the Site 5 years following injection of EOS. Model assumptions require an ongoing source; however, because the source will be excavated and removed from the Site, it is reasonable to anticipate a more rapid degradation rate than modeled.**



**Graph 3. Empirical data demonstrating attenuation of chlorinated solvents at another site with higher starting concentrations and no source removal. Because the source will be excavated and removed from the Site, it is reasonable to anticipate a more rapid degradation rate than observed here.**

In the event that compliance groundwater monitoring indicates that the native population of DHC needs to be supplemented, costs to inject proprietary DHC groups (KB1 or SB9) are included in the feasibility-level cost estimate (Table 5).

Due to the relatively long reaction time of the EOS, injection transects would be spaced 75 feet apart (a distance equivalent to the distance travelled by groundwater in 3 years) and oriented perpendicular to the groundwater flow direction in a barrier-type design. By virtue of the injectate and the layout of the system, EOS also will serve as a barrier to off-Site migration of contaminated groundwater from the source area. The zone where natural attenuation may supplement active groundwater treatment is up- and cross-gradient of the treatment area (south and west of the proposed conditional points of compliance), and any generated degradation products would be consumed within the anaerobic dechlorination zone.

Manifold piping would be used to introduce EOS and DHC into each of the injection wells. After the initial injection, the construction of the foundation and parking garage would commence. The injection well network would remain in place under the parking garage base floor slab in the event that future injections of EOS and/or DHC could be conducted as necessary.

In the event that confirmational groundwater sampling will be required beyond the proposed conditional points of compliance for groundwater, analysis of groundwater surrounding the conditional points of compliance will be conducted via enhanced fluid extraction. As a result of the extraction activities, significant drawdown will be implemented and a cone of depression will be created. Empirical data will be obtained by conducting quantitative laboratory analysis of extracted groundwater within the measured cone of depression to verify the effectiveness of the proposed remedy.

The estimated time frame to implement this cleanup alternative is approximately 6 years based on the following:

- Ecology approval of the RI, FS, and Cleanup Action Plan—6 months.
- Ecology Contained-Out Determination—4 to 6 months (conduct concurrent with above task).
- Engineering design—4 to 6 months.
- Project and permit review for the redevelopment project and remediation system—6 to 12 months.
- Remedial construction.
    - Mobilization and setup—1 month.
    - Shoring installation—2.5 months.
    - Remedial excavation and contaminated soil disposal—3 months.
    - Injection well installation and edible oil injection—2 months.
- Post-closure monitoring—5 years.

The feasibility study level cost estimate for this alternative is presented in Table 5. The estimated present worth cost is $10,260,000.

### 8.2.4 Cleanup Alternative 3—Excavation and Land Disposal of Soil with Electrical Resistance Heating and Vapor Extraction for Groundwater

The excavation and land disposal component for Cleanup Alternatives 1 and 2 would also be implemented for Cleanup Alternative 3. After the final site grade is achieved, the electrical resistance heating of groundwater portion of the remedy would be implemented (Figure 32). The conceptual cross sections A-A’ and B-B’ are shown on Figures 33 and 34.

Electrodes and temperature monitoring points (TMPs) would be installed in the approximate spacing shown on Figure 32. The electrodes would be constructed in borings advanced to a total depth of 40 feet below the final grade elevation (i.e., approximately 30 feet into the saturated zone) within the Property boundaries using standard HSA drilling techniques. The electrodes would be comprised of Schedule 40 steel. The details of the electrode head completions are proprietary and would be provided at the time of construction. Groundwater within the treatment zone would be heated to a temperature of 100 degrees C to transfer the dissolved COCs to the vapor phase for subsequent recovery by vapor extraction. During heating, subsurface temperatures would be measured at TMPs located within the treatment area. Each of the TMPs would consist of Schedule 80 chlorinated PVC pipe installed in borings advanced using standard hollow stem auger drilling techniques. Pipes for the collection of recovered soil vapor would be connected to the electrodes to convey soil vapor from the Remediation Area by vacuum to a treatment building. The treatment building, as shown on the conceptual site plan, would be installed within the completed parking garage and include a vacuum blower and vapor scrubber consisting of a permanganate solution to oxidize recovered COCs prior to atmospheric discharge.

After installation of the electrodes, TMPs, and the vapor extraction mechanical and treatment equipment, the system would be subjected to startup and testing. After testing, power would be applied to the Site continuously except for system adjustments, routine maintenance, and scheduled soil and groundwater sampling events. Thermocouples in the TMPs would be monitored continuously using a Power Control Unit (PCU) control and remote monitoring systems. The PCU is a variable transformer system capable of providing three simultaneous power outputs at automatically adjustable voltages. Based on the available data, the preliminary estimates for minimum power requirements assume that approximately 17.5 million kilowatt hour of electrical energy would need to be input to the subsurface in order to achieve the established subsurface heating goals for the project. The time required to apply this amount of energy to the subsurface is estimated at approximately 250 days. During operations, the heating contractor would monitor the system remotely and provide weekly updates and conduct site visits every other week for visual inspection and maintenance of the electrical resistance heating (ERH) components of the system. Additional trips would be made as necessary to ensure that the ERH system is functioning efficiently and effectively.

In the event that confirmational groundwater sampling will be required beyond the proposed conditional points of compliance for groundwater, analysis of groundwater surrounding the conditional points of compliance will be conducted via enhanced fluid extraction. As a result of the extraction activities, significant drawdown will be implemented and a cone of depression will be created. Empirical data will be obtained by conducting quantitative laboratory analysis of extracted groundwater within the measured cone of depression to verify the effectiveness of the proposed remedy.

The estimated time frame to implement this cleanup alternative is approximately 4 years based on the following:

- Ecology approval of the RI, FS, and Cleanup Action Plan—6 months.
- Ecology Contained-Out Determination—4 to 6 months (concurrent with above task).
- Engineering design—6 to 8 months.

- Project and permit review for the redevelopment project and remediation system—6 to 12 months.
- Remedial construction.
  - Mobilization and setup—1 month.
  - Shoring installation—2.5 months.
  - Remedial excavation and contaminated soil disposal—3 months.
  - ERH installation and demobilization (10 months).
- Post-closure monitoring – 2 years.

The feasibility study level cost estimate for this alternative is presented in Table 6. The estimated present worth cost is $16,822,000.

### 8.3 EVALUATION OF ALTERNATIVES

This section presents the criteria used to evaluate the potentially feasible cleanup alternatives with respect to the RAO established for the Property. Remedial components were identified per the requirements set forth in MTCA under WAC 173-340-350(8)(b) and the focused screening of potential remedial components using the requirements and procedures for selecting cleanup actions as set forth in MTCA under WAC 173-340-360(2)(a)(b). The criteria used to evaluate and compare applicable cleanup alternatives were derived from WAC 173-340-360(3)(f) and include the following:

- **Protectiveness.** The overall protectiveness of human health and the environment includes the degree to which existing risks are reduced, the time required to reduce risk at the facility and attain cleanup standards, the risks resulting from implementing the alternative, and improvement of overall environmental quality of the Site.
- **Permanence.** The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances includes the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and the sources of releases, the degree of irreversibility of the waste treatment process, and the characteristics and quantity of treatment residuals generated during the treatment process.
- **Effectiveness over the long term.** The degree of certainty that the alternative will be successful depends on the reliability of the alternative during the period of time over which hazardous substances are expected to remain on the Property, as well as the magnitude of residual risk associated with the contaminated soil and/or groundwater components. The following types of cleanup action components, presented in descending order, may be used as a guide when assessing the relative degree of long-term effectiveness of the chosen alternative: reuse or recycling; destruction or detoxification; immobilization or solidification; on- or off-Site disposal in an engineered, lined, and monitored facility; on-Site isolation or containment with attendant engineering controls; and institutional controls and monitoring.
- **Management of short-term risks.** Short-term risks include risks to human health and the environment associated with the alternative during its construction and implementation, and the effectiveness of measures that will be taken to manage such risks.
- **Technical and administrative implementability.** The ability to implement the alternative includes consideration of the technical feasibility of the alternative, administrative and

regulatory requirements, permitting, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with the future development plans for the Site.

- **Consideration of Public Concerns.** Consideration of public concerns is mandated under the MTCA cleanup regulation for an Ecology-led or potentially liable person-led cleanup action under an Agreed Order or Consent Decree. A public participation plan generated and implemented by both the Site owner and Ecology includes a mandatory public review and comment period. Because public comments have not yet been solicited by Ecology, consideration of public concerns regarding this FS is preliminarily included in this document.

### 8.3.1 Cleanup Action Alternative Cost Estimating

The following section presents the types and scope of costs considered when preparing the feasibility study cost estimates for use in the disproportionate cost analysis in accordance with WAC 173-340-360(3)(e) and 173-340-360(f)(iii).

- **Capital Costs.** These costs include expenditures for equipment, labor, and material necessary to implement a remedial action. Indirect costs may be incurred for engineering, financial, or other services not directly involved with implementation of remedial alternatives but necessary for completion of this activity.
- **Operation and Maintenance Costs.** These are post-construction costs necessary to provide effective implementation of the alternative. Such costs may include, but are not limited to, operating labor; maintenance materials and labor; disposal of residues; and administrative, insurance, and licensing costs.
- **Monitoring Costs.** These costs are incurred from monitoring activities associated with remedial activities. Cost items may include sampling labor, laboratory, analyses, and report preparation.
- **Present Worth Analysis.** Present worth analysis provides a method of evaluating and comparing costs that occur over different time periods by discounting all future expenditures to the present year. The present worth cost or value represents the amount of money which, if invested in year 0 and disbursed as needed, would be sufficient to cover all costs associated with a remedial alternative. The assumptions necessary to derive a present worth cost are inflation rate, discount rate, and period of performance. A discount rate, which is similar to an interest rate, is used to account for the time value of money. EPA policy on the use of discount rates for RI/FS cost analyses is stated in the preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) published at the Federal Register (55 FR 8722) and in the Office of Solid Waste and Emergency Response Directive 9355.3-20 titled Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis (EPA 1993). Based on the NCP and this directive, a discount rate of 7 percent is recommended in developing present value cost estimates for remedial action alternatives during the FS. This specified rate of 7 percent represents a "real" discount rate in that it approximates the marginal pretax rate of return on an average investment in the private sector in recent years and has been adjusted to eliminate the effect of expected inflation. For this FS, more conservative real discount rates ranging from 0.0 percent for 3 years to 1.7 percent for 15 years

were used based on the December 2010 revisions to Appendix C of the OMB Circular A-94. The real discount rates used to estimate the present worth of annual operating costs are based on the estimated restoration time frame (life cycle) for each alternative and are extrapolated from the referenced OMB Circular, which is published annually.

- Because it is assumed that all capital costs are incurred in year 0, the present worth analysis is performed only on annual operation and maintenance and groundwater monitoring costs. The total present worth for a given alternative is equal to the sum of the capital costs and the present worth of annual operation and maintenance and monitoring costs over the anticipated life cycle of the alternative.

### 8.3.2 Evaluation Results

A summary of the evaluation of the cleanup alternatives using the MTCA evaluation criteria (WAC 173-340-360[3][f]) is described below and summarized in the Remedial Alternatives Summary Table (Table 7). Table 7 includes parameters used in the disproportionate cost analysis such as the MTCA Composite Benefit Score and the estimated costs as described in Section 8.4, Disproportionate Cost Analysis Results.

- **Protectiveness.** The two types of exposure risk associated with the presence of COCs at the Site are terrestrial ecological risk and human health risk. Because the Site qualifies for a TEE exclusion based on WAC 173-340-7491, mitigating the potential human health risk associated with exposure to the COCs in indoor air, soil, and groundwater at the Site would be the primary objective of any cleanup action implemented. Each of the three alternatives provides a high degree of protectiveness considering that the source and main mass of COCs will be actively and quickly removed via excavation. Although Alternative 3 (ERH) would provide the greatest degree of protection, technological and access limitations preclude installation of remediation wells within the Boren Avenue North ROW, limiting its effectiveness in treating contaminated groundwater located beyond Property boundaries. Each of the alternatives is therefore ranked equally in regard to protectiveness. In addition, regardless of the groundwater treatment alternative implemented, the concrete floor slab and foundation walls of the proposed underground parking garage of the future development would be constructed to act as a barrier against direct contact with subsurface contamination and reduce the potential for vapor intrusion into the building interior.
- **Permanence.** If it could be implemented within the Boren Avenue North ROW, Cleanup Alternative 3 would exhibit a higher degree of permanence relative to Alternatives 1 and 2 because the thermal treatment process is superior to in situ chemical oxidation or reductive dechlorination in terms of treatment effectiveness and time to achieve remedial goals. However, because Alternative 3 likely will not fully address the contamination within the ROW, the extent of permanence achieved for all alternatives is ranked equally. In addition, regardless of the groundwater treatment alternative implemented, the contaminated soil would be permanently removed from the Site and disposed of at a permitted facility regardless of the alternative selected.

- **Effectiveness over the Long Term.** The ranking score for long-term effectiveness for Alternative 2 are slightly higher than Alternatives 1 and 3 because EOS provides a longer-term and wider-scale groundwater treatment remedy relative to thermal heating and chemical oxidation, and the time it will take to properly heat the aquifer using ERH can only be estimated at this time. Again, all alternatives employ the same remedial approach for soil.
- **Management of Short-Term Risks.** Each of the alternatives present significant short-term risks because they all include high-risk activities associated with shoring (drilling), excavation (heavy equipment), and an increased probability of a transportation accident due to the significant number of truck hauls. Short-term risks would be higher for Cleanup Alternatives 1 and 3 when compared to Cleanup Alternative 2 because of the risks of injury to workers from exposure to chemical oxidants and electrocution, respectively. Cleanup Alternative 2 scores highest for this criterion comparatively because it does not pose a risk of chemical exposure or electrocution.
- **Technical and Administrative Implementability.** Cleanup Alternative 2 scores higher than other alternatives because it presents the fewest obstacles to implementation when compared to other alternatives. Cleanup Alternative 3 poses the greatest obstacles to implementation due to the complexity of the remedy from an engineering and construction standpoint. Cleanup Alternative 1 would be difficult to implement because of the large number of injection wells to be installed as well as handling and mixing a large volume of powerful chemical oxidant in the field.
- **Public Concerns.** Cleanup Alternative 2 scores higher than the other alternatives because it provides the greatest area of coverage with the least amount of short-term risks. Cleanup Alternative 1 ranks slightly lower than Cleanup Alternative 2, and Cleanup Alternative 3 poses the greatest obstacles to implementation due to the technical limitations in treating a larger area of contaminated groundwater.
- **Cost.** Using these criteria and relying upon the assumptions outlined in Section 6.4.1, the total present worth costs of Cleanup Alternatives 1 through 3 are:
    - Cleanup Alternative 1—$11,327,000 (Table 4)
    - Cleanup Alternative 2—$10,260,000 (Table 5)
    - Cleanup Alternative 3—$16,822,000 (Table 6)

## 8.4 DISPROPORTIONATE COST ANALYSIS RESULTS

The purpose of the disproportionate cost analysis is to facilitate selection of the cleanup alternative providing the highest degree of permanence to the maximum extent practicable. This disproportionate cost analysis considers Cleanup Alternatives 1 through 3. Costs are considered disproportionate if the incremental costs of one alternative versus a less expensive alternative exceed the incremental benefit achieved by the more expensive alternative.

The disproportionate cost analysis was conducted according to the methodology provided by Ecology (2009b) in accordance with WAC 173-340-360(3)(e). The cleanup alternative evaluation presented in Table 7 is in a format suggested by Ecology (Ecology 2009b). Table 7 provides a semi-quantitative assessment of the MTCA criteria for permanence to the maximum extent practicable (WAC 173-340-360[3][f]). A numeric score ranging from 0 to 10 is assigned for each of the criteria based on best professional judgment. The higher the score, the more favorable the criterion evaluation is under MTCA. The criteria scores are weighted according to Ecology suggestions (Ecology 2009b) and as indicated in Table 7. A MTCA Composite Benefit Score is calculated for each alternative by summing the mathematical product of the criterion score times the weighting factor and represents a quantitative measure of environmental benefit that would be realized with implementation of a cleanup alternative. Based on Site conditions, the weighting factors for the six criteria are Protectiveness–30 percent, Permanence–30 percent, Long-Term Effectiveness–20 percent, Short-Term Risks–10 percent, and Implementability–10 percent. If, for example, the scores for each of these criteria are 10, 8, 8, 2, and 3, the MTCA Composite Benefit Score is calculated as follows: (10)(0.3) + (8)(0.3) + (8)(0.2) + (2)(0.1) + (3)(0.1) = 7.5. A score of 7.5 represents a moderate to high environmental benefit on a scale of 0 (lowest environmental benefit) to 10 (highest environmental benefit).

Table 7 provides details regarding the basis for scoring and estimated costs for the three cleanup alternatives. Charts 1 and 2 graphically present the results of the disproportionate cost analysis. On Chart 1, blue bars are indicative of the relative environmental benefit of each cleanup alternative. Red bars reflect cost estimates using the left axis of the graph. Because each alternative exhibits the same remedial response and cost for soil remediation (i.e., excavation and land disposal), a plot of the cost-to-benefit ratio for each alternative was generated based on the cost of groundwater remediation. The cost for soil remediation common to all alternatives is approximately $7,512,000. Chart 2 graphically presents the cost-to-benefit ratios of each of the alternatives.

As indicated above, the cost of Cleanup Alternative 2 is less than other alternatives. Chart 1 plots the relative cost and composite ranking scores and Chart 2 plots the cost-to-benefit ratios for the alternatives in order to illustrate the relative cost and benefits afforded by each alternative. The results of the analysis demonstrate that Cleanup Alternative 2 clearly exhibits the lowest cost-to-benefit ratio.

## 9.0 PREFERRED CLEANUP ALTERNATIVE

Touchstone performed an RI sufficient to define the extent of contamination and characterize the Site for the purpose of developing and evaluating cleanup action alternatives. Because MTCA requires that, in all cases, sufficient information must be collected, developed, and evaluated to enable the selection of a cleanup action under WAC 173-340-360 through 390, considerable effort was made between 2010 and 2012 to collect sufficient empirical data to define the extent of contamination in soil and groundwater. In areas where technical limitations were such that empirical data could not be collected, a highly conservative modeling approach was selected and applied to site-specific conditions, thereby providing worst-case scenarios for the extent of contamination and allowing for the development of cleanup alternatives protective of human health and the environment, consistent with WAC 173-340-350 through 390.

In addition, according to WAC 173-340-350(6), the scope of an RI/FS varies from site to site, depending on the informational and analytical needs of the specific facility. This requires that the process remain flexible and be streamlined when possible to avoid the collection and evaluation of unnecessary information so that the cleanup can proceed in a timely manner. As discussed above, in the case of the Troy Laundry Property, sufficient technical limitations exist to invalidate the data that would be acquired (between 300 and 450 feet cross-gradient of the Site) in an effort to empirically bound the low levels of groundwater contamination beneath the Site to the south and west during any subsequent investigations. Exclusive of the high costs associated with overcoming these limitations, attempting to do so would delay the project sufficient to prohibit the completion of both the proposed cleanup activities and subsequent redevelopment, thereby contributing to ongoing, undue exposure risks to human health and the environment. In cases such as this, MTCA affords the option of flexibility to ensure that the cleanup action can occur (WAC 173-340-350[6]).

Sufficient investigations were therefore conducted to characterize the distribution of hazardous substances present at the Site, as well as the threat to human health and the environment, and develop a comprehensive conceptual site model for the purposes of evaluating an appropriate cleanup action. An FS was conducted at the Troy Laundry Property subsequent to the RI to establish cleanup levels and the points of compliance, as well as to select a cleanup action that is based on the remedy selection criteria and requirements in WAC 173-340-350 through 390. Based on the results of the FS, Cleanup Alternative 2 (Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater) is the recommended alternative for the Site because it ranks comparatively high in environmental benefit and is both technically feasible and cost effective. Cleanup Alternative 2 satisfies requirements of the Model Toxics Control Act and significantly reduces risk from contamination to the maximum extent practicable by using in situ treatment to reduce groundwater contamination within the active groundwater treatment area, which was designed to include the worst-case, maximum extent of the plume, to proposed cleanup levels fairly quickly following complete removal of all contaminated soil from the Site. Concentrations of contaminants in groundwater located beyond the proposed conditional points of compliance will drop via natural attenuation, in accordance with WAC 173-340-370, as a result of the complete removal of all contaminated soil, the implementation of enhanced reductive dechlorination, and the subsequent creation of a barrier between the former source area and off-Property groundwater. If required to validate this assumption, empirical data will be collected via drawdown of the wells established as the points of compliance and quantitative laboratory analysis of extracted groundwater within the measured cone of depression.

Cleanup Alternative 2 addresses the COCs at the Site in all media of concern: soil gas, soil, groundwater, and indoor air. Cleanup Alternative 2 is protective of the indoor air inhalation pathway and of direct contact exposure (dermal contact, ingestion) with soil and with groundwater. Excavation of the source area, subsequent active remediation of the contaminated groundwater, and coincident implementation of a groundwater treatment barrier between the source area and off-Property portions of the Site demonstrates that Cleanup Alternative 2 is also protective of groundwater. Elements of Cleanup Alternative 2 would be conducted in conjunction with redevelopment of the Property.

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## 11.0 LIMITATIONS

The services, findings, and conclusions described in this report were prepared for the specific application to this project and were developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area. A potential always remains for the presence of unknown, unidentified, or unforeseen subsurface contamination on portions of the Property not sampled. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. SoundEarth is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SoundEarth does not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

# FIGURES

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\FIGURE 1\0731-004-04 FIG 1 F.DWG

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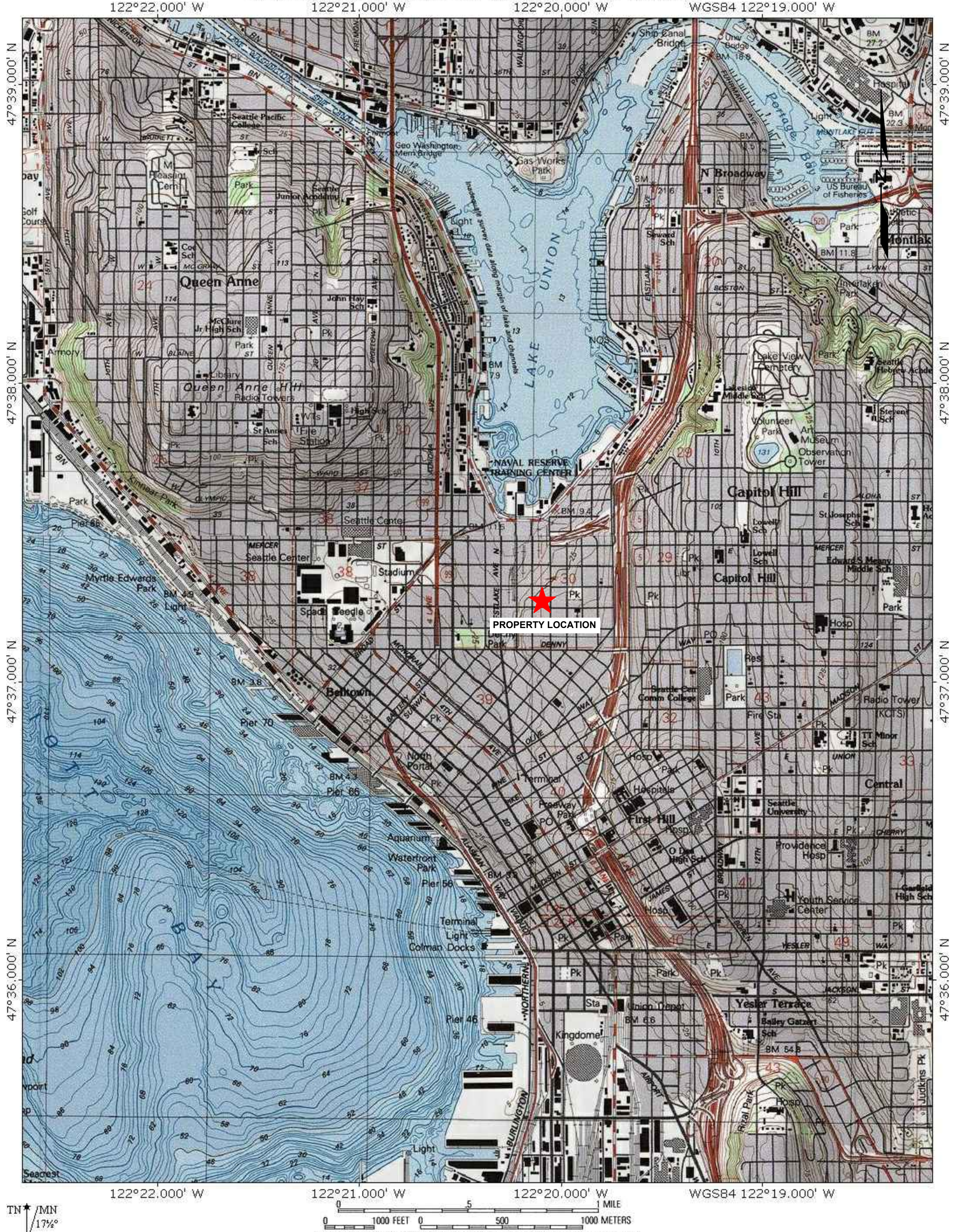

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| PROJECT NUMBER: | 0731-004-04 |
| STREET ADDRESS: | 307 FAIRVIEW AVENUE NORTH |
| CITY, STATE: | SEATTLE, WASHINGTON |

**FIGURE 1**
PROPERTY
LOCATION MAP

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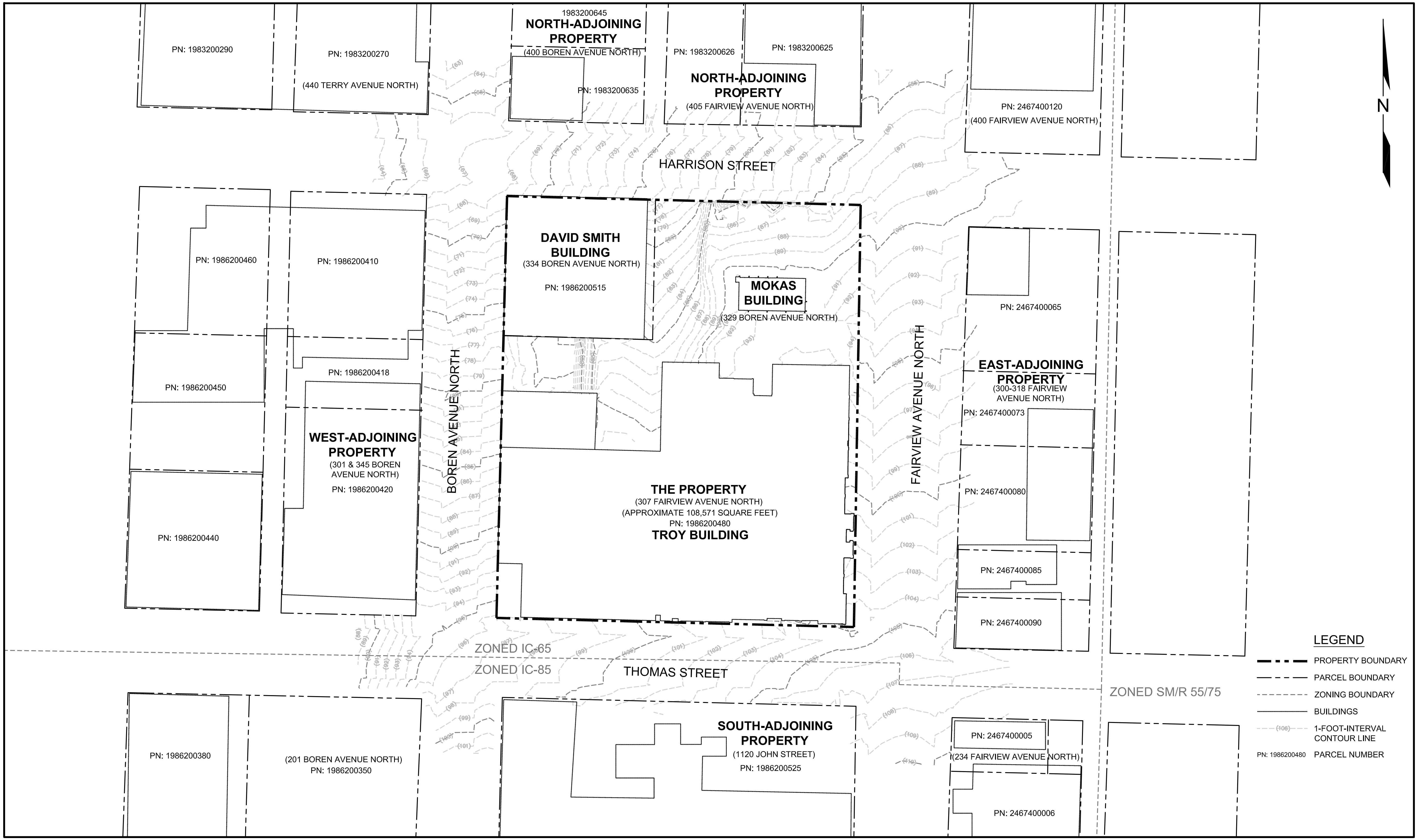

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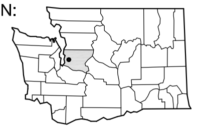

0 40 80 160
APPROXIMATE SCALE IN FEET

**FIGURE 2**
SITE LOCATION MAP

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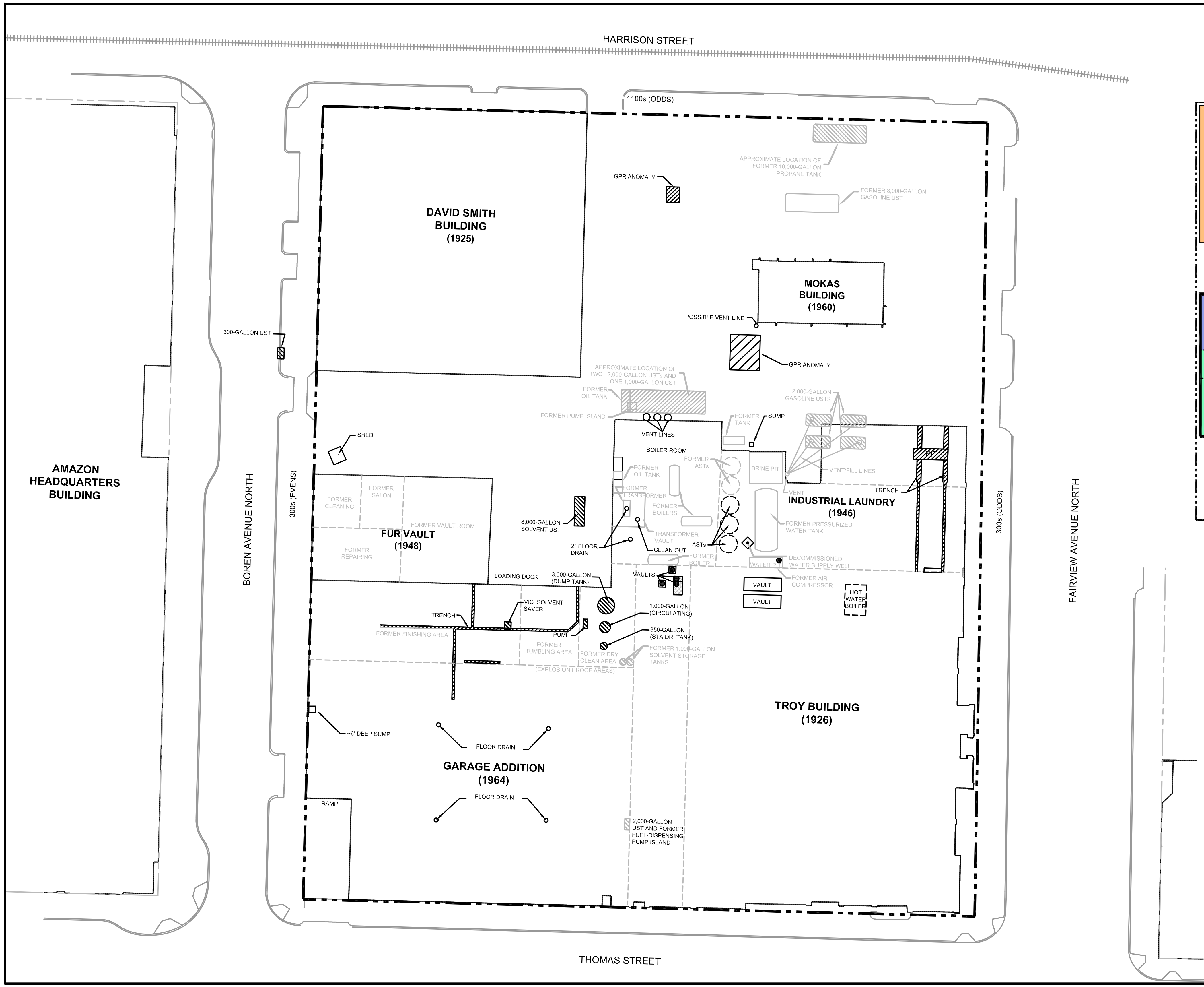

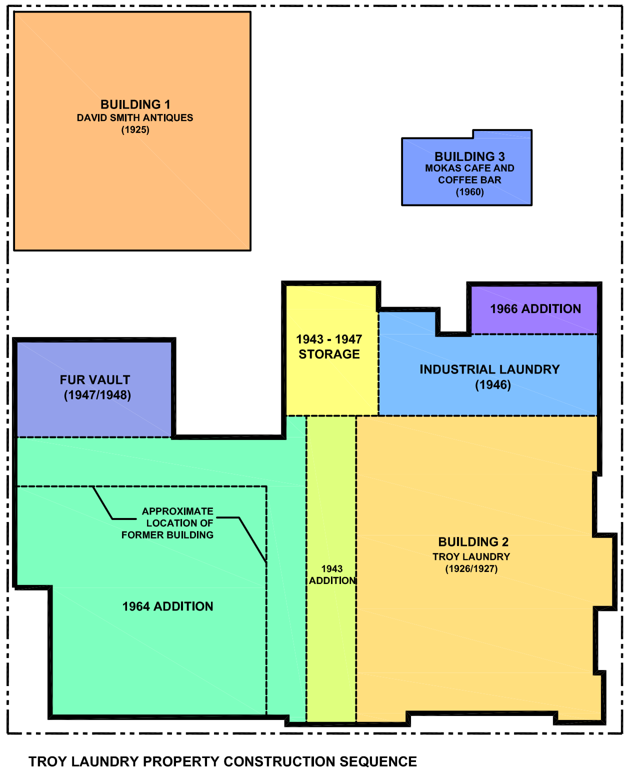

TROY LAUNDRY PROPERTY CONSTRUCTION SEQUENCE

## LEGEND

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|---|---|
| ● | VAULT ACCESS |
| — · — · | PROPERTY BOUNDARY |
| — — — | PARCEL BOUNDARY |
| - - - - - | PROPERTY FEATURES |
| - - - - - | FORMER PROPERTY FEATURES |
| ┼┼┼┼┼┼┼┼ | SOUTH LAKE UNION STREETCAR LINE |
| UST | UNDERGROUND STORAGE TANK |
| AST | ABOVEGROUND STORAGE TANK |
| GPR | GROUND PENETRATING RADAR |

LOCATIONS OF FORMER SITE FEATURES ARE APPROXIMATE

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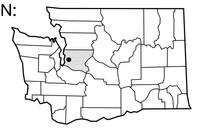
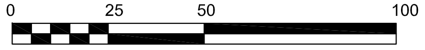
CAD FILE: 0731-004_2011RI_SP

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



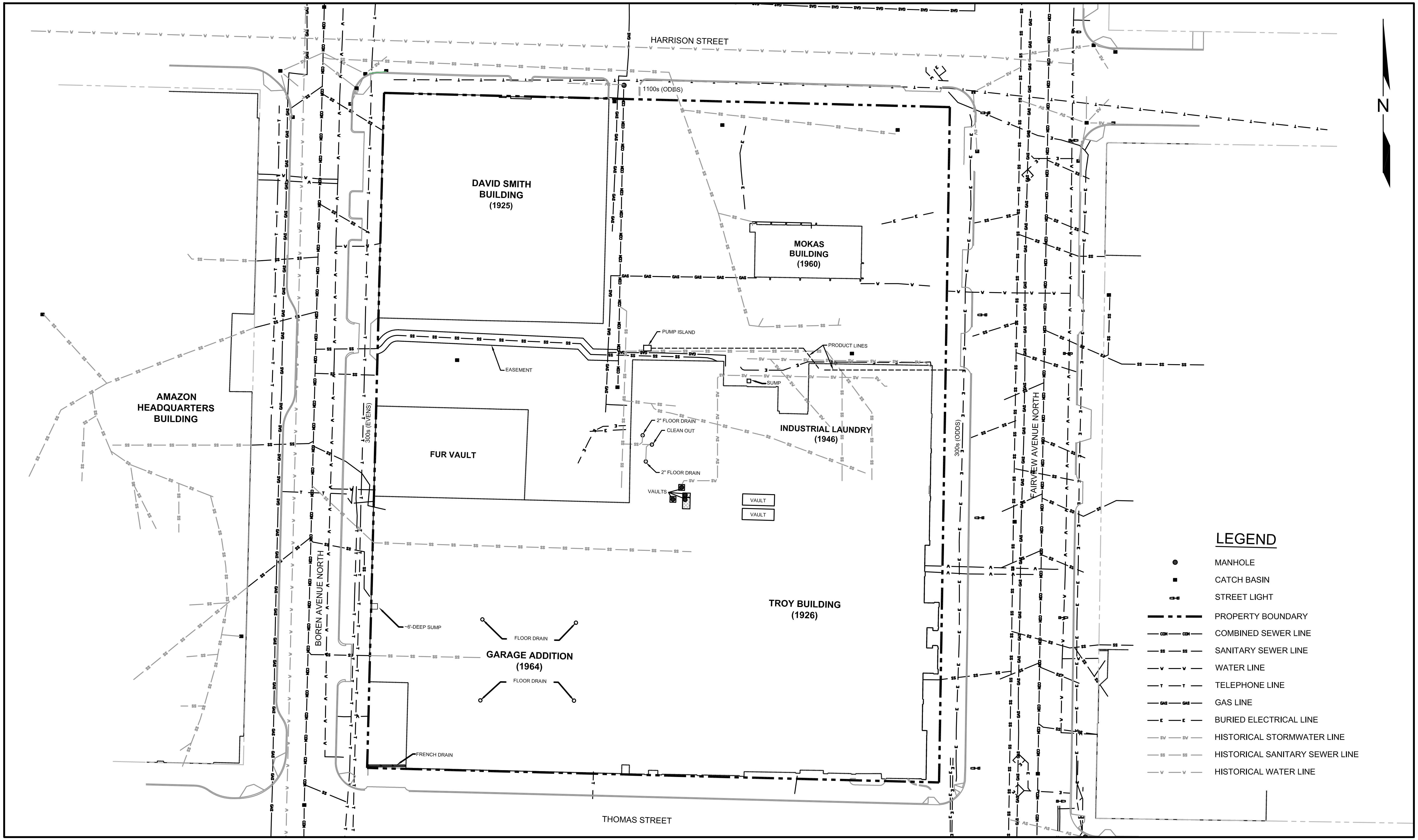


APPROXIMATE SCALE IN FEET

## FIGURE 3

PROPERTY PLAN

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_SP_F.DWG



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PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

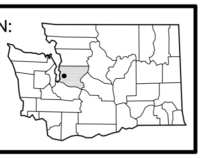
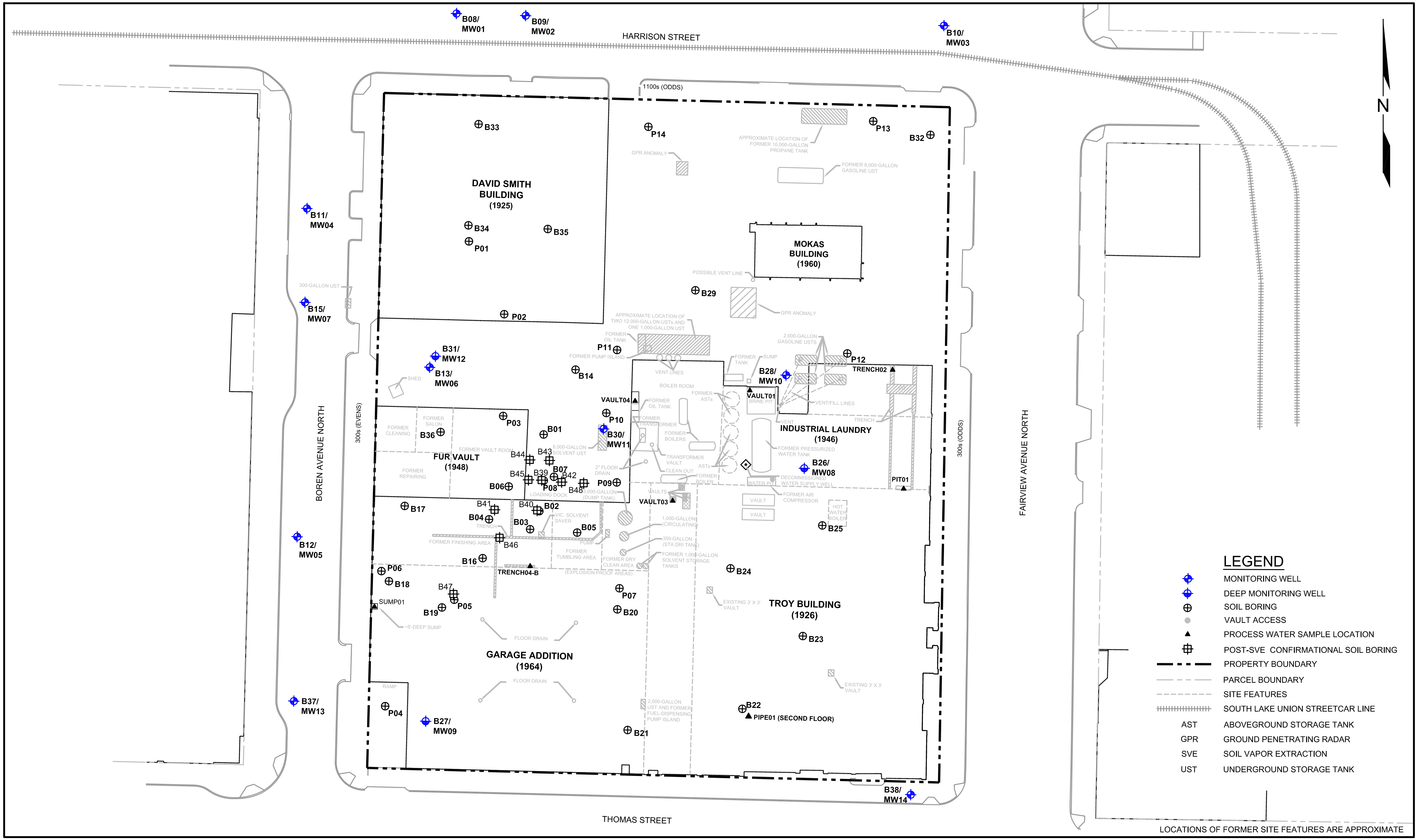


**FIGURE 4**
SUBSURFACE UTILITIES MAP

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004 2011RI UTILITY F.DWG

2/8/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_EL_F.DWG



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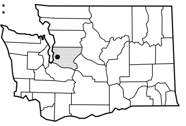
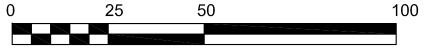
CAD FILE: 0731-004_2011RI_EL

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:





APPROXIMATE SCALE IN FEET

## FIGURE 5
EXPLORATION LOCATION PLAN

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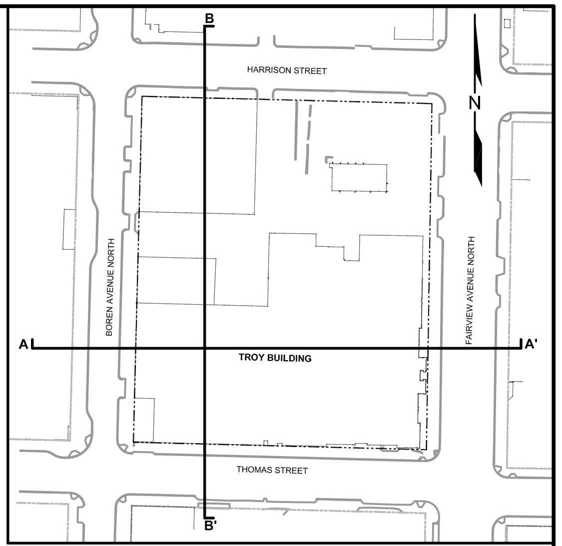

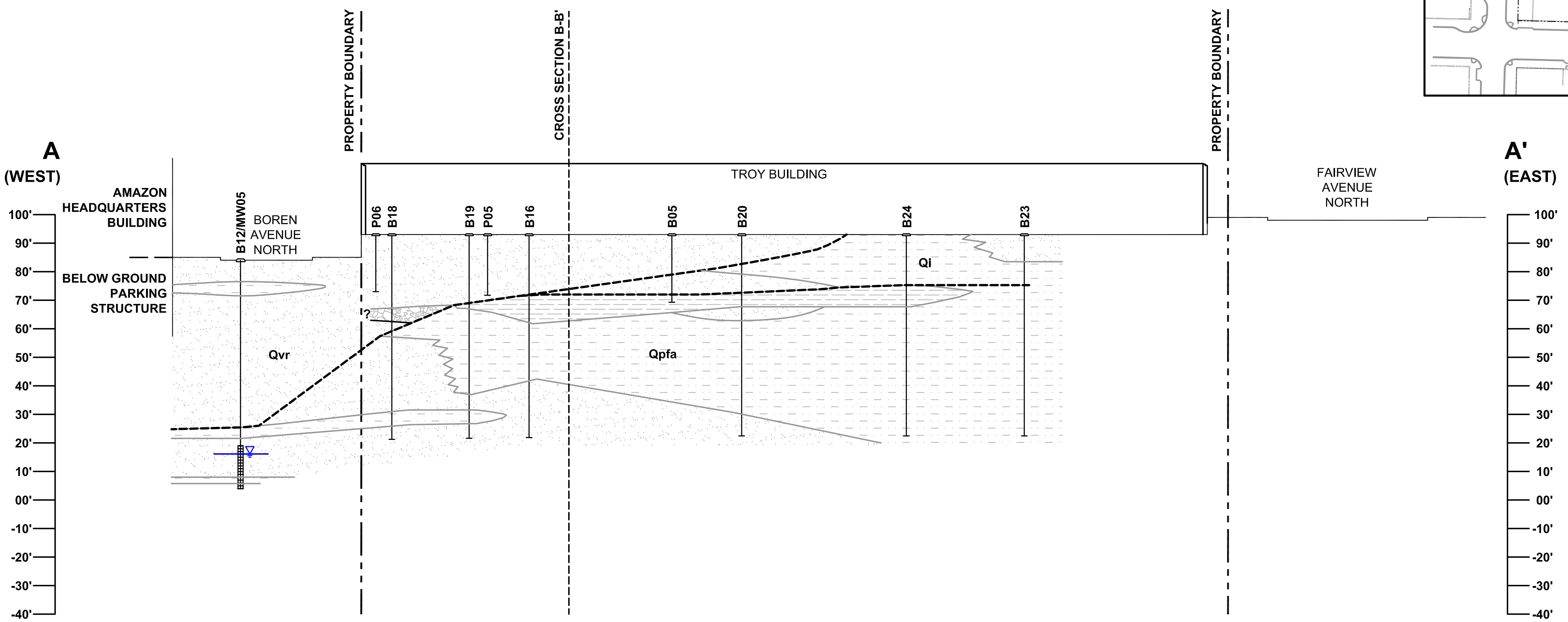

## LEGEND

MONITORING WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (OCTOBER 20, 2011)

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS):

| | |
|---|---|
| ⬚ | SP AND SP-SM: MOSTLY FINE TO MEDIUM-GRAINED SANDS AND SANDS WITH SILTS, WITH VARYING AMOUNTS OF GRAVEL. |
| ⬚ | SM: SILTY FINE TO MEDIUM SANDS WITH VARYING AMOUNTS OF GRAVEL. |
| ▤ | ML AND SM: SILTS AND SANDY SILTS, GRADING TO SILTY SANDS. MAY LOCALLY CONTAIN VARIOUS AMOUNTS OF COARSE SAND, GRAVEL AND COBBLES. |
| ▨ | GP: GRAVEL WITH SAND AND VARYING AMOUNTS OF SILT. SOME COBBLES. HORIZONTALLY DISCONTINUOUS. |

| | |
|---|---|
| Qvr | VASHON RECESSIONAL OUTWASH DEPOSITS: PREDOMINANTLY LOOSE TO MEDIUM DENSE, FINE TO MEDIUM-GRAINED SANDS AND SANDS WITH SILTS, WITH VARYING GRAVEL CONTENTS. LOCALIZED DEPOSITS OF GRAVEL AND/OR GRAVEL RICH SANDS. TYPICALLY GRAY TO GRAYISH-BROWN OR LIGHT BROWN. MINOR, DISCONTINUOUS INTERBEDS OF SILTY SAND AND SILT. |
| Qi | ICE-CONTACT DEPOSITS: PREDOMINANTLY VERY DENSE, SILTY FINE SANDS WITH VARYING GRAVEL CONTENTS, BROWN TO DARK BROWN OR GRAYISH-BROWN IN COLOR. |
| Qpfa | PRE-FRASER NONGLACIAL DEPOSITS: PREDOMINANTLY VERY DENSE, FINE TO MEDIUM SANDS AND SANDS WITH SILTS, INTERBEDDED WITH AND GRADING LATERALLY INTO SILTY FIND SANDS. GRAVEL CONTENT VARIES. LOCALIZED DEPOSITS OF GRAVEL AND/OR GRAVEL-RICH ZONES. TYPICALLY BROWN TO LIGHT BROWN OR GRAY-BROWN, WITH LOCAL HORIZONS OF REDDISH-BROWN OXIDATION. AN UPPER LAYER OF DARK BROWN OXIDAL ORGANIC-RICH SILT AND SILTY SAND EXTENDS ACROSS A PORTION OF THE SITE. |

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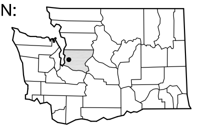
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 6
GEOLOGIC CROSS SECTION A-A'

12/12/2011
P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_XAA_F.DWG

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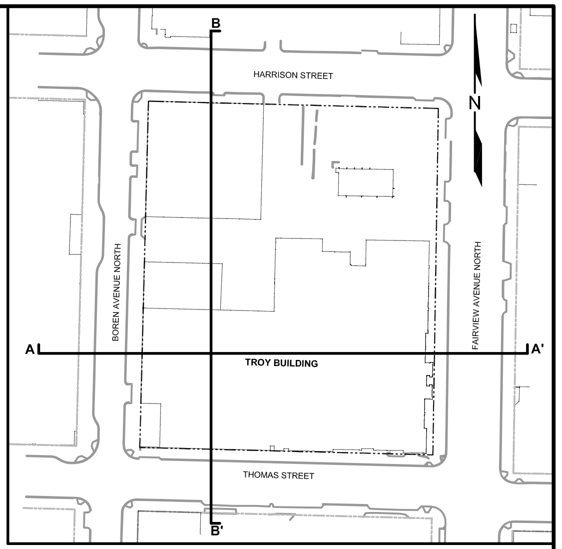
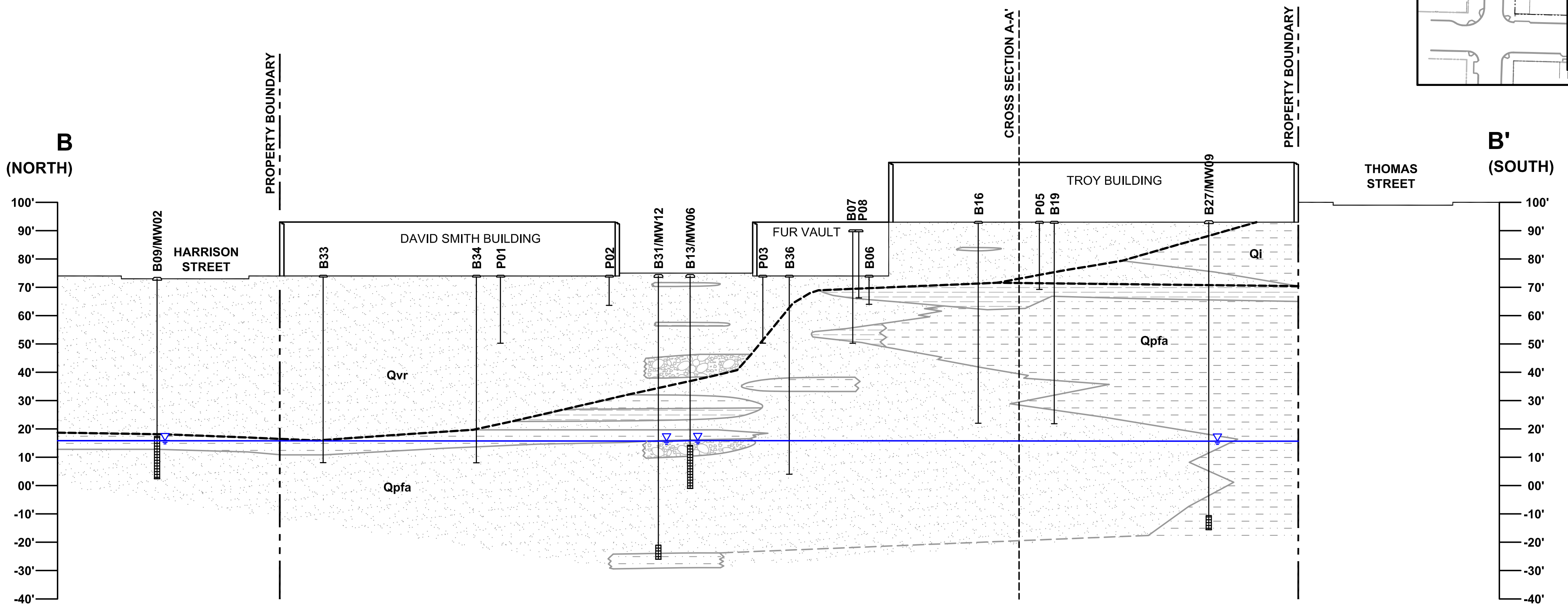
P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_XBB_F.DWG





## LEGEND

MONITORING WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (OCTOBER 20, 2011)

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS):

**SP AND SP-SM:** MOSTLY FINE TO MEDIUM-GRAINED SANDS AND SANDS WITH SILTS, WITH VARYING AMOUNTS OF GRAVEL.

**SM:** SILTY FINE TO MEDIUM SANDS WITH VARYING AMOUNTS OF GRAVEL.

**ML AND SM:** SILTS AND SANDY SILTS, GRADING TO SILTY SANDS. MAY LOCALLY CONTAIN VARIOUS AMOUNTS OF COARSE SAND, GRAVEL AND COBBLES.

**GP:** GRAVEL WITH SAND AND VARYING AMOUNTS OF SILT. SOME COBBLES. HORIZONTALLY DISCONTINUOUS.

| | |
|---|---|
| Qvr | VASHON RECESSIONAL OUTWASH DEPOSITS: PREDOMINANTLY LOOSE TO MEDIUM DENSE, FINE TO MEDIUM-GRAINED SANDS AND SANDS WITH SILTS, WITH VARYING GRAVEL CONTENTS. LOCALIZED DEPOSITS OF GRAVEL AND/OR GRAVEL RICH SANDS. TYPICALLY GRAY TO GRAYISH-BROWN OR LIGHT BROWN. MINOR, DISCONTINUOUS INTERBEDS OF SILTY SAND AND SILT. |
| Qi | ICE-CONTACT DEPOSITS: PREDOMINANTLY VERY DENSE, SILTY FINE SANDS WITH VARYING GRAVEL CONTENTS, BROWN TO DARK BROWN OR GRAYISH-BROWN IN COLOR. |
| Qpfa | PRE-FRASER NONGLACIAL DEPOSITS: PREDOMINANTLY VERY DENSE, FINE TO MEDIUM SANDS AND SANDS WITH SILTS, INTERBEDDED WITH AND GRADING LATERALLY INTO SILTY FIND SANDS. GRAVEL CONTENT VARIES. LOCALIZED DEPOSITS OF GRAVEL AND/OR GRAVEL-RICH ZONES. TYPICALLY BROWN TO LIGHT BROWN OR GRAY-BROWN, WITH LOCAL HORIZONS OF REDDISH-BROWN OXIDATION. AN UPPER LAYER OF DARK BROWN OXIDIZED ORGANIC-RICH SILT AND SILTY SAND EXTENDS ACROSS A PORTION OF THE SITE. |

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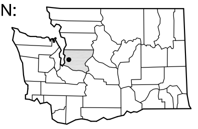
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

**FIGURE 7**
GEOLOGIC CROSS SECTION B-B'

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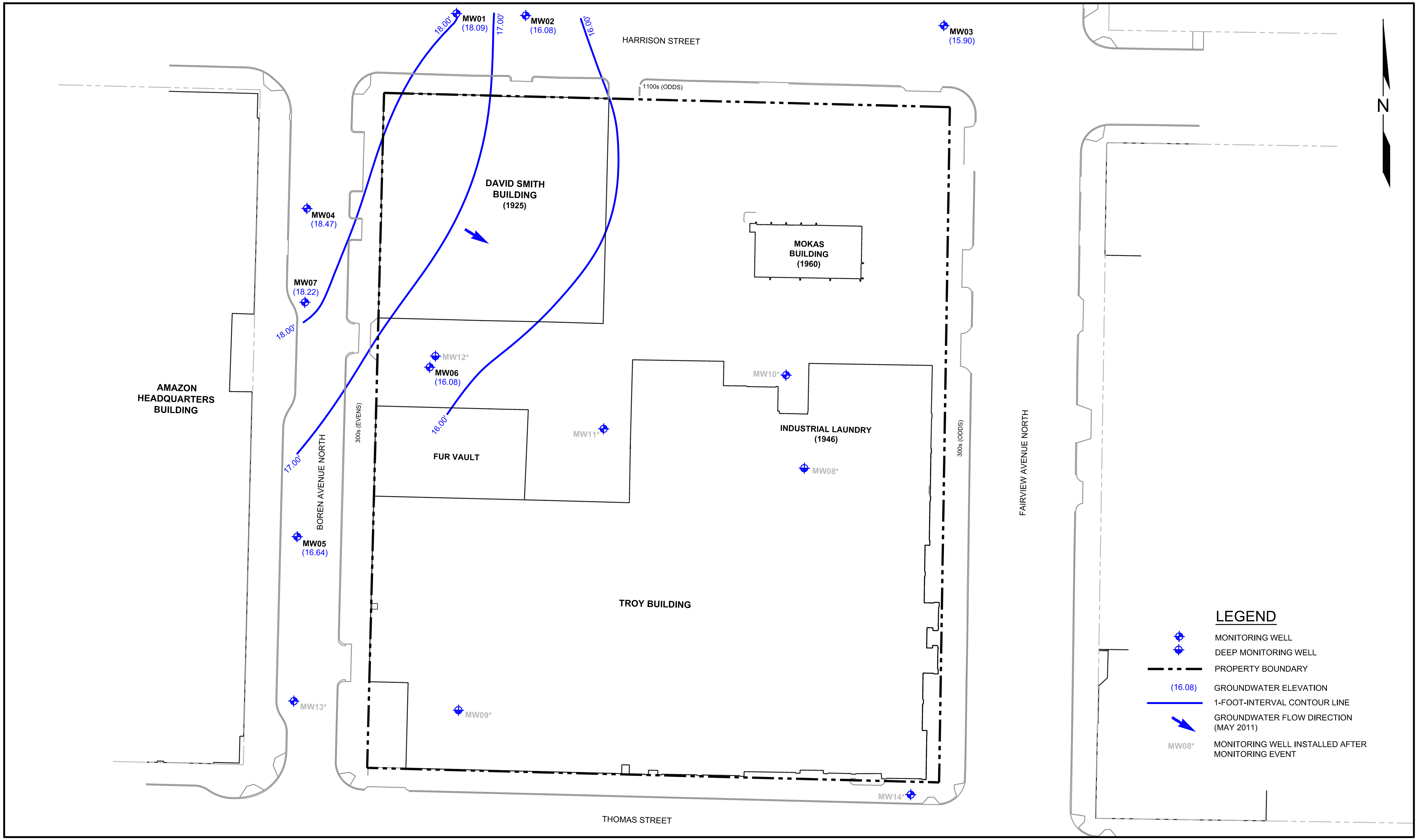

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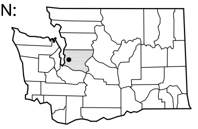
PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

**FIGURE 8**
GROUNDWATER CONTOUR MAP
(MAY 2011)

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_CM1_F.DWG

12/12/2011

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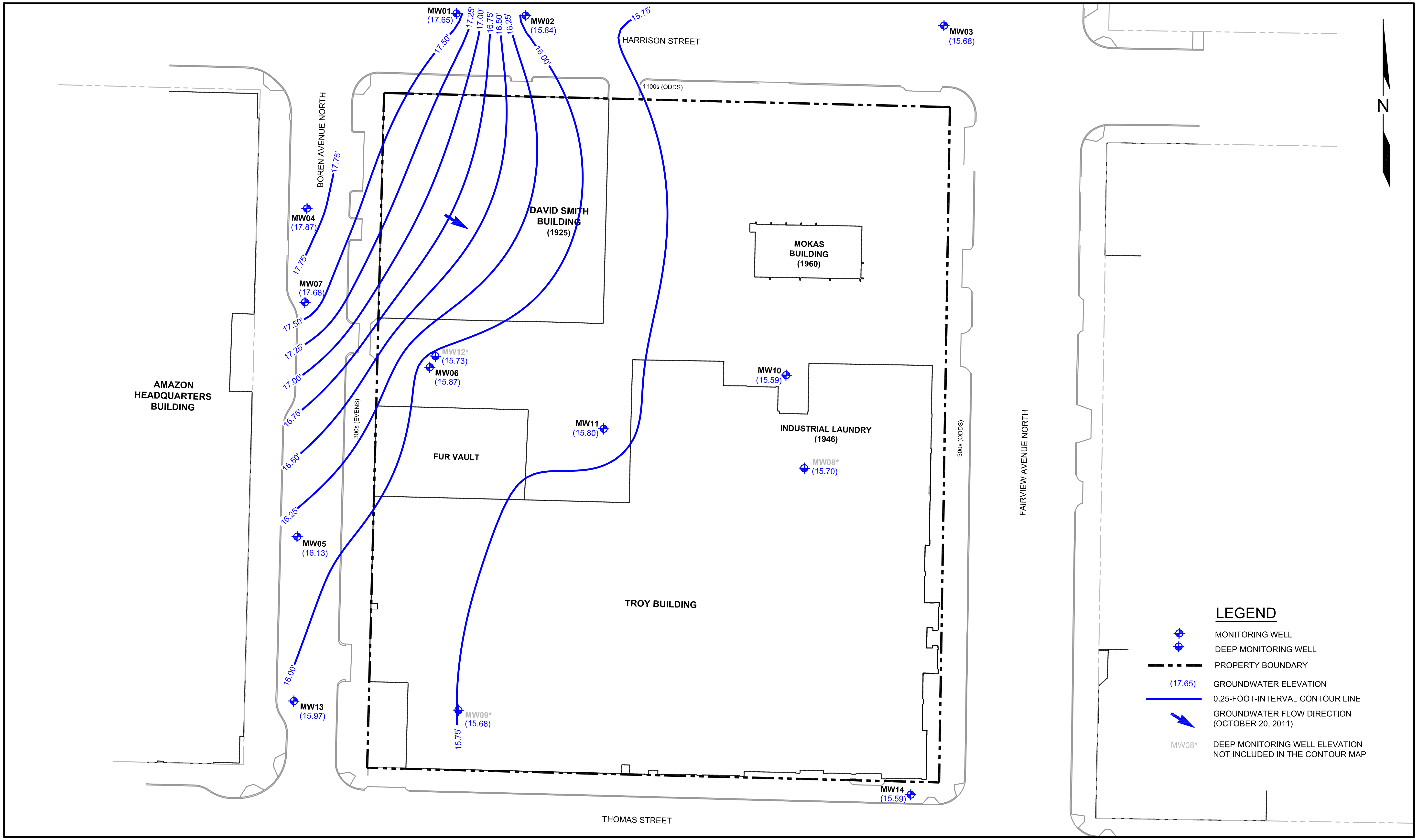
P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_CM2_F.DWG



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DATE: 11/2/11
DRAWN BY: NAC
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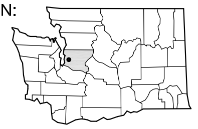
CAD FILE: 0731-004_2011RI_CM2

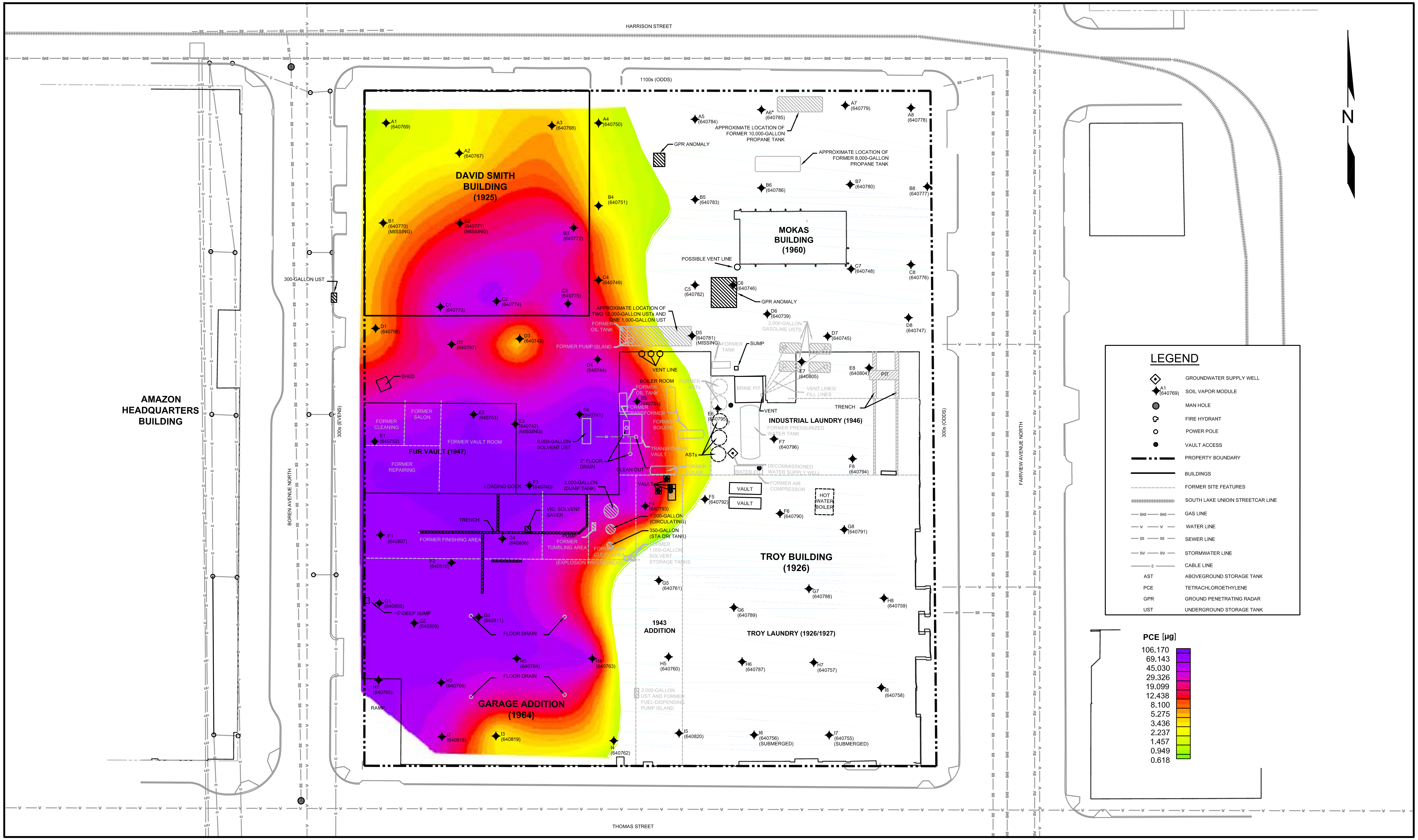
PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 9
GROUNDWATER CONTOUR MAP
(OCTOBER 20, 2011)



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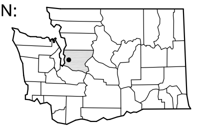
DATE: 12/02/11
DRAWN BY: NAC/JQC
CHECKED BY: EKR
CAD FILE: 0731-004_2011RI_PCE

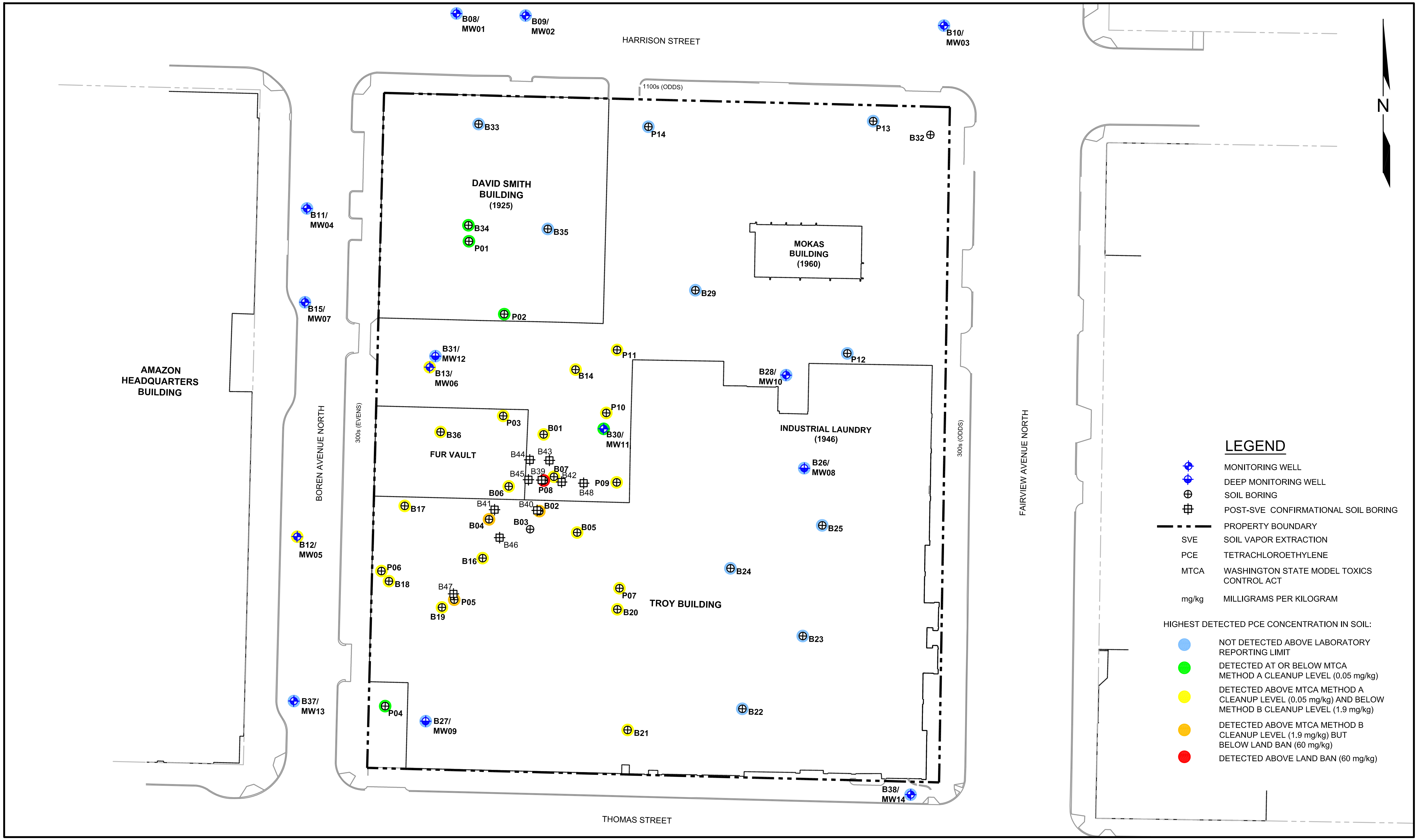
PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 10
PCE IN SOIL VAPOR



## LEGEND

- MONITORING WELL
- DEEP MONITORING WELL
- ⊕ SOIL BORING
- ⊞ POST-SVE CONFIRMATIONAL SOIL BORING
- PROPERTY BOUNDARY

SVE SOIL VAPOR EXTRACTION
PCE TETRACHLOROETHYLENE
MTCA WASHINGTON STATE MODEL TOXICS CONTROL ACT
mg/kg MILLIGRAMS PER KILOGRAM

HIGHEST DETECTED PCE CONCENTRATION IN SOIL:

- ● NOT DETECTED ABOVE LABORATORY REPORTING LIMIT
- 🟢 DETECTED AT OR BELOW MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg)
- 🟡 DETECTED ABOVE MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg) AND BELOW METHOD B CLEANUP LEVEL (1.9 mg/kg)
- 🟠 DETECTED ABOVE MTCA METHOD B CLEANUP LEVEL (1.9 mg/kg) BUT BELOW LAND BAN (60 mg/kg)
- 🔴 DETECTED ABOVE LAND BAN (60 mg/kg)

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CAD FILE: 0731-004_2011RI_SD_PCE

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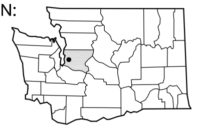
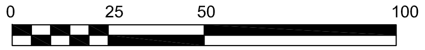
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:





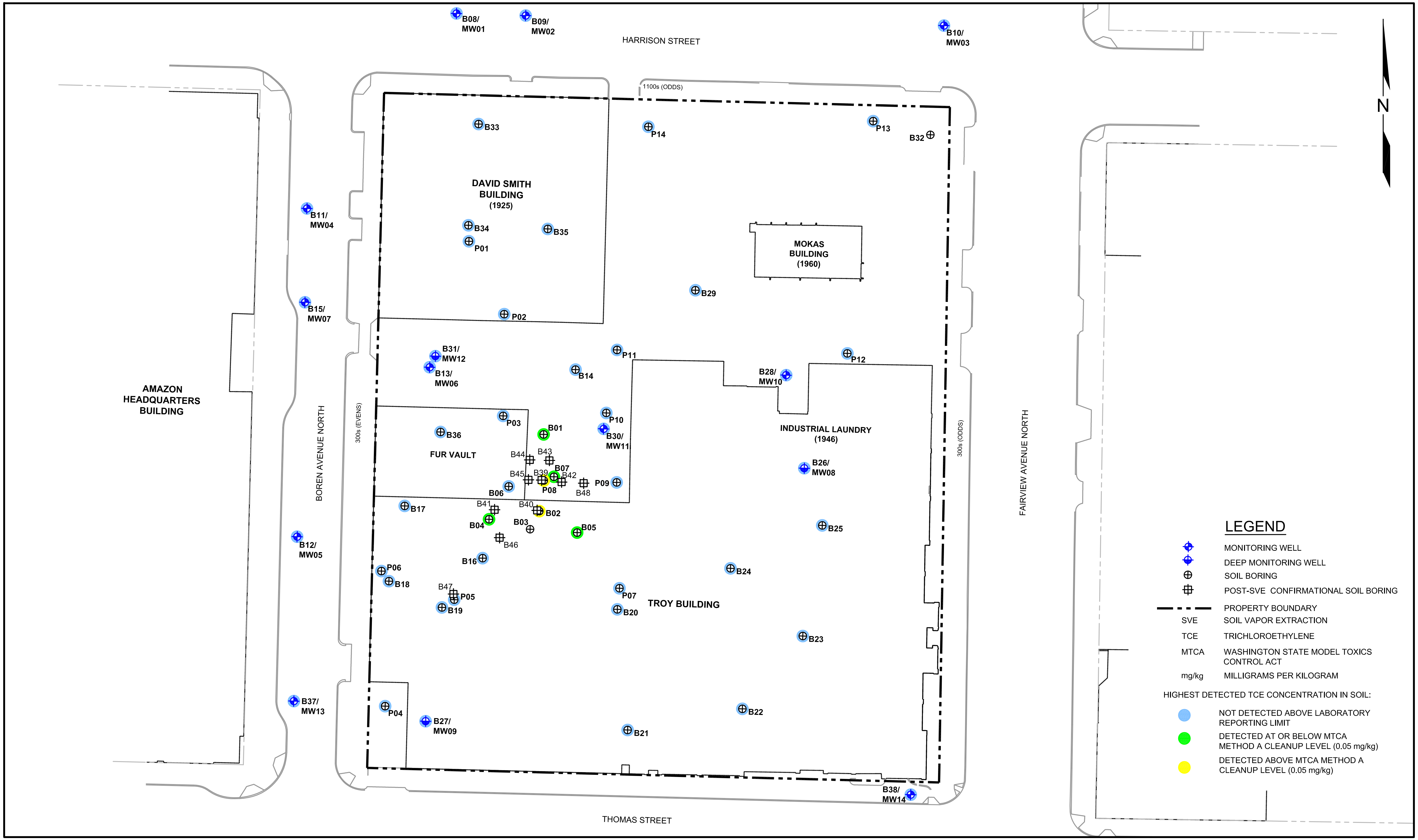
APPROXIMATE SCALE IN FEET

## FIGURE 11

SOIL ANALYTICAL RESULTS FOR PCE
(PRE-SVE SYSTEM OPERATION)

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_SD_PCE_F.DWG

8/8/2012



## LEGEND

⊕ MONITORING WELL
⊕ DEEP MONITORING WELL
⊕ SOIL BORING
⊞ POST-SVE CONFIRMATIONAL SOIL BORING
—·— PROPERTY BOUNDARY
SVE SOIL VAPOR EXTRACTION
TCE TRICHLOROETHYLENE
MTCA WASHINGTON STATE MODEL TOXICS CONTROL ACT
mg/kg MILLIGRAMS PER KILOGRAM

HIGHEST DETECTED TCE CONCENTRATION IN SOIL:

🔵 NOT DETECTED ABOVE LABORATORY REPORTING LIMIT
🟢 DETECTED AT OR BELOW MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg)
🟡 DETECTED ABOVE MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg)

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DATE: 10/19/11
DRAWN BY: NAC
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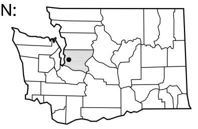
CAD FILE: 0731-004_2011RI_SD_TCE

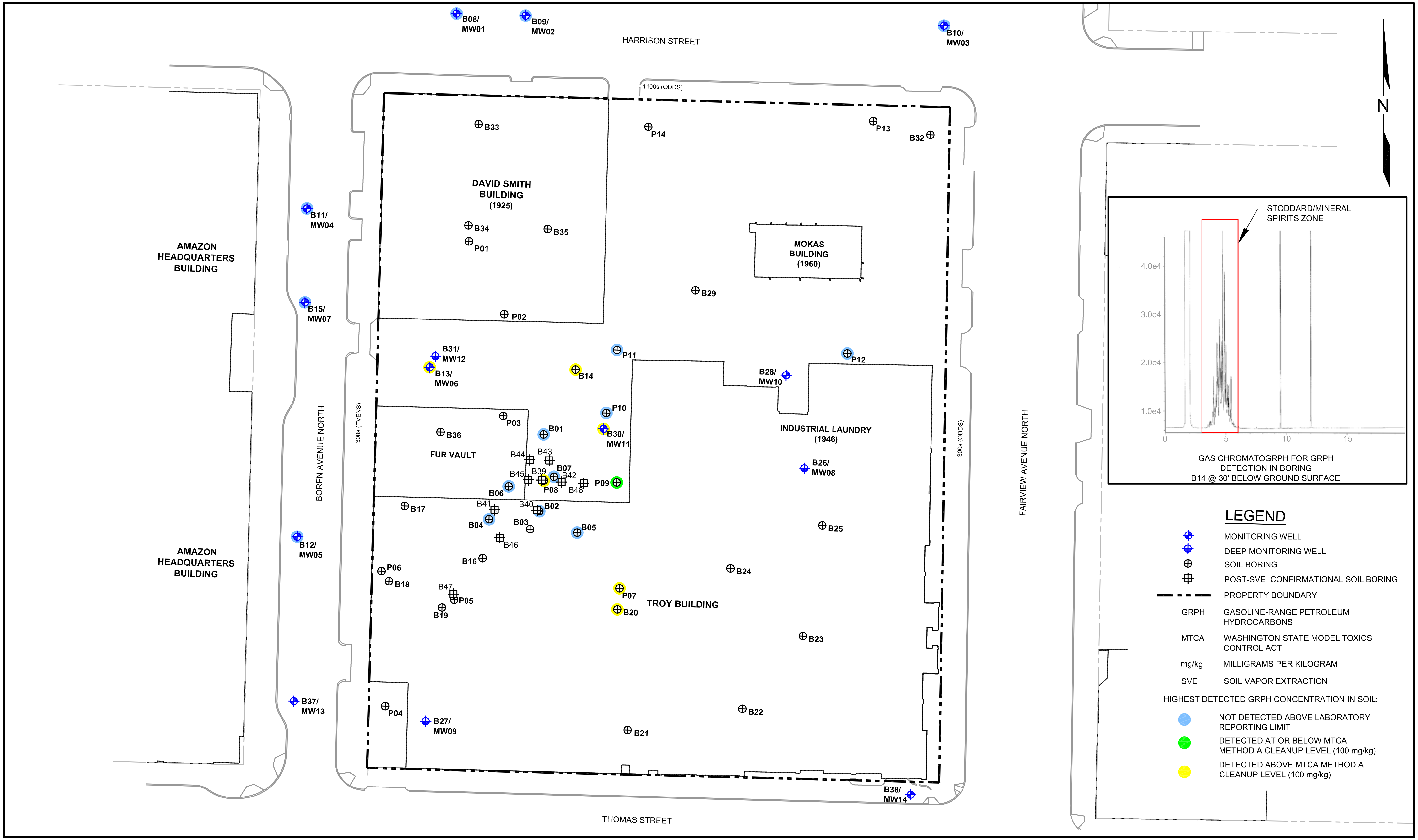
PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 12
SOIL ANALYTICAL RESULTS FOR TCE



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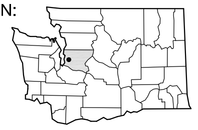
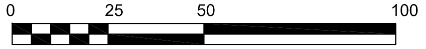
CHECKED BY: EKR
CAD FILE: 0731-004_2011RI_SD_GRPH

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

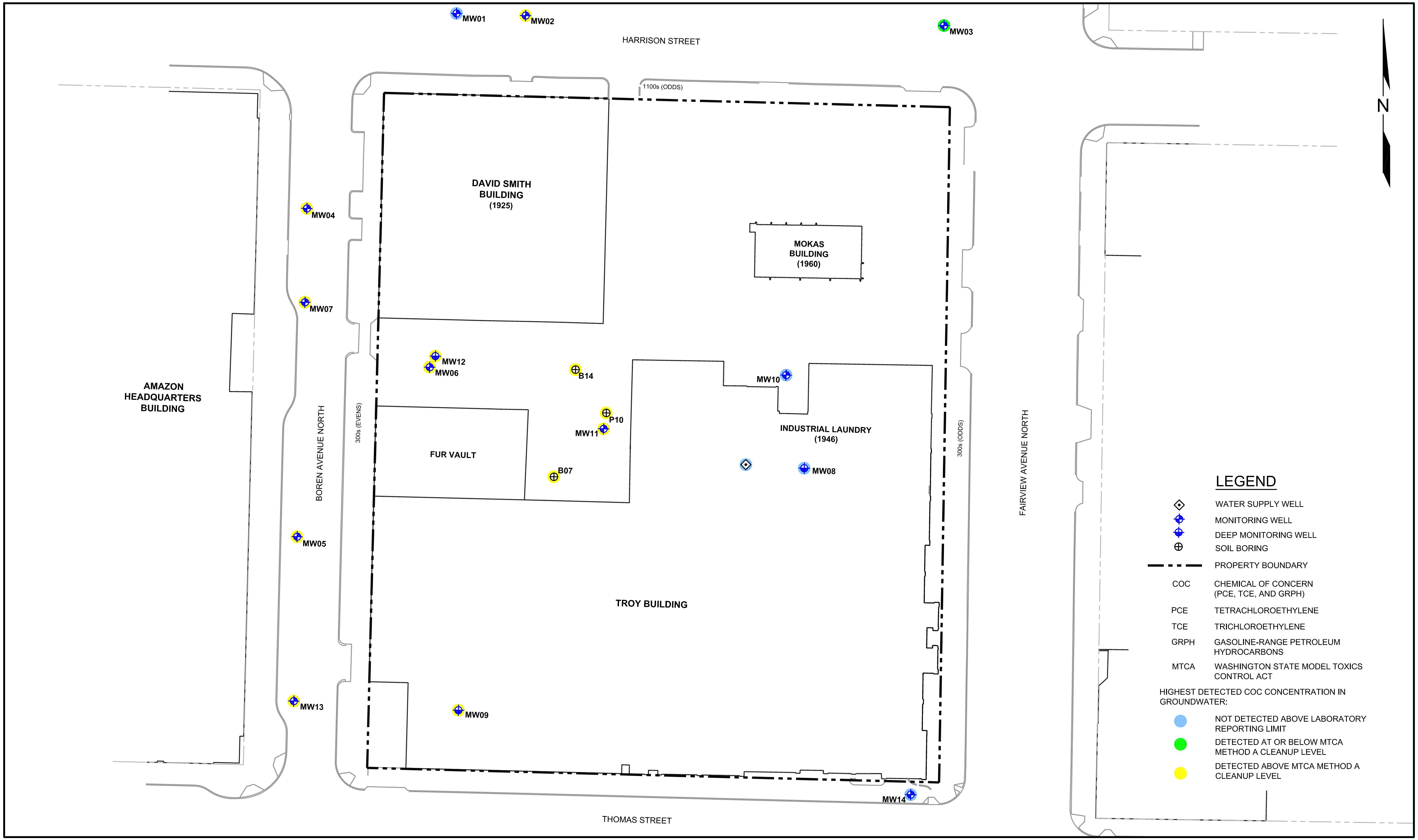




APPROXIMATE SCALE IN FEET

## FIGURE 13
SOIL ANALYTICAL RESULTS FOR GRPH

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_SD_GRPH_F.DWG
3/9/2012



3/9/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_GD_F.DWG

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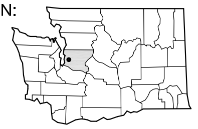
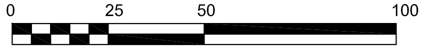
CAD FILE: 0731-004_2011RI_GD

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

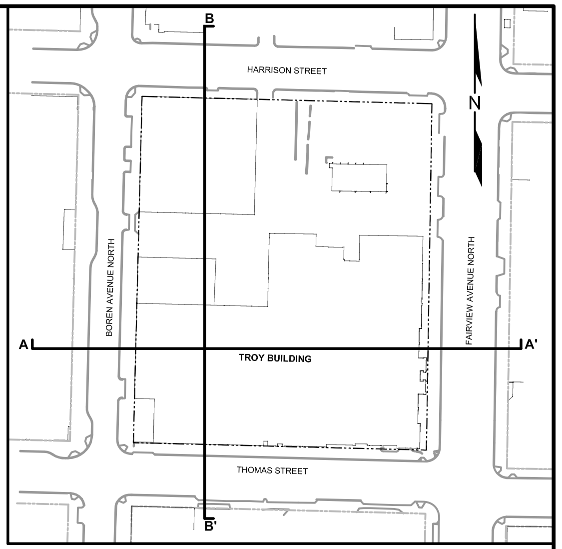


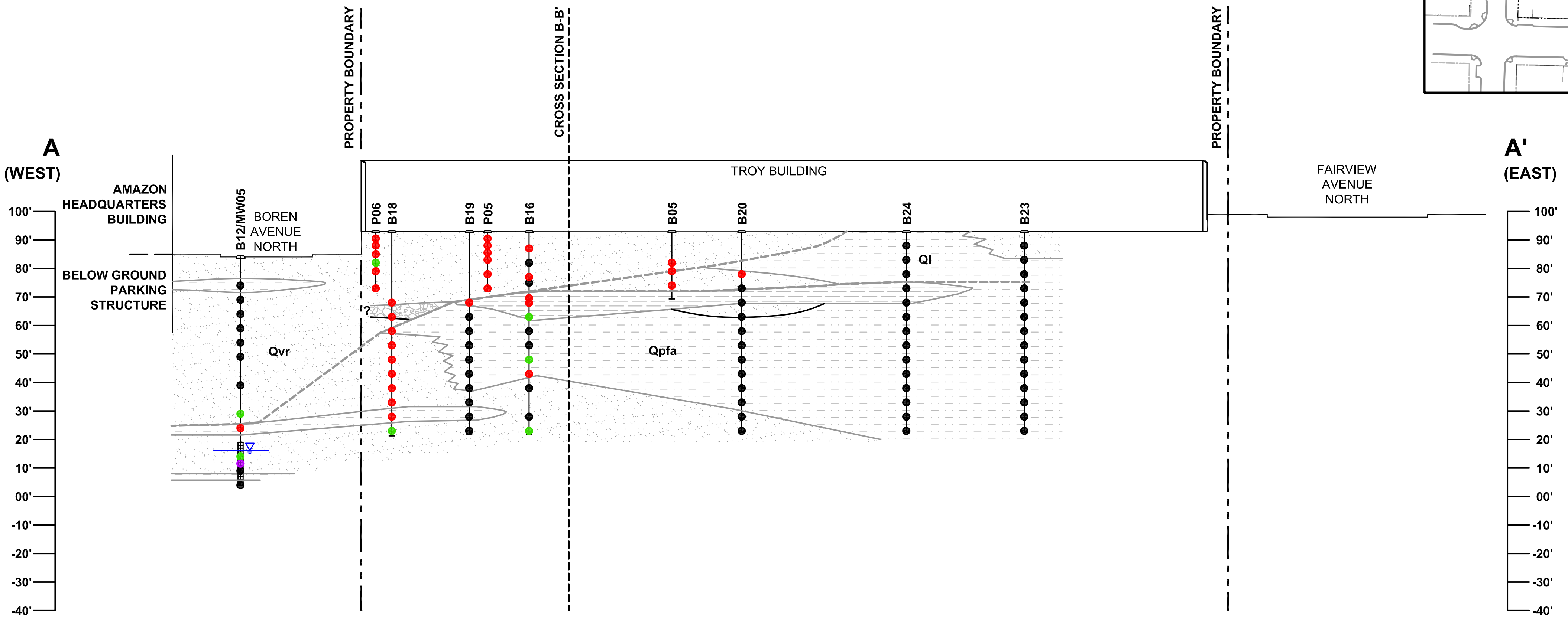


APPROXIMATE SCALE IN FEET

## FIGURE 14

GROUNDWATER ANALYTICAL RESULTS
FOR PCE, TCE, AND GRPH





## LEGEND

MONITORING WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (OCTOBER 20, 2011)

| | |
|---|---|
| TCE | TRICHLOROETHYLENE |
| PCE | TETRACHLOROETHYLENE |
| MTCA | WASHINGTON STATE MODEL TOXICS CONTROL ACT |
| mg/kg | MILLIGRAMS PER KILOGRAM |
| µg/L | MICROGRAMS PER LITER |

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS):

| | |
|---|---|
| ☐ | SP AND SP-SM |
| ☐ | SM |
| ▤ | ML AND SM |
| ▨ | GP |
| Qvr | VASHON RECESSIONAL OUTWASH DEPOSITS |
| Qi | ICE-CONTACT DEPOSITS |
| Qpfa | PRE-FRASER NONGLACIAL DEPOSITS |

PCE CONCENTRATIONS IN SOIL (mg/kg):

- ● CONCENTRATION BELOW LABORATORY DETECTION LIMIT
- 🟢 CONCENTRATION AT OR BELOW MTCA METHOD A CLEANUP LEVEL
- 🔴 CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

HIGHEST PCE/TCE CONCENTRATIONS IN GROUNDWATER (µg/L):

- 🔵 CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL
- 🟣 CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

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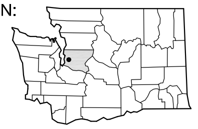
CHECKED BY: EKR
CAD FILE: 0731-004_2011RI_XAA2

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

# FIGURE 15

CROSS SECTION A-A'
CHLORINATED SOLVENTS IN SOIL AND GROUNDWATER

3/9/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_XAA2_F.DWG

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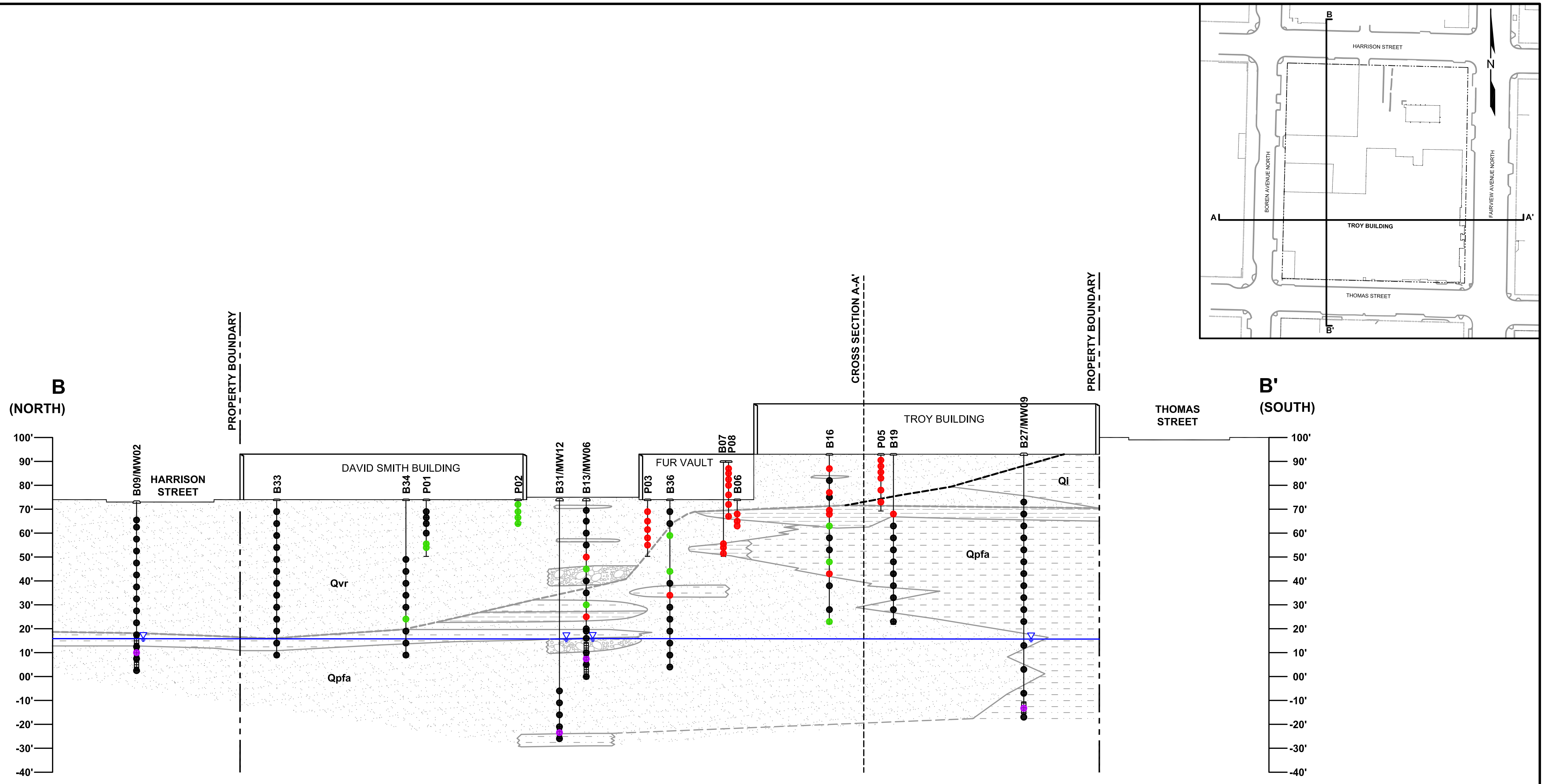

## LEGEND

MONITORING WELL
SCREEN INTERVAL
GROUNDWATER LEVEL (OCTOBER 20, 2011)

| | |
|---|---|
| TCE | TRICHLOROETHYLENE |
| PCE | TETRACHLOROETHYLENE |
| MTCA | WASHINGTON STATE MODEL TOXICS CONTROL ACT |
| mg/kg | MILLIGRAMS PER KILOGRAM |
| µg/L | MICROGRAMS PER LITER |

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS):

| | |
|---|---|
| ▨ | SP AND SP-SM |
| ▨ | SM |
| ▨ | ML AND SM |
| ▨ | GP |
| Qvr | VASHON RECESSIONAL OUTWASH DEPOSITS |
| Qi | ICE-CONTACT DEPOSITS |
| Qpfa | PRE-FRASER NONGLACIAL DEPOSITS |

PCE CONCENTRATIONS IN SOIL (mg/kg):

- ● CONCENTRATION BELOW LABORATORY DETECTION LIMIT
- 🟢 CONCENTRATION AT OR BELOW MTCA METHOD A CLEANUP LEVEL
- 🔴 CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

HIGHEST PCE/TCE CONCENTRATIONS IN GROUNDWATER (µg/L):

- 🔵 CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL
- 🟣 CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

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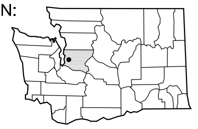
DATE: 12/5/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011RI_XBB2

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 16
CROSS SECTION B-B'
CHLORINATED SOLVENTS IN SOIL AND GROUNDWATER

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_XBB2_F.DWG
3/9/2012
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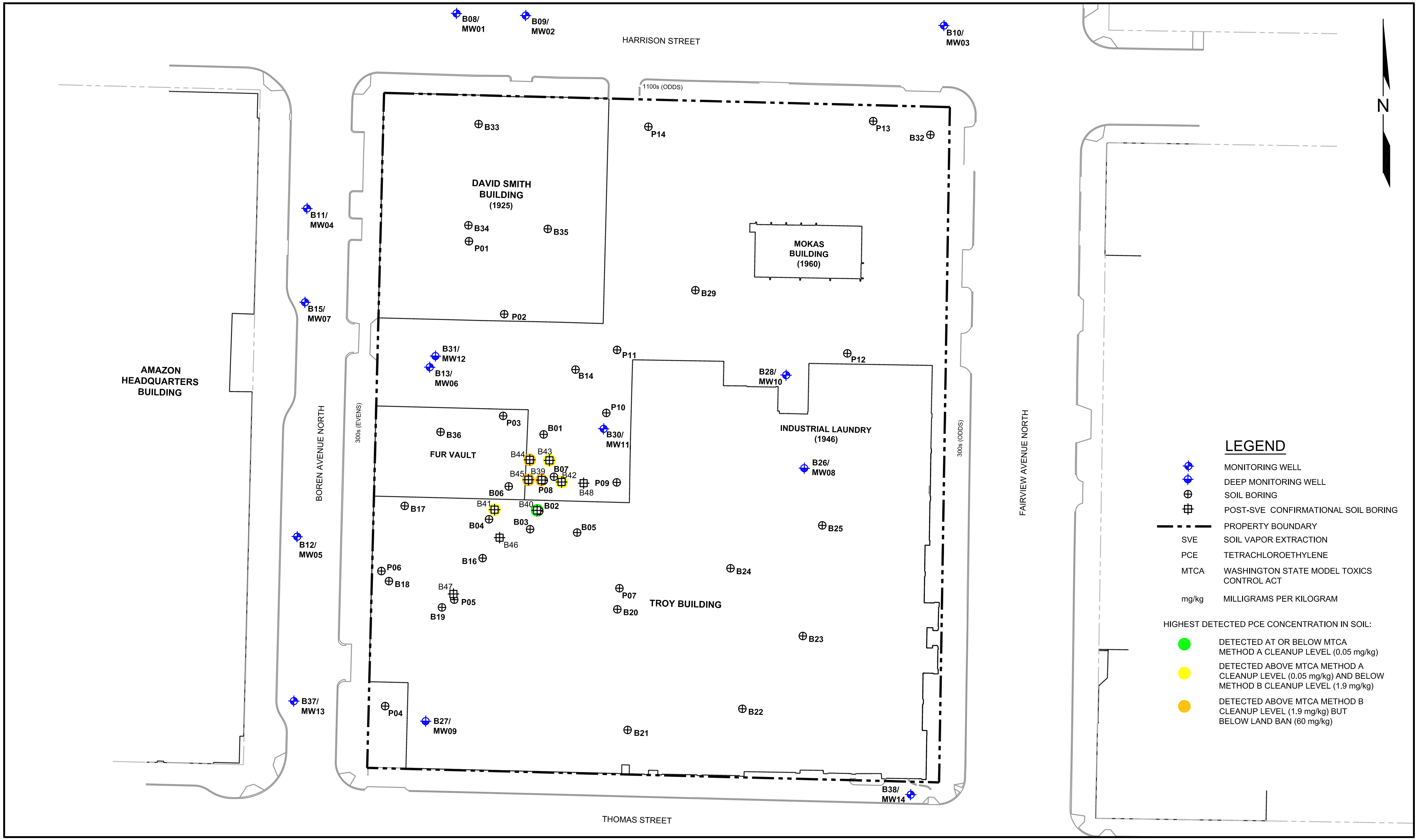
P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011RI_PSVE_F.DWG



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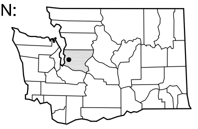
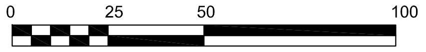
DATE: 02/08/12
DRAWN BY: BLR
CHECKED BY: EKR
CAD FILE: 0731-004_2011RI_PSVE

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

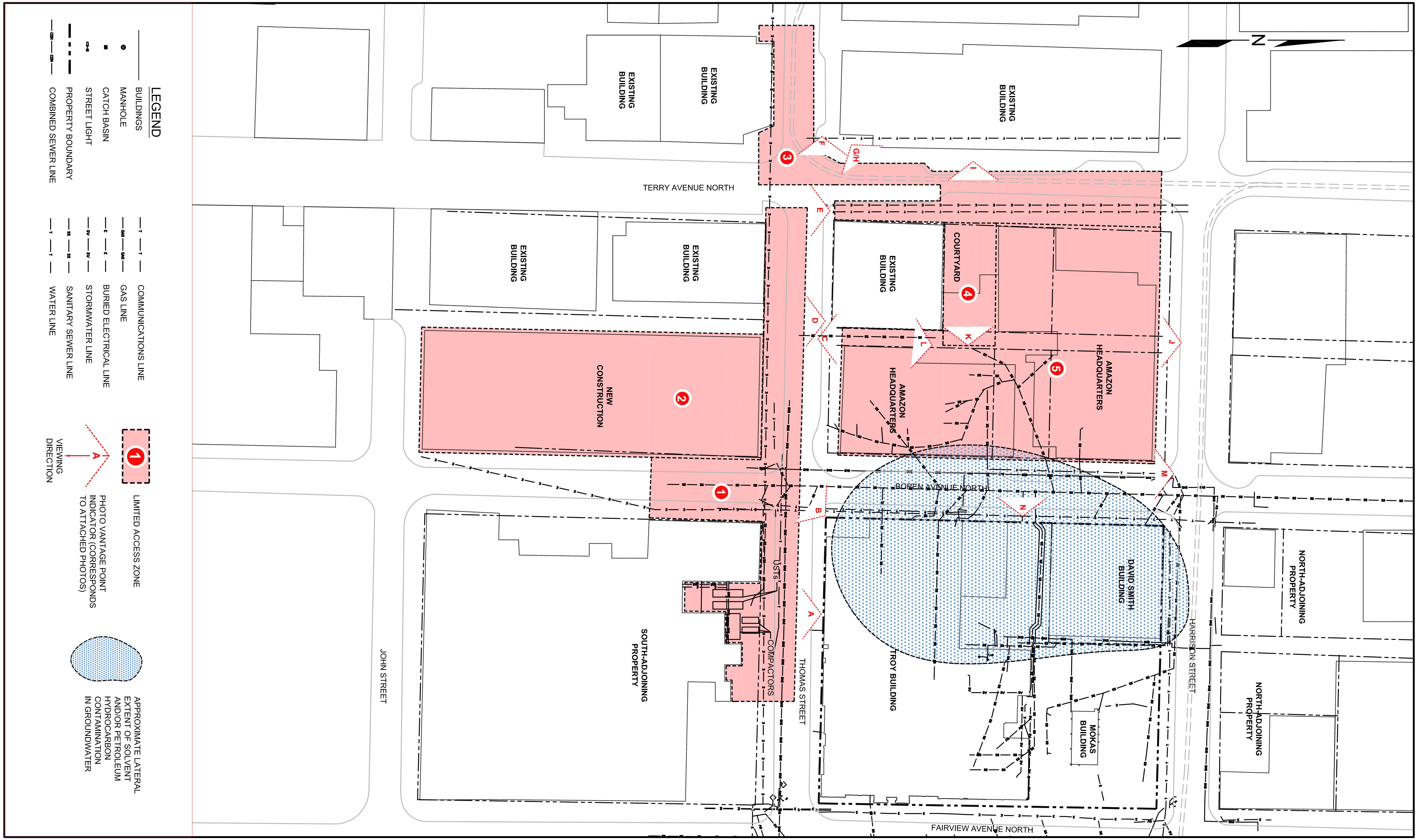




APPROXIMATE SCALE IN FEET

## FIGURE 17

POST-SVE CONFIRMATIONAL SOIL ANALYTICAL RESULTS FOR PCE



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CAD FILE: 0731-004_2012CAP_ACCESS

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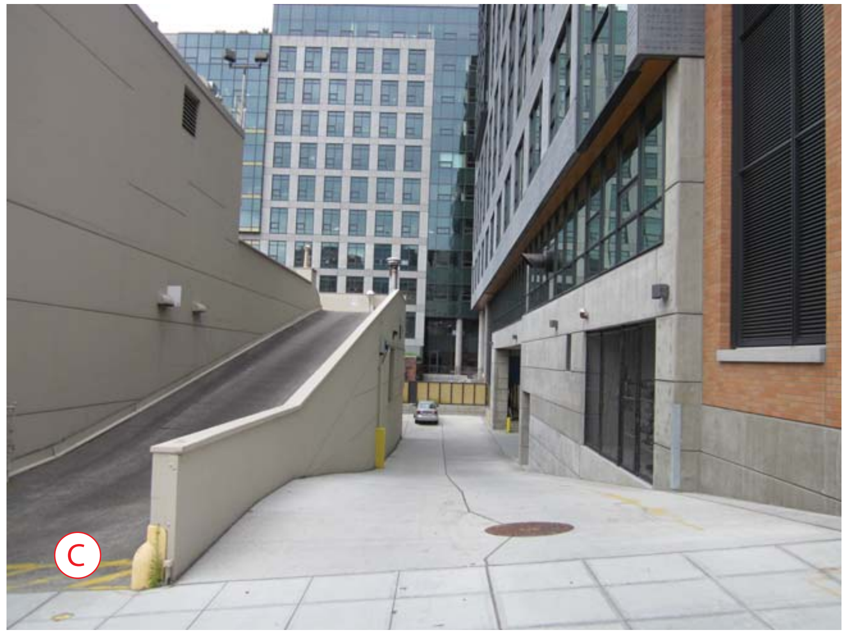
CITY,STATE: SEATTLE, WASHINGTON

REGION:

0 30 60 120 240
APPROXIMATE SCALE IN FEET

## FIGURE 18A
ACCESS LIMITATIONS



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PROJECT NAME: TROY LAUNDRY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

NO SCALE

**FIGURE 18B**
PHOTO LOG

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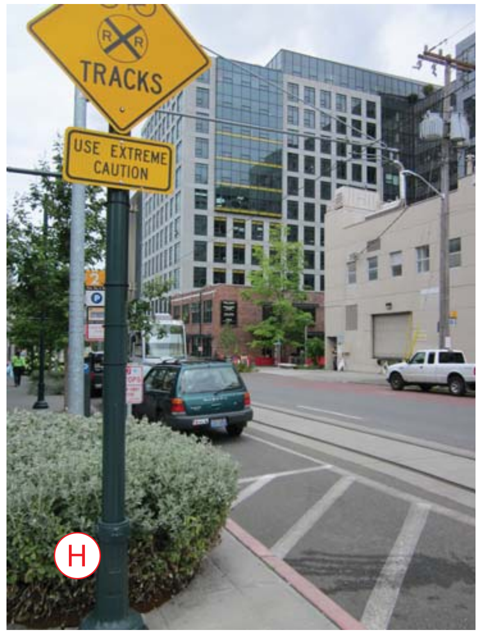

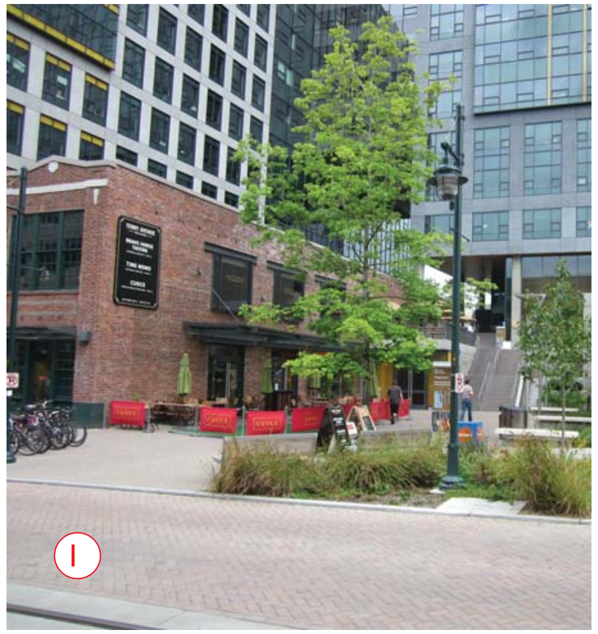

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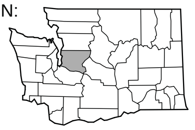
DATE: 7/23/2012
DRAWN BY: VPB
CHECKED BY: EKR
CAD FILE: 0731-004_PHOTOLOG

PROJECT NAME: TROY LAUNDRY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

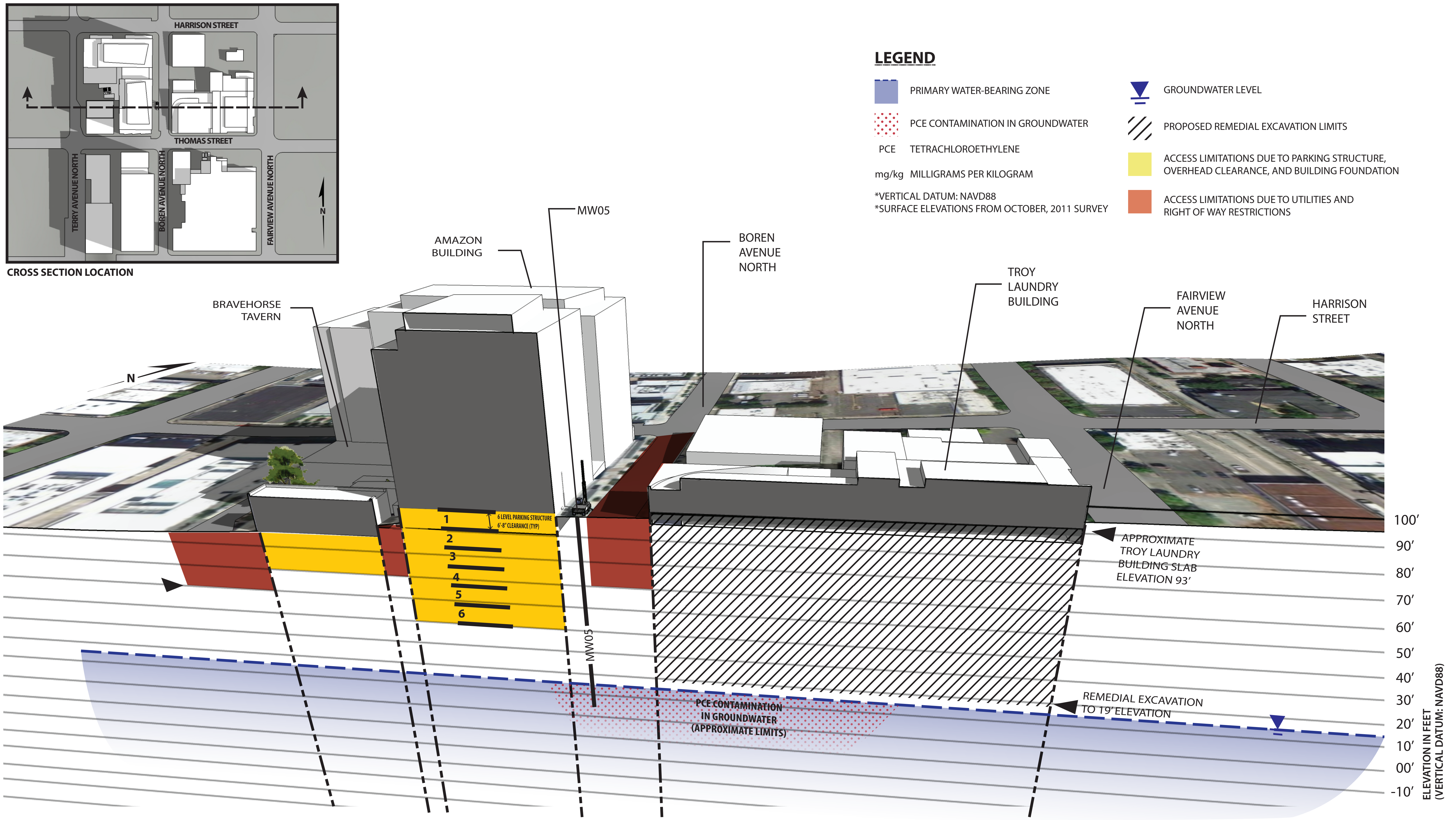
REGION:



NO SCALE

**FIGURE 18C**
PHOTO LOG

SOUNDEARTHINC.COM



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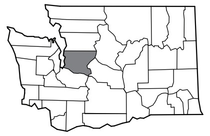
DRAWN BY: VPB
CHECKED BY: EKR
FILE: 0731-001_2012CAP_ACCLIMITS

PROJECT NAME: TROY LAUNDRY PROPERTY
SES PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:



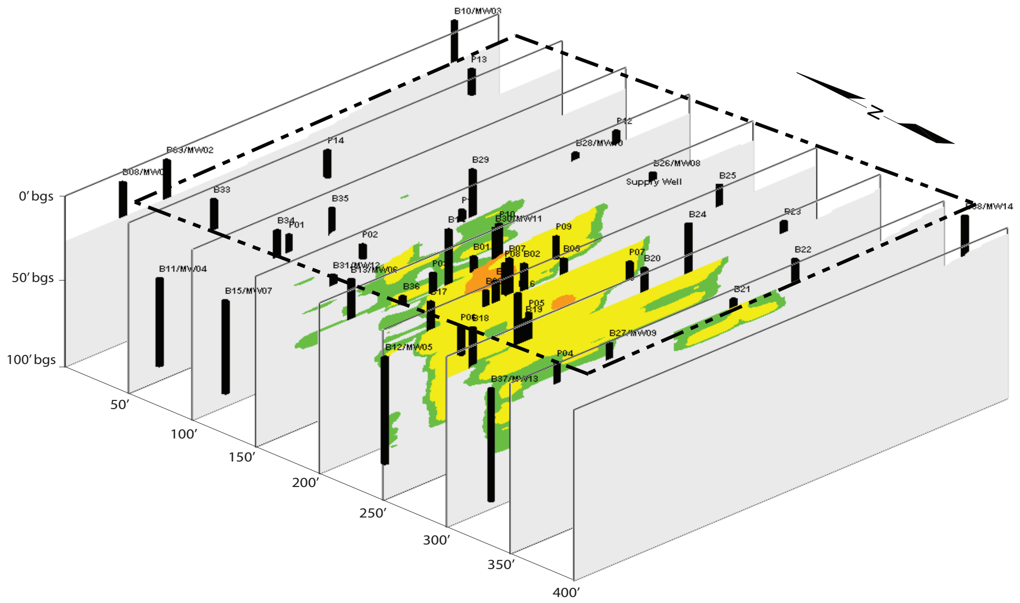
NOT TO SCALE

## FIGURE 19

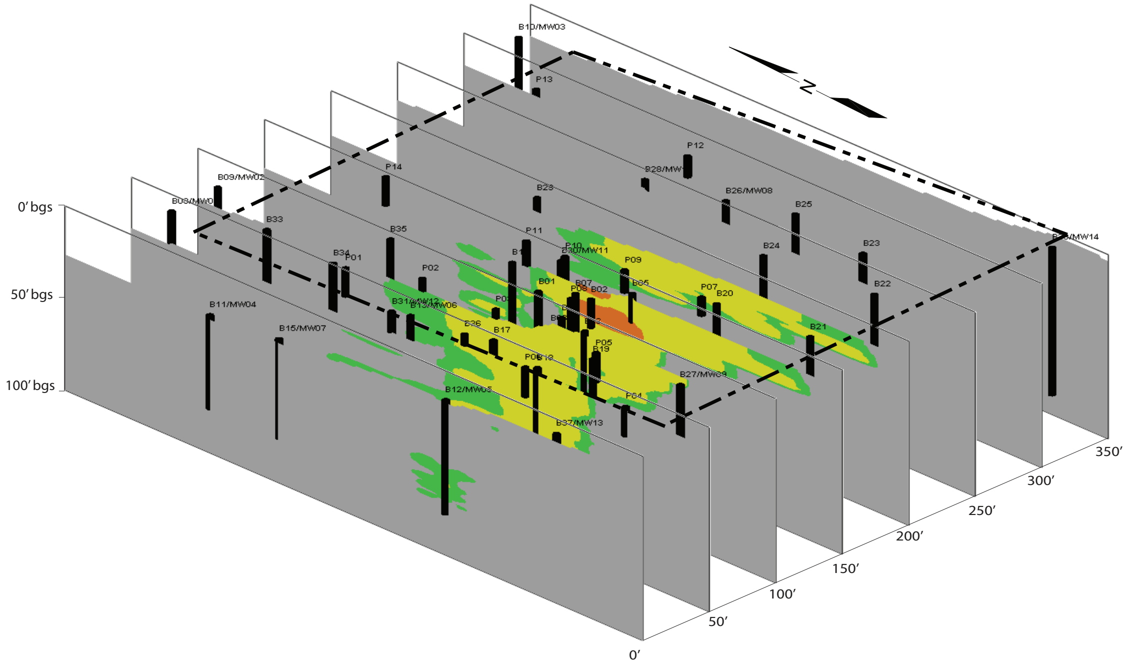
3D MODEL AND CROSS SECTION OF PHYSICAL AND TECHNICAL LIMITATIONS TO ADDITIONAL INVESTIGATIONS

# PCE CONCENTRATIONS IN SOIL

PLAN VIEW SHOWING CROSS SECTION LOCATIONS

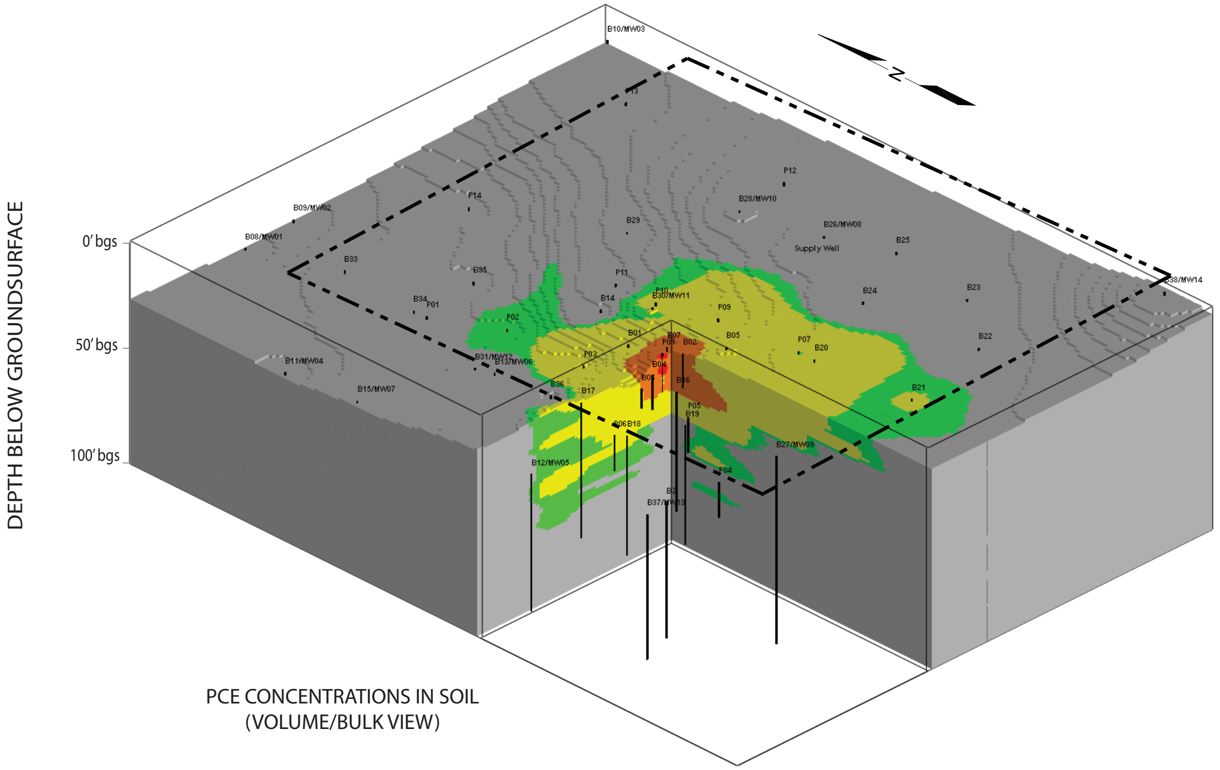


PCE CONCENTRATIONS IN SOIL
(DETAIL/SLICE VIEW)



ESTIMATED SOIL VOLUME FOR EACH OF THE
THREE REGULATED CATEGORIES FOR PCE CONTAMINATION

| | |
|---|---|
| 🔴 | 310 TONS |
| 🟠 | 2,230 TONS |
| 🟡 🟢 | 95,000 TONS |



PCE CONCENTRATIONS IN SOIL
(VOLUME/BULK VIEW)

## LEGEND

| | |
|---|---|
| B08/MW01 (boring symbol) | SOIL BORING LOCATION WITH MONITORING WELL DESIGNATION |
| — - — - | PROPERTY BOUNDARY |
| mg/kg | MILLIGRAMS PER KILOGRAM |
| MTCA | WASHINGTON STATE MODEL TOXICS CONTROL ACT |
| PCE | TETRACHLOROETHYLENE |
| bgs | BELOW GROUND SURFACE |

PCE CONCENTRATION

| | |
|---|---|
| 🟢 | DETECTED BELOW MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg) AND ABOVE LABORATORY REPORT LIMIT (0.025 mg/kg) |
| 🟡 | DETECTED ABOVE MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg) AND BELOW METHOD B CLEANUP LEVEL (1.9 mg/kg) |
| 🟠 | DETECTED ABOVE MTCA METHOD B CLEANUP LEVEL (1.9 mg/kg) AND BELOW LAND BAN (60 mg/kg) |
| 🔴 | DETECTED ABOVE LAND BAN (60 mg/kg) |

PCE VOLUME ESTIMATES ARE BASED ON STATISTICAL ANALYSIS OF SITE-SPECIFIC DATA.

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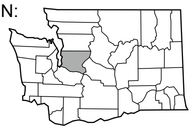
DATE: 12/02/11
DRAWN BY: JQC
CHECKED BY: EKR
CAD FILE: 0731-004-2011FS_PCE

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE WASHINGTON

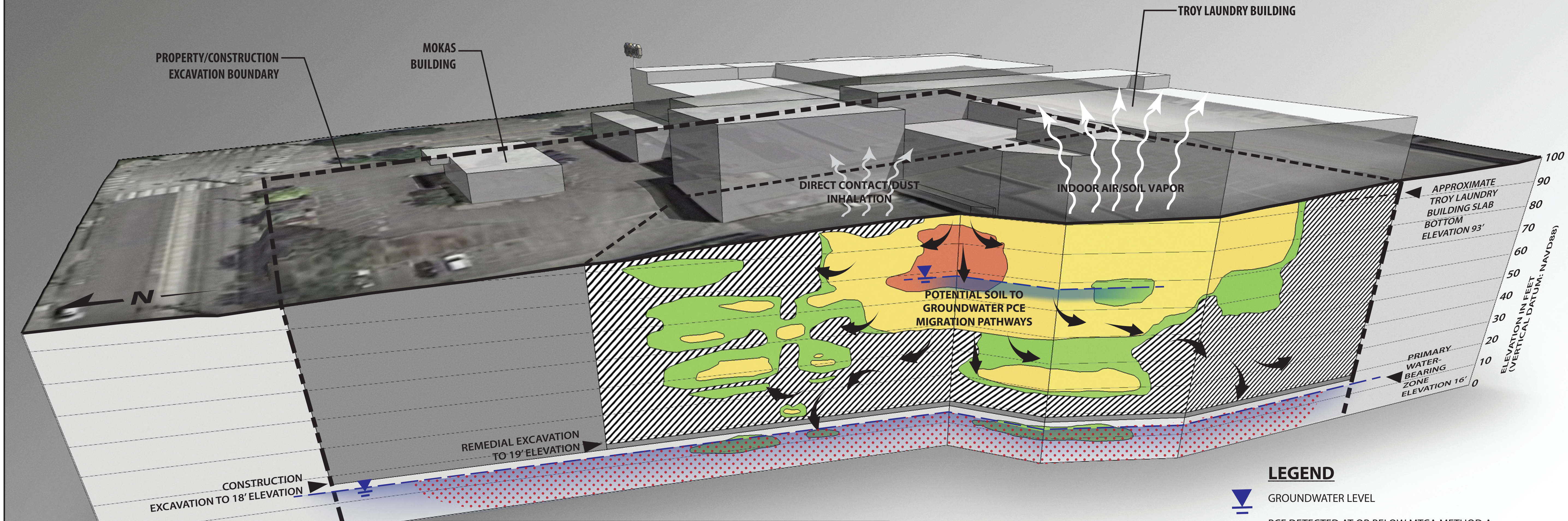
REGION:

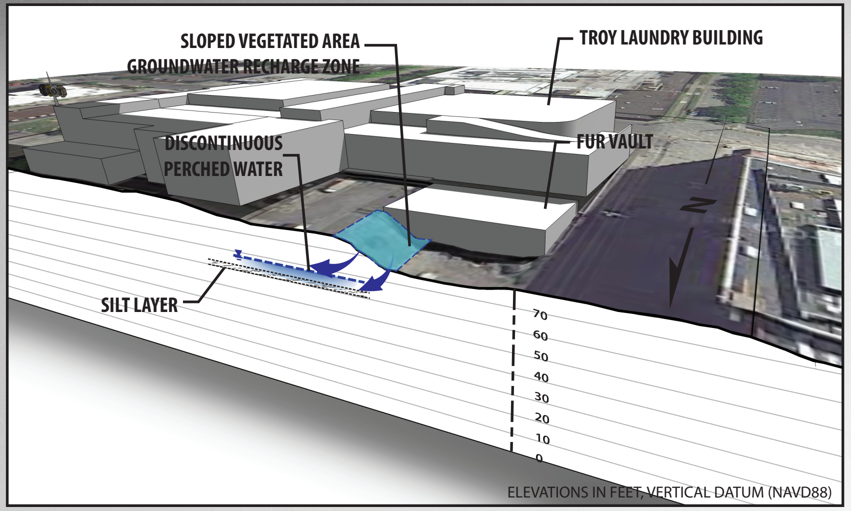


NOT TO SCALE

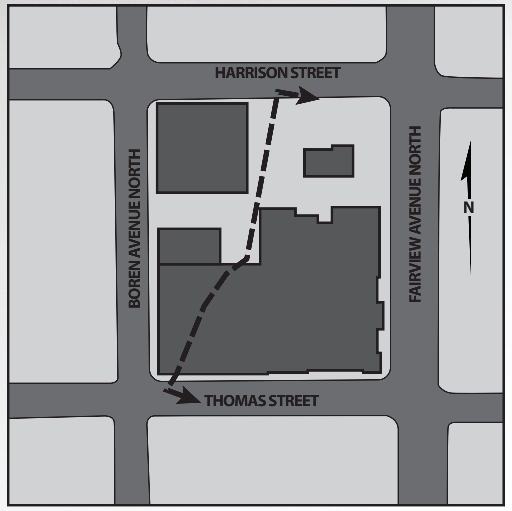
## FIGURE 20

MODELED DISTRIBUTION
PCE CONTAMINATION IN SOIL
(PRE-SVE SYSTEM OPERATION)





GROUNDWATER INFILTRATION DIAGRAM



CROSS SECTION LOCATION

## LEGEND

| | |
|---|---|
| ▼ | GROUNDWATER LEVEL |
| 🟩 | PCE DETECTED AT OR BELOW MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg) AND ABOVE LABRATORY REPORTING LIMIT |
| 🟨 | PCE DETECTED ABOVE MTCA METHOD A CLEANUP LEVEL (0.05 mg/kg) AND BELOW METHOD B CLEANUP LEVEL (1.9 mg/kg) |
| 🟧 | PCE DETECTED ABOVE MTCA METHOD B CLEANUP LEVEL (1.9 mg/kg) AND BELOW LAND BAN (60 mg/kg) |
| 🟦 | PRIMARY WATER-BEARING ZONE |
| ⁙ | PCE CONTAMINATION IN GROUNDWATER |
| PCE | TETRACHLOROETHYLENE |
| mg/kg | MILLIGRAMS PER KILOGRAM |

*VERTICAL DATUM: NAVD88
*SURFACE ELEVATIONS FROM OCTOBER, 2011 SURVEY

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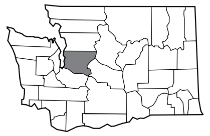
CHECKED BY: EKR
FILE: 0731-001_2011RI_CSM

PROJECT NAME: TROY LAUNDRY PROPERTY
SES PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:



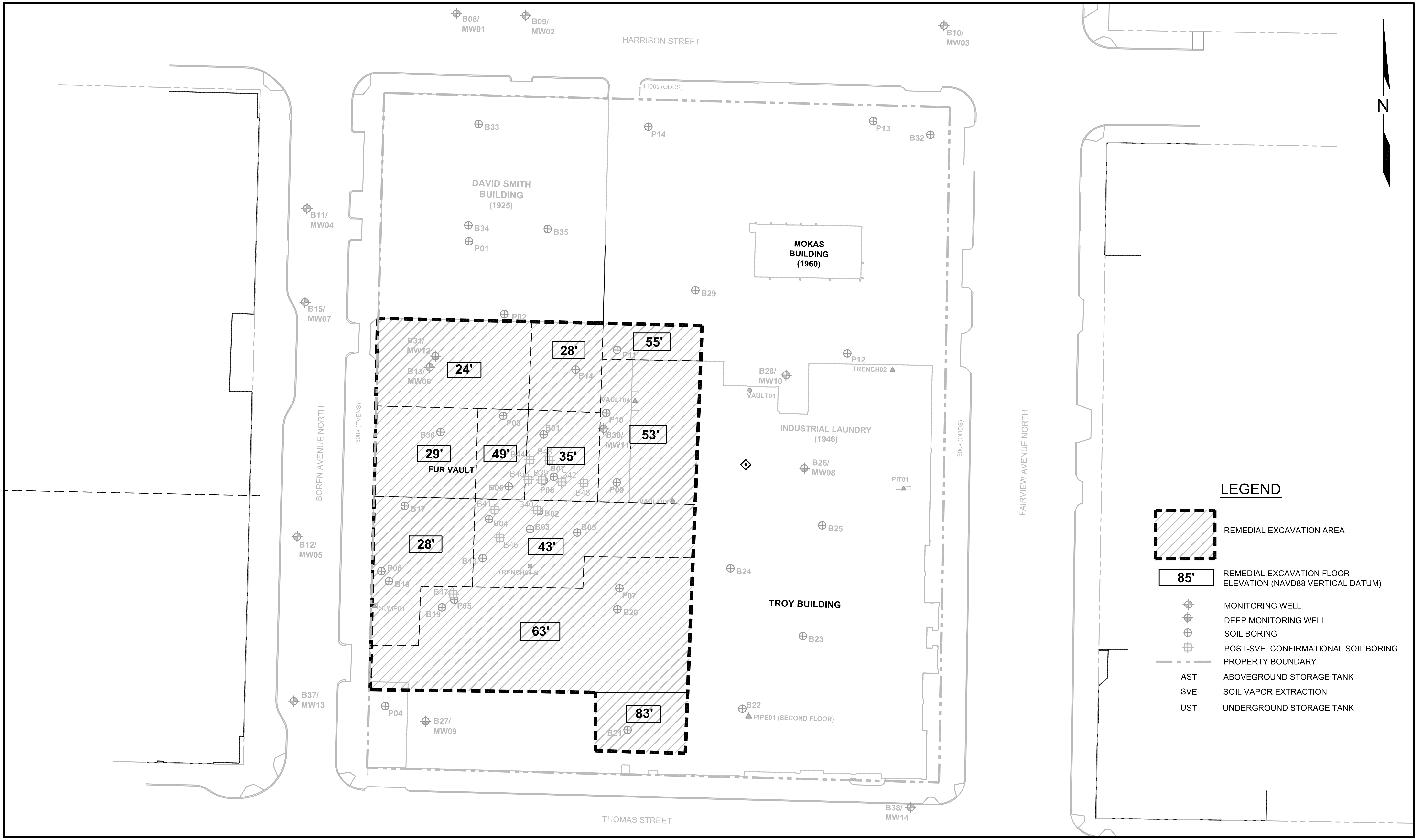
NOT TO SCALE

**FIGURE 21**

CONCEPTUAL SITE MODEL SHOWING
PCE-CONTAMINATED SOIL AND GROUNDWATER

7/30/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004 2011FS EXC-PLAN MTCA.DWG



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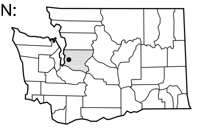
CAD FILE: 0731-004_2011FS_ALT-B

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004-02
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100

APPROXIMATE SCALE IN FEET

# FIGURE 22

ESTIMATED REMEDIAL EXCAVATION DIAGRAM (BASED ON MTCA METHOD A EXCEEDENCES FOR PCE)

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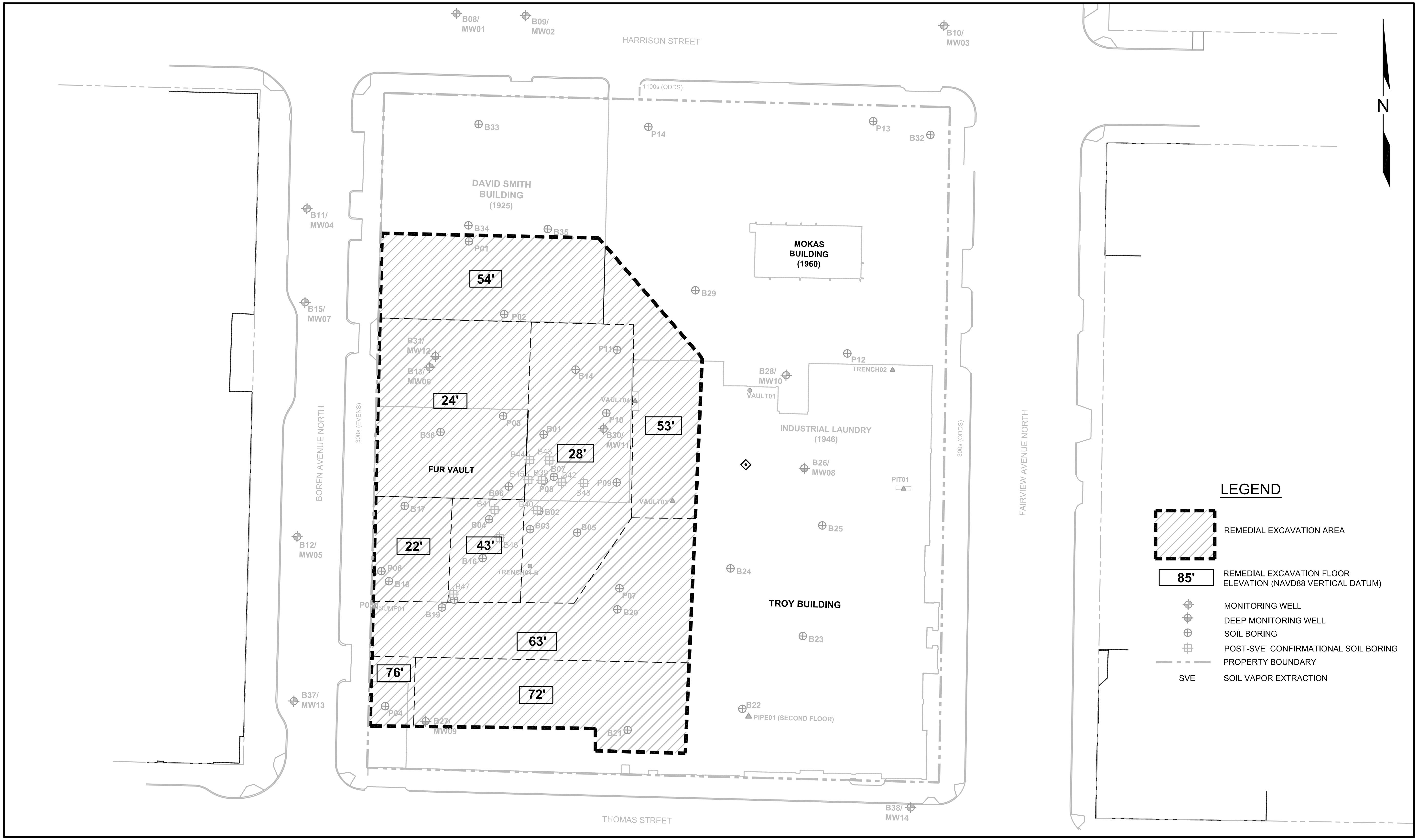
7/30/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_EXC-PLAN.DWG



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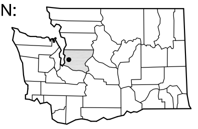
DATE: 11/18/2011
DRAWN BY: VPB
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_ALT-B

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004-02
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100

APPROXIMATE SCALE IN FEET

## FIGURE 23

ESTIMATED REMEDIAL EXCAVATION DIAGRAM (BASED ON LABORATORY LIMIT EXCEEDENCES FOR PCE)

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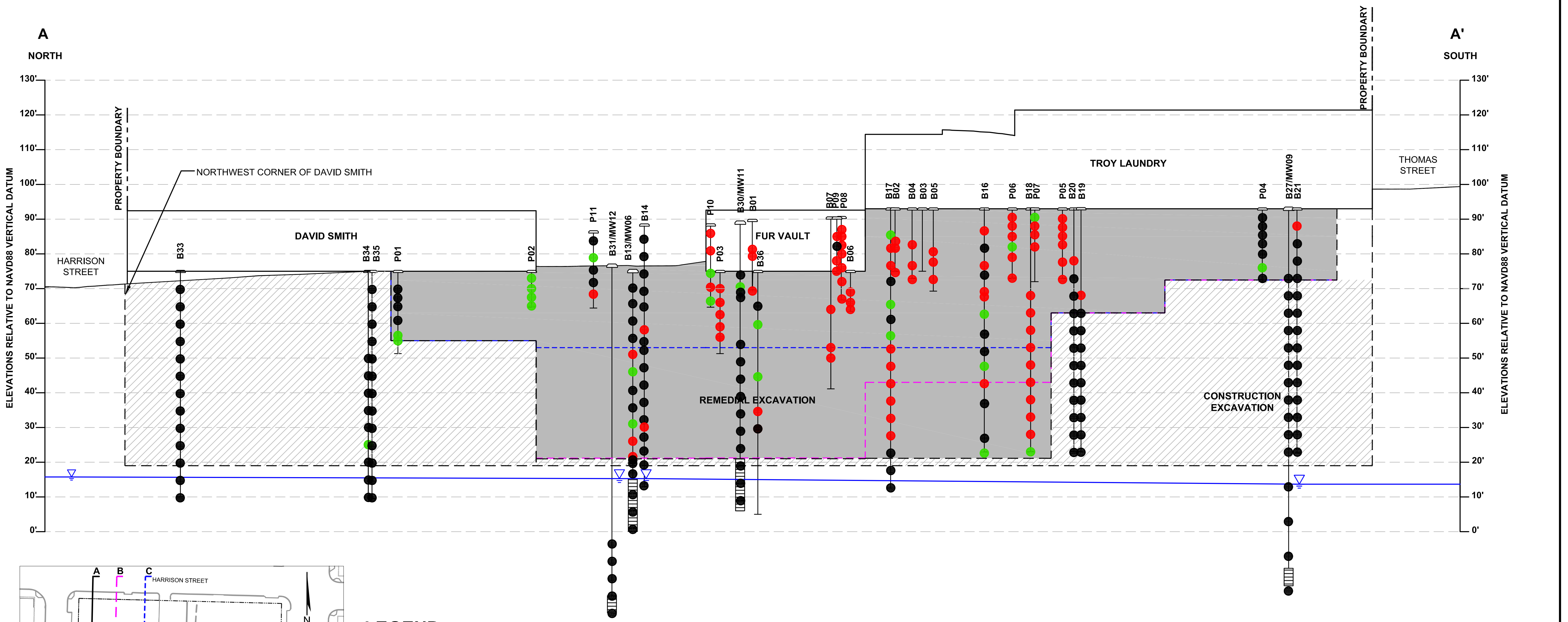
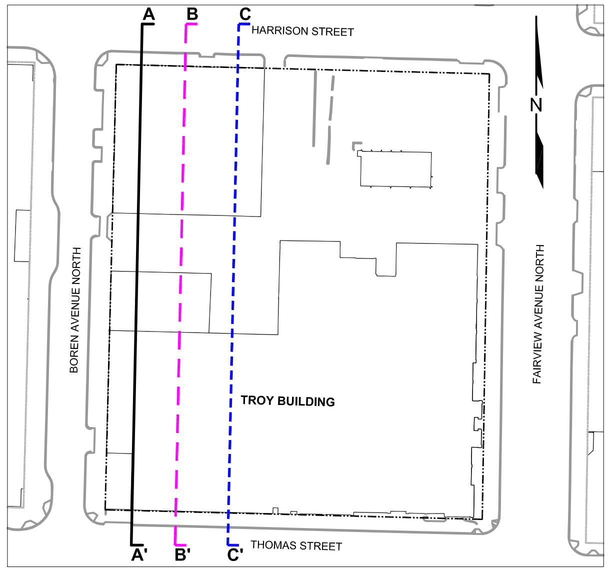




## PLAN VIEW

## LEGEND

▩ REMEDIAL EXCAVATION

▨ CONSTRUCTION EXCAVATION

── GROUNDWATER LEVEL

– – – EXCAVATION EXTENT

PCE CONCENTRATIONS IN SOIL (mg/kg):

● CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL

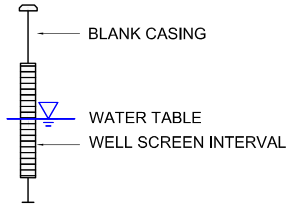
🟢 CONCENTRATION AT OR BELOW MTCA METHOD A CLEANUP LEVEL

🔴 CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

| | |
|---|---|
| mg/kg | MILLIGRAMS PER KILOGRAM |
| MTCA | WASHINGTON STATE MODEL TOXICS CONTROL ACT |

VERTICAL DATUM: NAVD88

**MW11 (21' E)** WELL OFFSET 21' EAST



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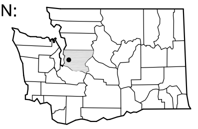
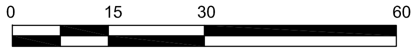
DATE: 11/30/11
DRAWN BY: BLR
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_EXEC-XS

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

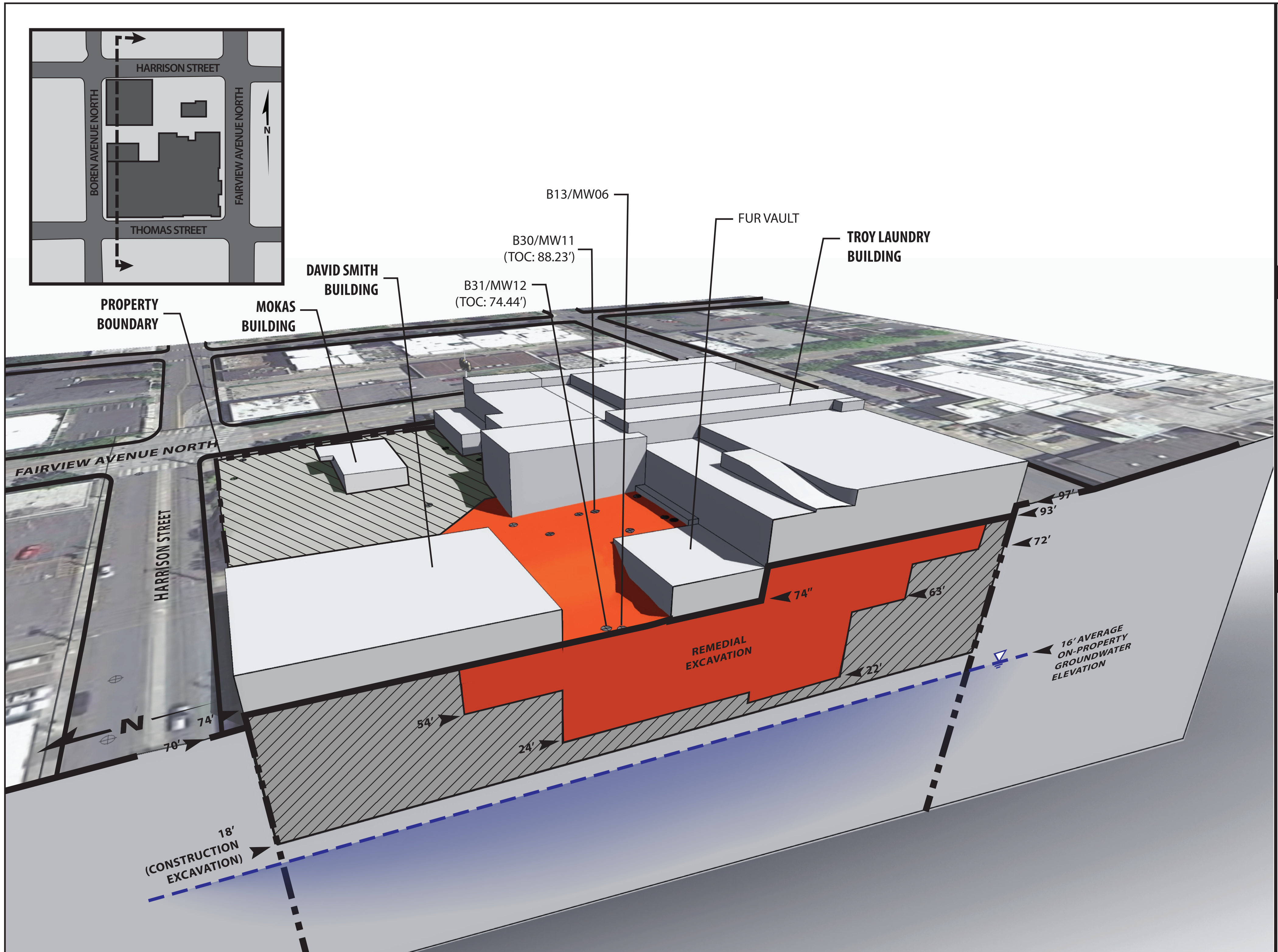




APPROXIMATE SCALE IN FEET

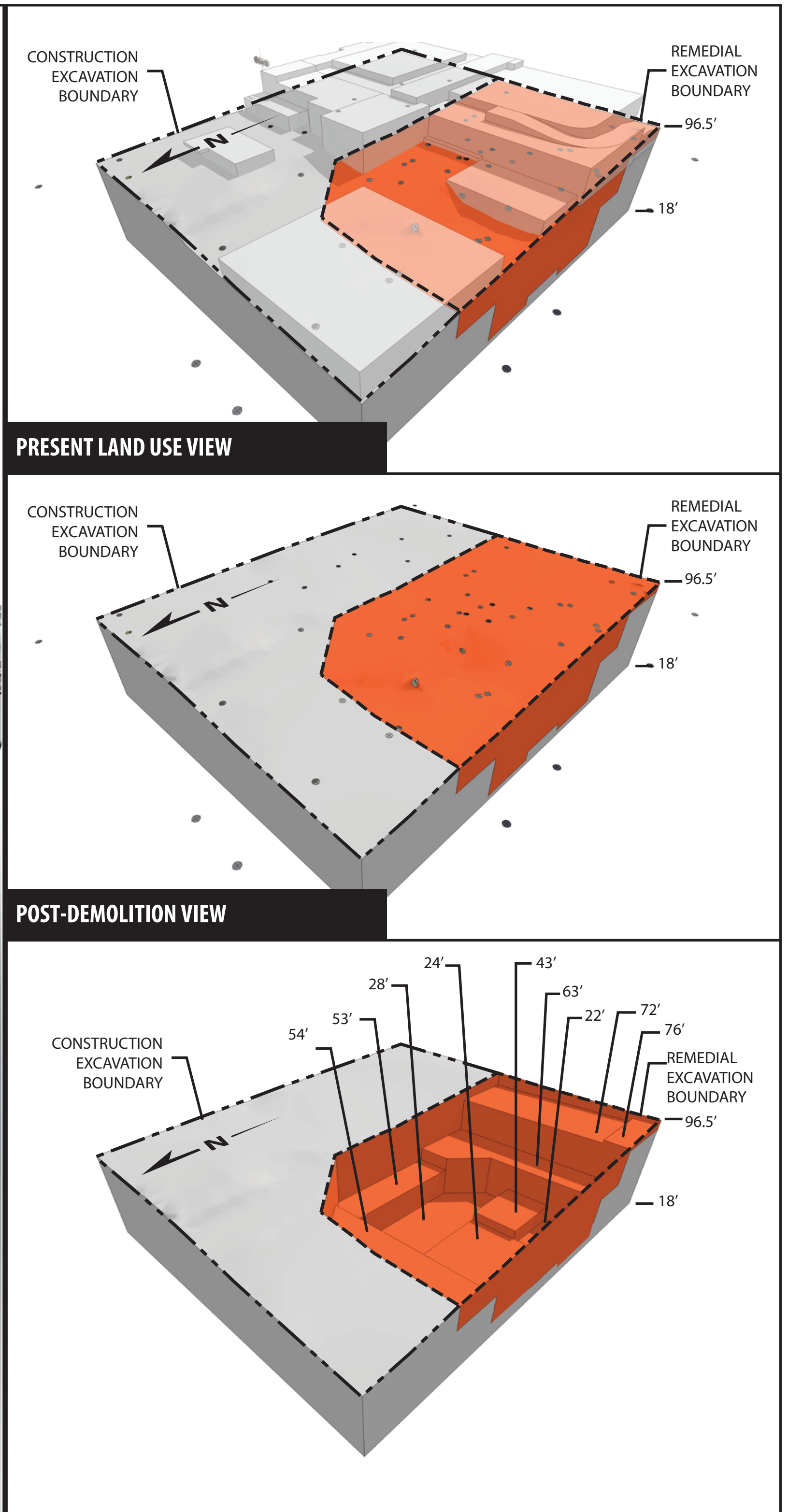
## FIGURE 24

REMEDIAL EXCAVATION CROSS SECTIONS
BASED ON DETECTABLE
CONCENTRATIONS OF PCE



VERTICAL DATUM: NAVD88

MW11 AND MW12 SHOW TOP OF CASING (TOC) ELEVATIONS TO ILLUSTRATE THE ELEVATION DIFFERENCE BETWEEN THE TWO POINTS (~13.8′)



VERTICAL DATUM: NAVD88

**ESTIMATED REMEDIAL/CONSTRUCTION EXCAVATION ELEVATIONS**

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DRAWN BY: VPB
CHECKED BY: EKR
FILE: 0731-004_2011FS_EXCAVATION

PROJECT NAME: TROY LAUNDRY PROPERTY
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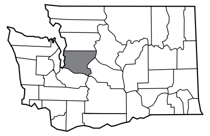
CITY, STATE: SEATTLE, WASHINGTON

REGION:



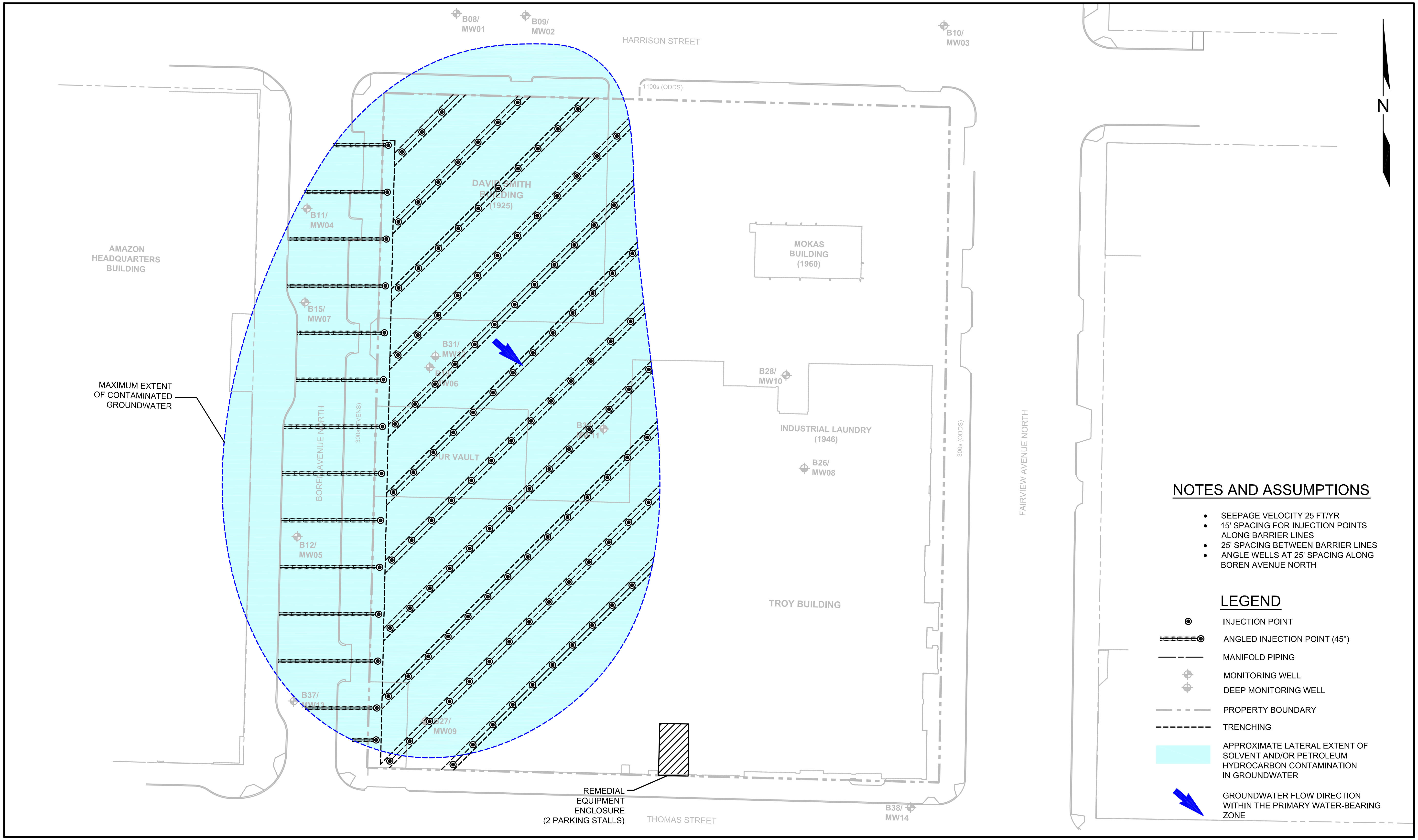
NOT TO SCALE

## FIGURE 25

3D VIEW OF ESTIMATED EXCAVATION PLAN - BASED ON DETECTABLE CONCENTRATIONS OF PCE

8/8/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_CLEANUP-ALT_1.DWG



## NOTES AND ASSUMPTIONS

- SEEPAGE VELOCITY 25 FT/YR
- 15' SPACING FOR INJECTION POINTS ALONG BARRIER LINES
- 25' SPACING BETWEEN BARRIER LINES
- ANGLE WELLS AT 25' SPACING ALONG BOREN AVENUE NORTH

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DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_ALT-1

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

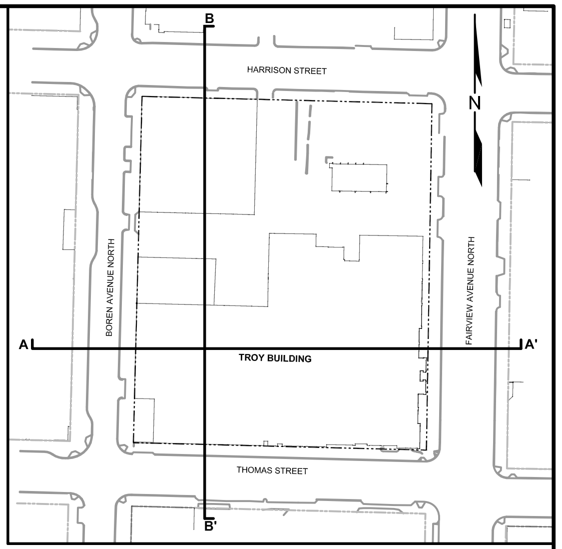
REGION:

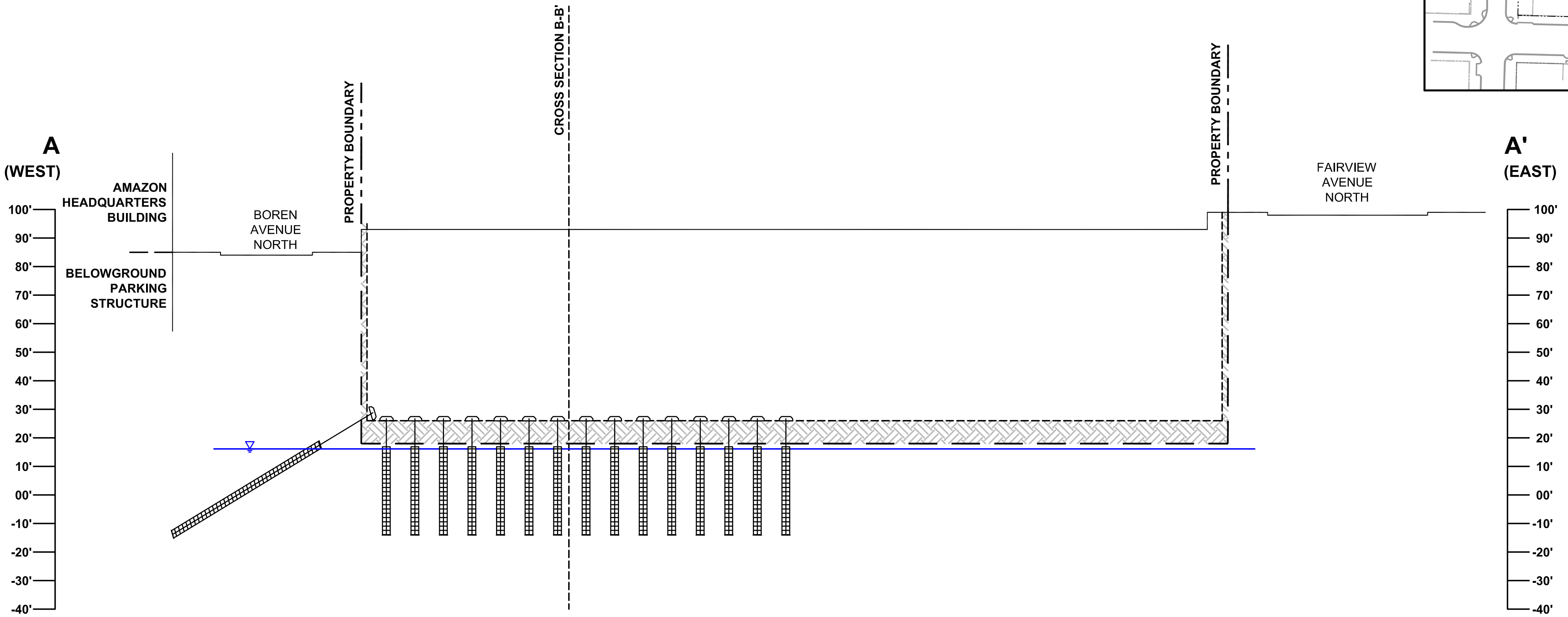
0 25 50 100
APPROXIMATE SCALE IN FEET

**FIGURE 26**
CONCEPTUAL LAYOUT
CLEANUP ALTERNATIVE 1-
IN SITU CHEMICAL OXIDATION

7/30/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_CA1_XAA.DWG





## LEGEND

PERMANGANATE INJECTION WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (OCTOBER 20, 2011)

— — — LIMITS OF CONSTRUCTION EXCAVATION (ELEVATION 18') AND LIMITS OF REMEDIAL EXCAVATION (ELEVATION 19')

▨ CONCRETE BUILDING FOUNDATION

SoundEarth Strategies
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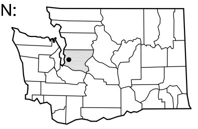
DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_CA1_XAA

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

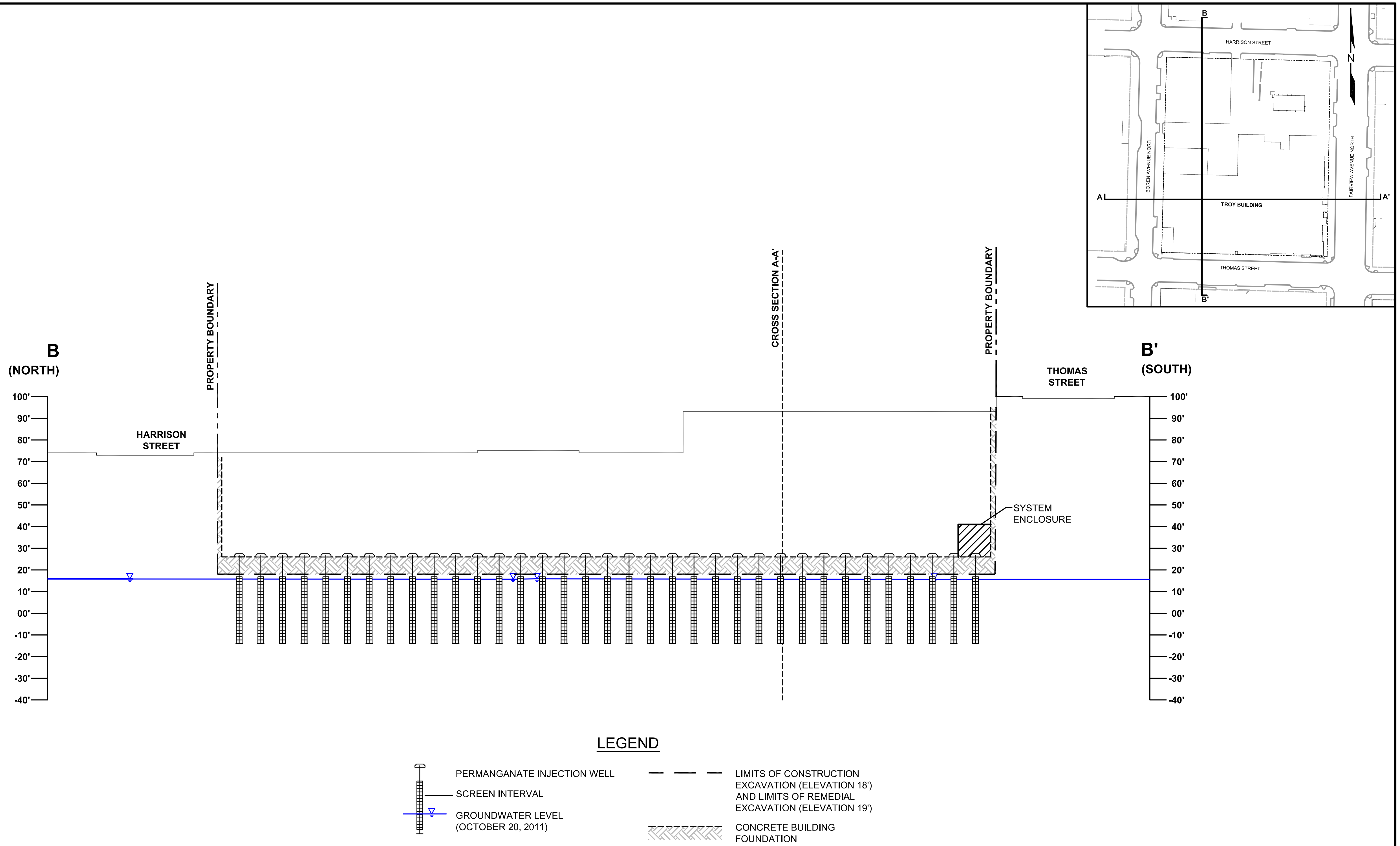


0 25 50 100
APPROXIMATE SCALE IN FEET

# FIGURE 27

CONCEPTUAL CROSS SECTION A-A'
CLEANUP ALTERNATIVE 1 -
IN SITU CHEMICAL OXIDATION

7/30/2012



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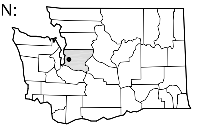
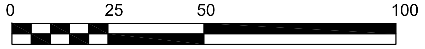
DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_CA1_XBB

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:





APPROXIMATE SCALE IN FEET

## FIGURE 28

CONCEPTUAL CROSS SECTION B-B'
CLEANUP ALTERNATIVE 1 -
IN SITU CHEMICAL OXIDATION

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004 2011FS CA1 XBB.DWG

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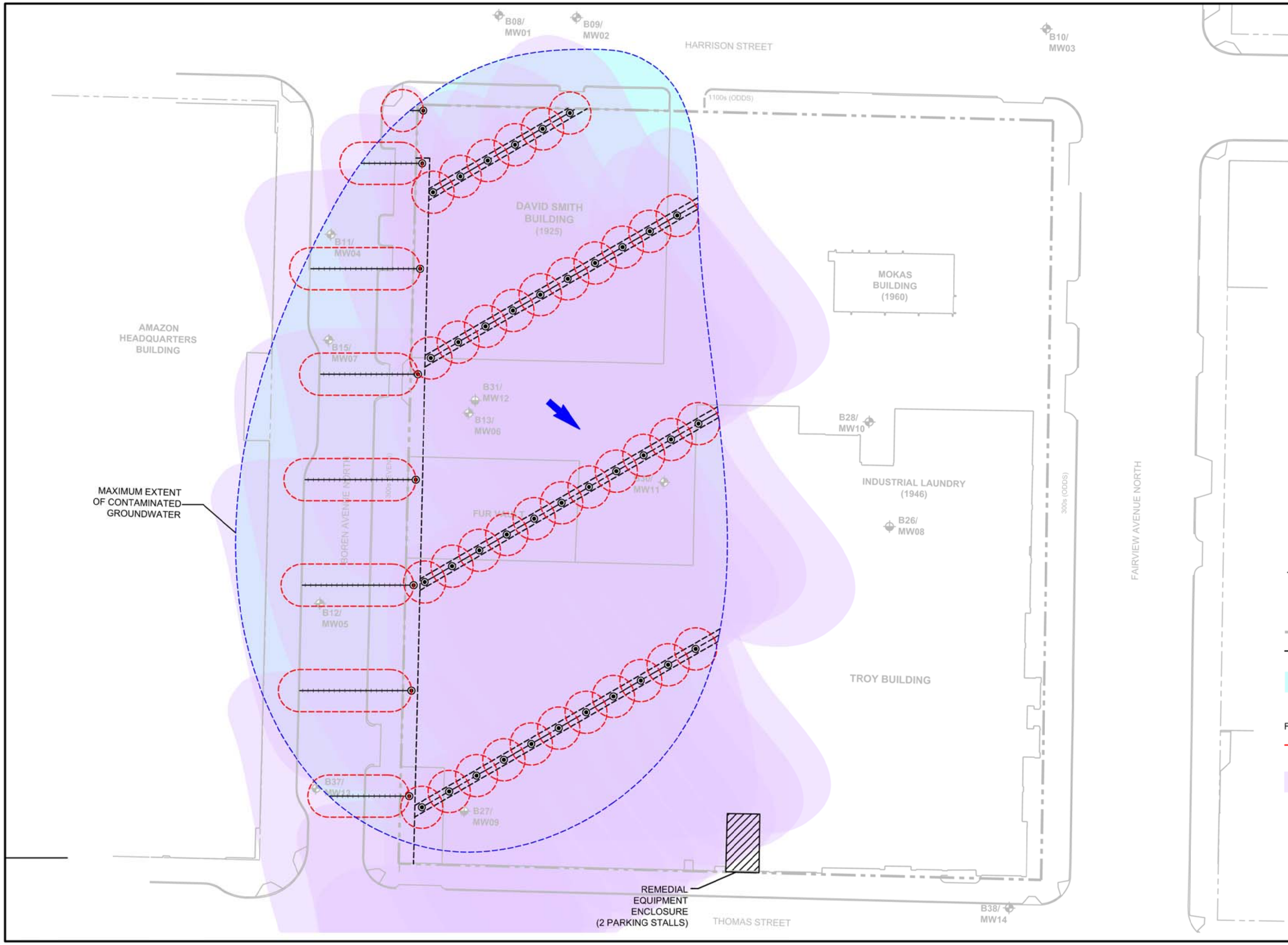

## NOTES AND ASSUMPTIONS

- SEEPAGE VELOCITY 25 FT/YR
- 15' SPACING FOR INJECTION POINTS ALONG BARRIER LINES
- 75' SPACING BETWEEN BARRIER LINES
- ANGLE WELLS AT 50' SPACING ALONG BOREN AVENUE NORTH
- INJECTION WELLS ALONG PERIPHERY OF SITE PROVIDE ACTIVE TREATMENT TO OFF-PROPERTY GROUNDWATER AND ACT AS BARRIER TO ONGOING OFF-PROPERTY MIGRATION OF CONTAMINATED GROUNDWATER

## LEGEND

| | |
|---|---|
| ◉ | INJECTION POINT |
| +++++◉ | ANGLED INJECTION POINT |
| — - — | MANIFOLD PIPING |
| ⌖ | MONITORING WELL |
| ⌖ | DEEP MONITORING WELL |
| — - - — | PROPERTY BOUNDARY |
| - - - - - | TRENCHING |
| ▭ | APPROXIMATE LATERAL EXTENT OF SOLVENT AND/OR PETROLEUM HYDROCARBON CONTAMINATION IN GROUNDWATER |
| FT/YR | FEET PER YEAR |
| - - - - - | APPROXIMATE EOS RADIUS OF INFLUENCE |
| ▭ | ESTIMATED ZONE OF ANAEROBIC DECHLORINATION (BASED ON EMPIRICAL DATA COLLECTED AT SIMILAR EOS SITES UNDER SIMILAR CONDITIONS) |
| ↘ | GROUNDWATER FLOW DIRECTION WITHIN THE PRIMARY WATER-BEARING ZONE |

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DATE: 07/23/12
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_ALT-2

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

APPROXIMATE SCALE IN FEET

## FIGURE 29

CONCEPTUAL LAYOUT
CLEANUP ALTERNATIVE 2 -
IN SITU REDUCTIVE DECHLORINATION

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_CLEANUP-ALT_2_EOS.DWG

8/8/2012

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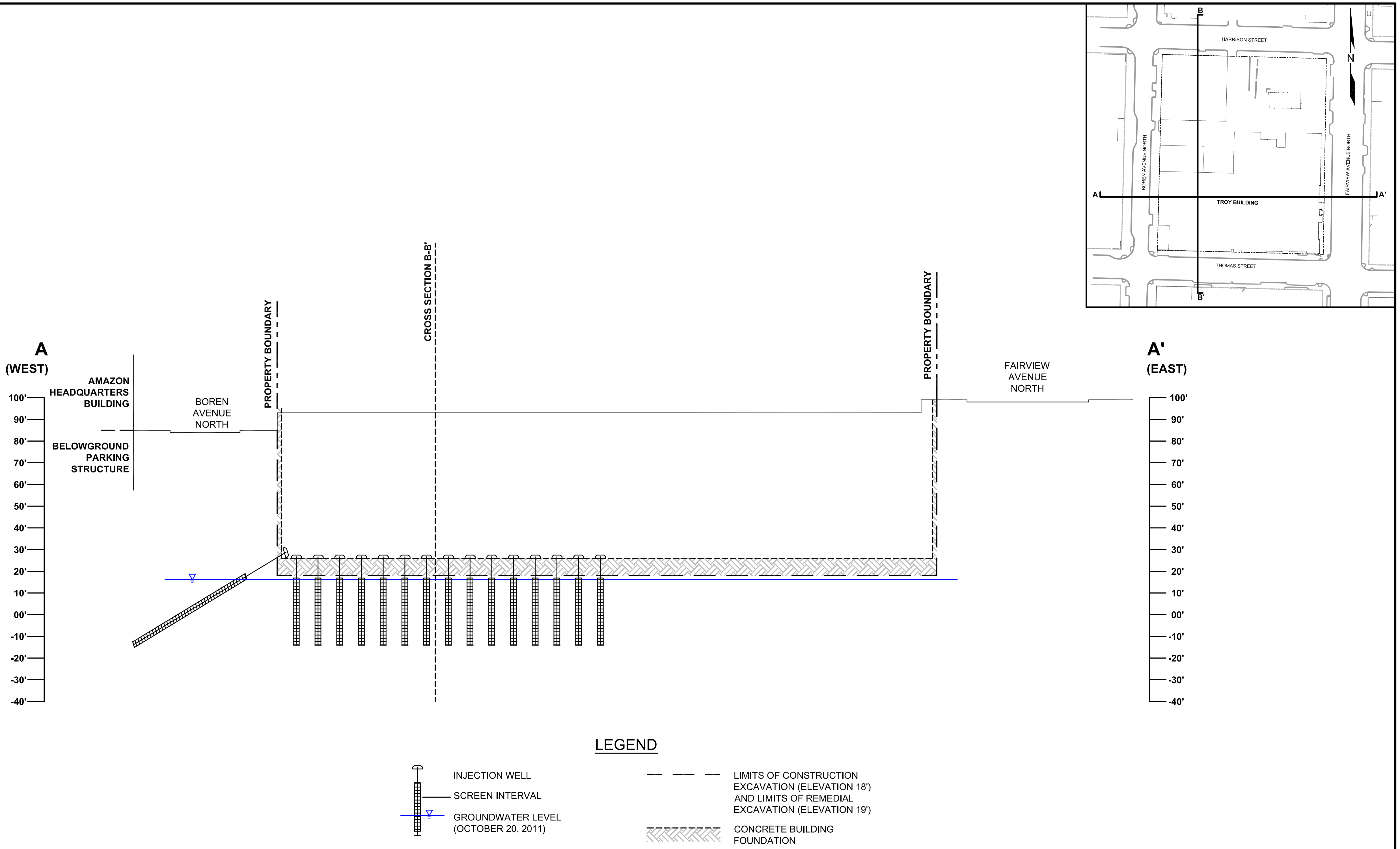

7/30/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_CA2_XAA.DWG

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DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_CA2_XAA

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 30

CONCEPTUAL CROSS SECTION A-A'
CLEANUP ALTERNATIVE 2 -
IN SITU REDUCTIVE DECHLORINATION

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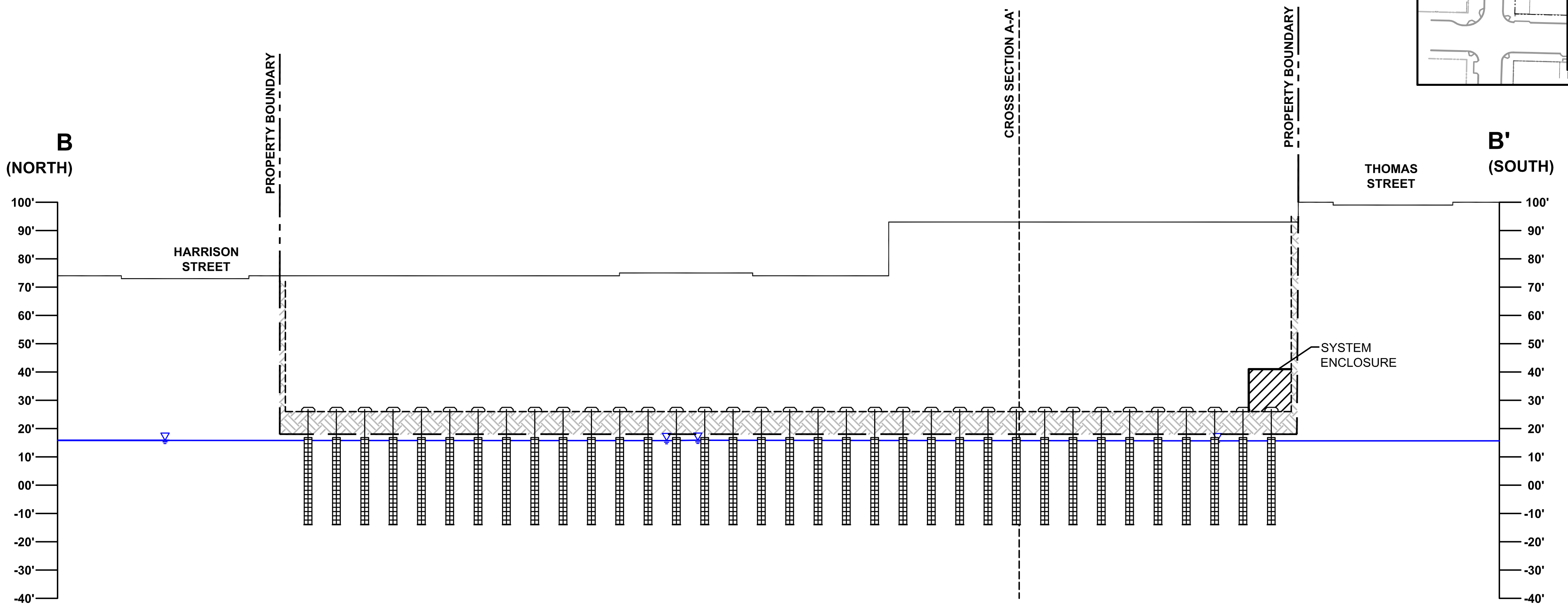
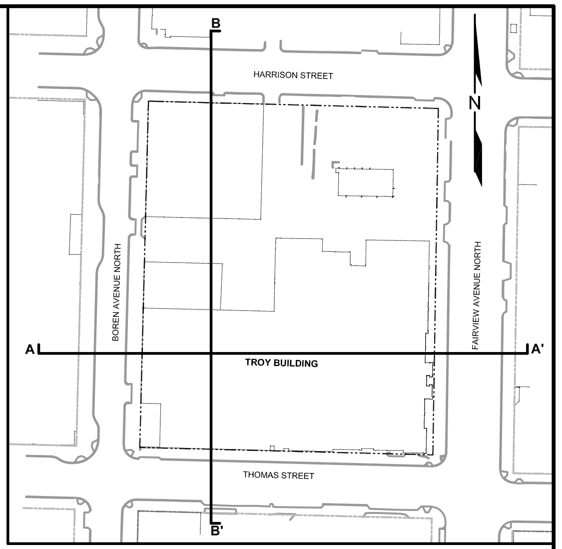
7/30/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_CA2_XBB.DWG





LEGEND

INJECTION WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (OCTOBER 20, 2011)

LIMITS OF CONSTRUCTION EXCAVATION (ELEVATION 18') AND LIMITS OF REMEDIAL EXCAVATION (ELEVATION 19')

CONCRETE BUILDING FOUNDATION

SoundEarth Strategies
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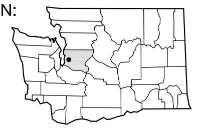
DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_CA2_XBB

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 31

CONCEPTUAL CROSS SECTION B-B'
CLEANUP ALTERNATIVE 2
IN SITU REDUCTIVE DECHLORINATION

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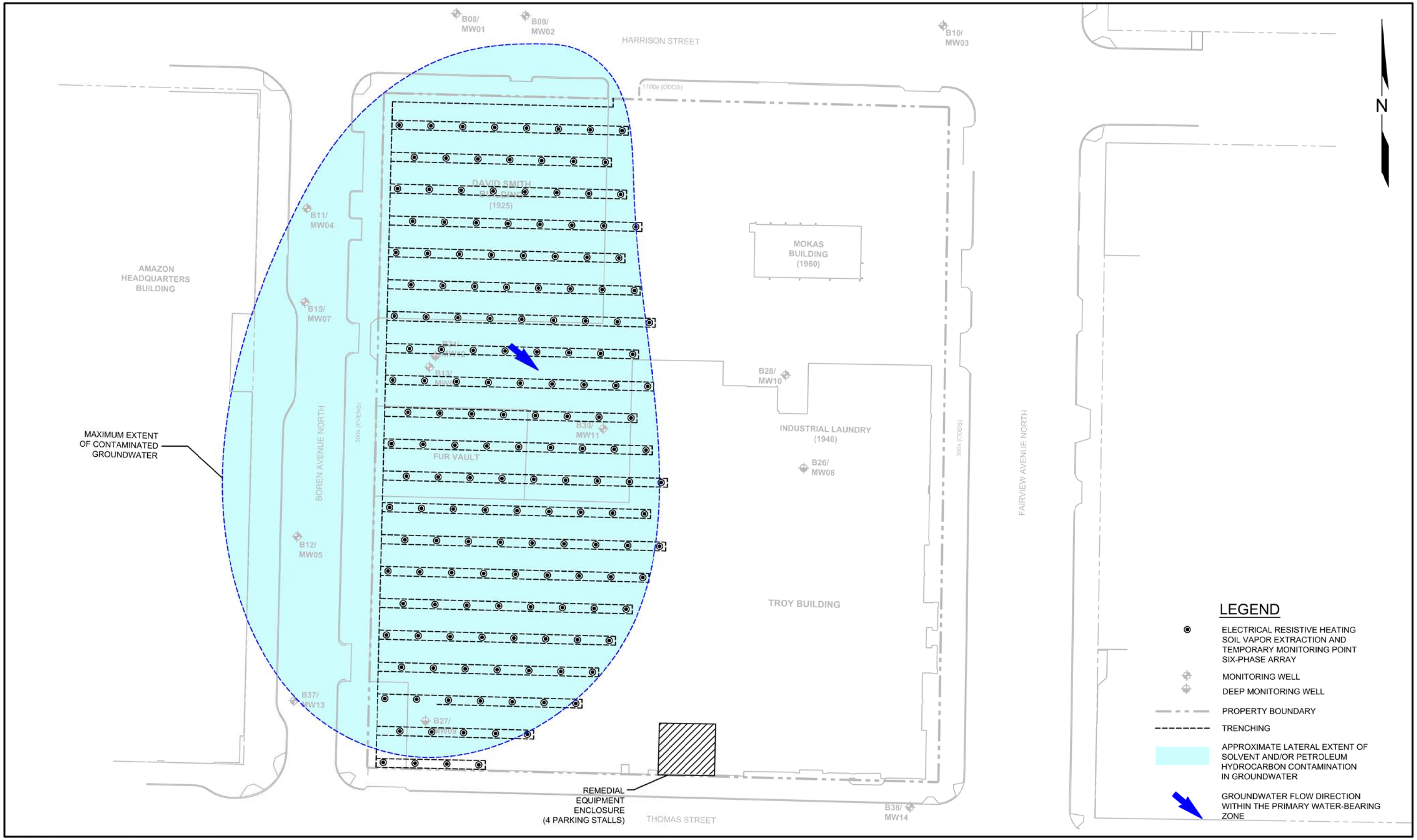
8/8/2012

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004 2011FS CLEANUP-ALT 3.DWG



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DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_ALT-3

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

# FIGURE 32

CONCEPTUAL LAYOUT
CLEANUP ALTERNATIVE 3 -
ELECTRICAL RESISTANCE HEATING

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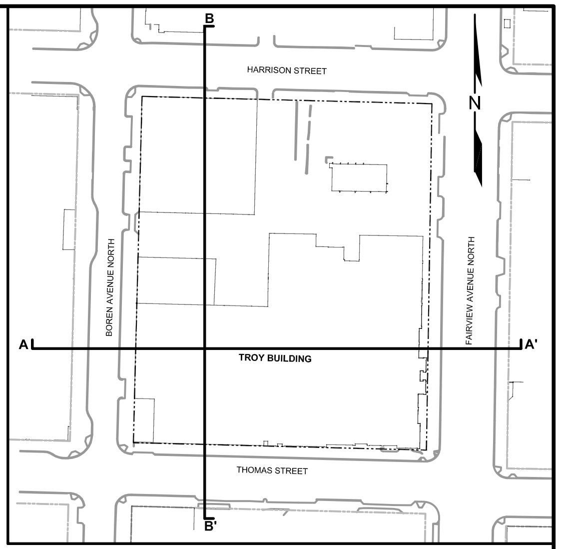

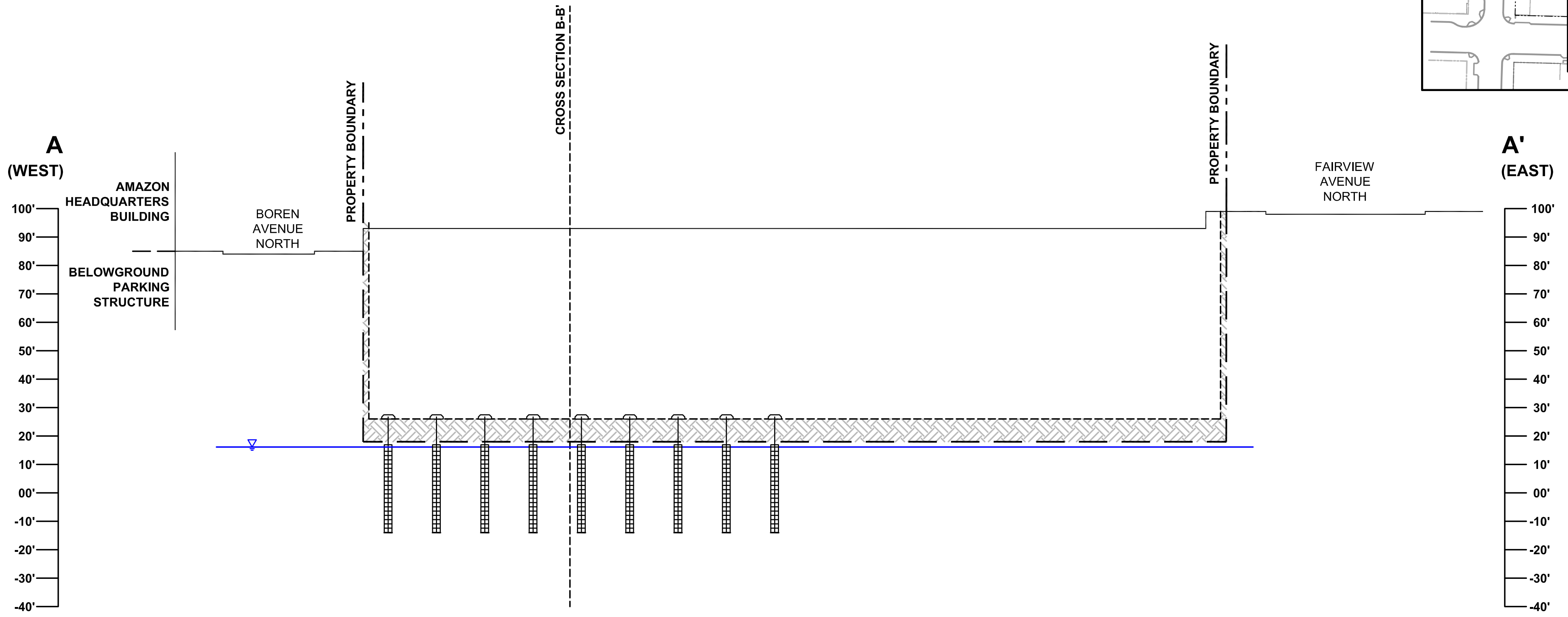

## LEGEND

| | |
|---|---|
| | ELECTRODE AND SVE VENT |
| | SCREEN INTERVAL |
| | GROUNDWATER LEVEL (OCTOBER 20, 2011) |
| — — — | LIMITS OF CONSTRUCTION EXCAVATION (ELEVATION 18') AND LIMITS OF REMEDIAL EXCAVATION (ELEVATION 19') |
| ▨ | CONCRETE BUILDING FOUNDATION |
| SVE | SOIL VAPOR EXTRACTION |

SoundEarth Strategies
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DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_CA3_XAA

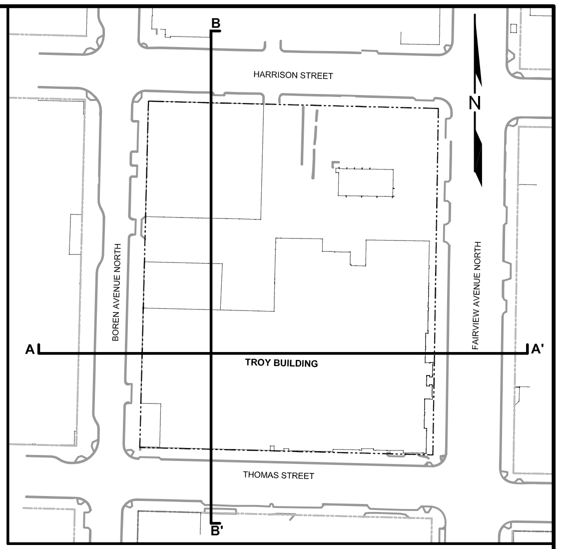
PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

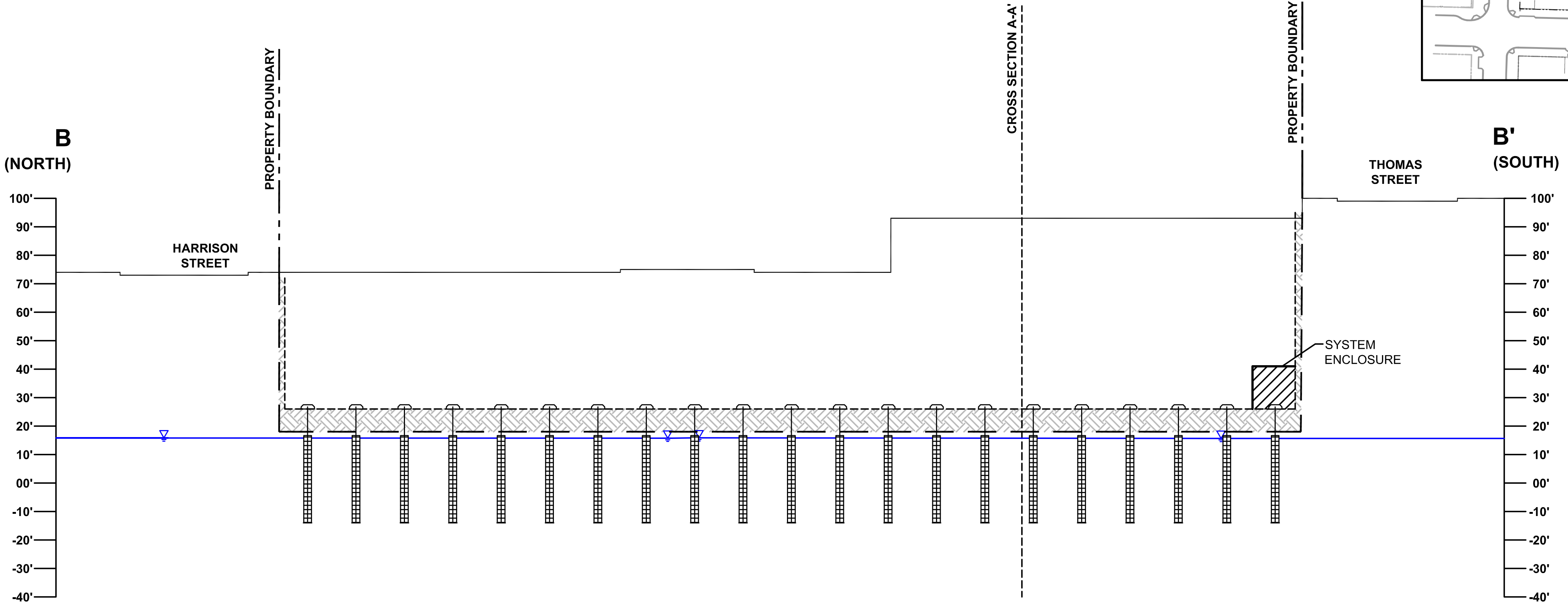
REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

# FIGURE 33

CONCEPTUAL CROSS SECTION A-A'
CLEANUP ALTERNATIVE 3 -
ELECTRICAL RESISTANCE HEATING





## LEGEND

| | | | |
|---|---|---|---|
| | ELECTRODE AND SVE VENT | — — — | LIMITS OF CONSTRUCTION EXCAVATION (ELEVATION 18') AND LIMITS OF REMEDIAL EXCAVATION (ELEVATION 19') |
| | SCREEN INTERVAL | ▨ | CONCRETE BUILDING FOUNDATION |
| ▽ | GROUNDWATER LEVEL (OCTOBER 20, 2011) | SVE | SOIL VAPOR EXTRACTION |

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2011FS\0731-004_2011FS_CA3_XBB.DWG

7/30/2012

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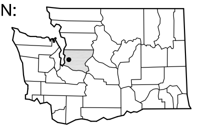
DATE: 12/2/11
DRAWN BY: NAC
CHECKED BY: EKR
CAD FILE: 0731-004_2011FS_CA3_XBB

PROJECT NAME: TROY LAUNDRY PROPERTY
PROJECT NUMBER: 0731-004
STREET ADDRESS: 307 FAIRVIEW AVENUE NORTH
CITY,STATE: SEATTLE, WASHINGTON

REGION:



0 25 50 100
APPROXIMATE SCALE IN FEET

## FIGURE 34

CONCEPTUAL CROSS SECTION B-B'
CLEANUP ALTERNATIVE 3
ELECTRICAL RESISTANCE HEATING

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# TABLES

## Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH$^{1}$ | DRPH$^{2}$ | ORPH$^{2}$ | Benzene$^{3}$ | Toluene$^{3}$ | Ethylbenzene$^{3}$ | Total Xylenes$^{3}$ | Vinyl Chloride$^{3}$ | cis-1,2-DCE$^{3}$ | Trans-1,2-DCE$^{3}$ | EDC$^{3}$ | TCE$^{3}$ | PCE$^{3}$ | SVOCs$^{4,5}$ |
| **On Property** | | | | | | | | | | | | | | | | | | |
| P01 | P01-05 | 5 | 10/06/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P01-07.5 | 7.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P01-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P01-14 | 14 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P01-18.5 | 18.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.026 | -- |
| | P01-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.028 | -- |
| P02 | P02-02 | 2 | 10/06/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.039 | -- |
| | P02-05 | 5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.042 | -- |
| | P02-07.5 | 7.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.025 | -- |
| | P02-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.035 | -- |
| P03 | P03-05 | 5 | 10/06/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.13** | -- |
| | P03-09 | 9 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.099** | -- |
| | P03-12.5 | 12.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.076** | -- |
| | P03-16 | 16 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.057** | -- |
| | P03-19 | 19 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.080** | -- |
| P04 | P04-02.5 | 2.5 | 10/06/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P04-05 | 5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P04-07.5 | 7.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P04-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P04-13 | 13 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P04-17 | 17 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.029 | -- |
| | P04-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| P05 | P05-02.5 | 2.5 | 10/06/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **1.4** | -- |
| | P05-05 | 5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **2.5** | -- |
| | P05-07.5 | 7.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.073** | -- |
| | P05-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.087** | -- |
| | P05-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.082** | -- |
| | P05-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.14** | -- |
| P06 | P06-02.5 | 2.5 | 10/06/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.15** | -- |
| | P06-05 | 5 | | | -- | -- | -- | -- | | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.68** | -- |
| | P06-08 | 8 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.44** | -- |
| | P06-11 | 11 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.028 | -- |
| | P06-14 | 14 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.063** | -- |
| | P06-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.099** | -- |
| P07 | P07-02.5 | 2.5 | 10/06/10 | SoundEarth | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.047 | -- |
| | P07-05 | 5 | | | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.13** | -- |
| | P07-07.5 | 7.5 | | | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.055** | -- |
| | P01-11 | 11 | | | **1,400$^{x}$** | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.16** | -- |
| **MTCA Cleanup Level** | | | | | **100/30$^{a,b}$** | **2,000$^{b}$** | **2,000$^{b}$** | **0.03$^{b}$** | **7$^{b}$** | **6$^{b}$** | **9$^{b}$** | **0.67$^{c}$** | **160$^{d}$** | **1,600$^{d}$** | **11$^{c}$** | **0.03$^{b}$** | **0.05$^{b}$** | **NE** |

### Table 1
### Summary of Soil Analytical Data for Petroleum and VOCs
### Troy Laundry Property
### 307 Fairview Avenue North
### Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH$^{1}$ | DRPH$^{2}$ | ORPH$^{2}$ | Benzene$^{3}$ | Toluene$^{3}$ | Ethylbenzene$^{3}$ | Total Xylenes$^{3}$ | Vinyl Chloride$^{3}$ | cis-1,2-DCE$^{3}$ | Trans-1,2-DCE$^{3}$ | EDC$^{3}$ | TCE$^{3}$ | PCE$^{3}$ | SVOCs$^{4,5}$ |
| P08 | P08-03 | 3 | 10/07/10 | SoundEarth | **52**$^{x}$ | 100$^{x}$ | <250 | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | **0.15** | **63** | -- |
| | P08-05 | 5 | | | 2.6$^{x}$ | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.46** | -- |
| | P08-07.5 | 7.5 | | | **580**$^{x}$ | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | **0.14** | **450** | -- |
| | P08-10 | 10 | | | **150**$^{x}$ | **4,300**$^{x}$ | **3,200** | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | **0.13** | **250** | -- |
| | P08-14 | 14 | | | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **1.3** | -- |
| | P08-18 | 18 | | | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **1.6** | -- |
| | P08-23 | 23 | | | <2 | <50 | <250 | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **1.6** | -- |
| P09 | P09-05 | 5 | 10/07/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.098** | -- |
| | P09-07.5 | 7.5 | | | <2 | <50 | <250 | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P09-12 | 12 | | | 2.3$^{x}$ | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.076** | -- |
| | P09-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.089** | -- |
| P10 | P10-02.5 | 2.5 | 10/07/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.13** | -- |
| | P10-07.5 | 7.5 | | | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.066** | -- |
| | P10-14 | 14 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.038 | -- |
| | P10-18 | 18 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.069** | -- |
| | P10-22 | 22 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.030 | -- |
| P11 | P11-02.5 | 2.5 | 10/07/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P11-07.5 | 7.5 | | | <2 | <50 | <250 | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.039 | -- |
| | P11-11 | 11 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P11-14 | 14 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P11-18 | 18 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.10** | -- |
| P12 | P12-05 | 5 | 10/07/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P12-10 | 10 | | | <2 | -- | -- | <0.03 | <0.05 | <0.05 | <0.15 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P12-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| P13 | P13-02.5 | 2.5 | 10/07/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P13-07.5 | 7.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P13-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P13-18 | 18 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| P14 | P14-02.5 | 2.5 | 10/07/10 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P14-07.5 | 7.6 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P14-14 | 14 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | P14-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B01 | -- | 6-8 | 12/08/10 | AECOM | <5.7 | <5.1 | <10 | <0.001 | NR | NR | NR | NR | <0.001 | NR | NR | 0.003 | **0.22** | -- |
| | -- | 8-10 | | | -- | -- | -- | <0.0012 | NR | NR | NR | NR | <0.0012 | NR | NR | 0.0028 | **0.2** | -- |
| | -- | 18-20 | | | -- | -- | -- | <0.0009 | NR | NR | NR | NR | 0.0039 | NR | NR | 0.0058 | **0.86** | -- |
| B02 | -- | 7-9 | 12/08/10 | AECOM | -- | -- | -- | 0.0062 | NR | NR | NR | NR | 0.0013 | NR | NR | **0.031** | **2.3** | -- |
| | -- | 9-11 | | | <6 | <5.2 | <10 | 0.001 | NR | NR | NR | NR | 0.0015 | NR | NR | 0.02 | **2.3** | -- |
| | -- | 16-18 | | | -- | -- | -- | <0.0011 | NR | NR | NR | NR | 0.0013 | NR | NR | 0.0046 | **0.5** | -- |
| **MTCA Cleanup Level** | | | | | **100/30**$^{a,b}$ | **2,000**$^{b}$ | **2,000**$^{b}$ | **0.03**$^{b}$ | **7**$^{b}$ | **6**$^{b}$ | **9**$^{b}$ | **0.67**$^{c}$ | **160**$^{d}$ | **1,600**$^{d}$ | **11**$^{c}$ | **0.03**$^{b}$ | **0.05**$^{b}$ | **NE** |

# Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B03 | -- | -- | -- | AECOM | No Samples Collected | | | | | | | | | | | | | |
| B04 | -- | 8-10 | 12/08/10 | AECOM | -- | -- | -- | 0.003 | NR | NR | NR | NR | <0.0009 | NR | NR | 0.0098 | **2** | -- |
| | -- | 14-16 | | | <5.2 | <5 | <10 | <0.001 | NR | NR | NR | NR | <0.001 | NR | NR | 0.0069 | **0.69** | -- |
| | -- | 18-20 | | | -- | -- | -- | <0.001 | NR | NR | NR | NR | <0.001 | NR | NR | 0.003 | **0.47** | -- |
| B05 | -- | 10-12 | 12/08/10 | AECOM | -- | -- | -- | <0.0009 | NR | NR | NR | NR | <0.0009 | NR | NR | <0.0009 | **0.057** | -- |
| | -- | 13-15 | | | <5 | <5.2 | <10 | <0.0009 | NR | NR | NR | NR | <0.0009 | NR | NR | 0.0012 | **0.34** | -- |
| | -- | 18-20 | | | -- | -- | -- | <0.0009 | NR | NR | NR | NR | <0.0009 | NR | NR | 0.0012 | **0.42** | -- |
| B06 | -- | 5-7 | 12/08/10 | AECOM | -- | -- | -- | <0.051 | NR | NR | NR | NR | <0.051 | NR | NR | <0.051 | **0.87** | -- |
| | -- | 8-10 | | | -- | -- | -- | <0.047 | NR | NR | NR | NR | <0.047 | NR | NR | <0.047 | **0.53** | -- |
| | -- | 10-11.5 | | | <4.9 | <5.7 | <1 | <0.052 | NR | NR | NR | NR | <0.052 | NR | NR | <0.052 | **0.43** | -- |
| B07 | -- | 23-26 | 12/08/10 | AECOM | <6.2 | <5.9 | <12 | <0.06 | NR | NR | NR | NR | 0.064 | NR | NR | <0.06 | **0.58** | -- |
| | -- | 35-37 | | | -- | -- | -- | <0.058 | NR | NR | NR | NR | <0.058 | NR | NR | <0.058 | **1.7** | -- |
| | -- | 37-40 | | | -- | -- | -- | <0.0009 | NR | NR | NR | NR | 0.017 | NR | NR | 0.0071 | **0.16** | -- |
| B08/MW01 | B08-05 | 5 | 05/19/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-50 | 50 | | | <2 | <50 | <250 | <0.2 | <0.02 | <0.2 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B08-60 | 60 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| B09/MW02 | B09-07 | 7 | 05/20/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-45 | 45 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-60 | 60 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B09-70 | 70 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

## Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B10/MW03 | B10-05 | 5 | 05/24/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-10 | 10 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-75 | 75 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B10-80 | 80 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| B11/MW04 | B11-05 | 5 | 05/25/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-60 | 60 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B11-65 | 65 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| B12/MW05 | B12-10 | 10 | 05/25/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.044 | ND |
| | B12-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.057** | ND |
| | B12-70 | 70 | 05/26/11 | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.035 | ND |
| | B12-75 | 75 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B12-80 | 80 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

## Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
### Troy Laundry Property
### 307 Fairview Avenue North
### Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B13/MW06 | B13-04.5 | 4.5 | 05/25/11 | SoundEarth | 2.8 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-09 | 9 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-14 | 14 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-19 | 19 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-24 | 24 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.069** | <0.3 |
| | B13-29 | 29 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.039 | <0.3 |
| | B13-34 | 34 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-39 | 39 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-44 | 44 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.037 | <0.3 |
| | B13-49 | 49 | | | **1,700** | 300 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.070** | <0.3 |
| | B13-54 | 54 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-55 | 55 | 05/26/11 | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-58 | 58 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-64 | 64 | | | <2 | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-69 | 69 | | | <2 | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B13-74 | 74 | | | <2 | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| B14 | B14-04 | 4 | 05/26/11 | SoundEarth | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-09 | 9 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-14 | 14 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-19 | 19 | | | <2 | <50 | <250 | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-23.5 | 23.5 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-30 | 30 | | | **1,100** | 350[x] | <250 | <0.2 | <0.2 | 2.0 | 2.7 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.23** | <0.3 |
| | B14-33.5 | 33.5 | | | **930** | 120[x] | <250 | <0.2 | <0.2 | 2.4 | 3.1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-36 | 36 | | | 14 | <50 | <250 | <0.02 | <0.02 | 0.059 | 0.070 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-41 | 41 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | 0.31 |
| | B14-46 | 46 | 05/27/11 | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | 1.2 |
| | B14-51 | 51 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | 0.44 |
| | B14-56 | 56 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-58 | 58 | | | **2,000** | <50 | <250 | <0.1 | <0.1 | 2.7 | 3.9 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.13** | <0.3 |
| | B14-61 | 61 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | 1.1 |
| | B14-65 | 65 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-69 | 69 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| | B14-75 | 75 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | <0.3 |
| B15/MW07 | B15-30 | 30 | 05/26/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-65 | 65 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| | B15-70 | 70 | | | <2 | <50 | <250 | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | ND |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

SoundEarth Strategies

## Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B16 | B16-06 | 6 | 09/26/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.38** | -- |
| | B16-11 | 11 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B16-16 | 16 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.051** | -- |
| | B16-18 | 18 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B16-23.5 | 23.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.18** | -- |
| | B16-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.085** | -- |
| | B16-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.028 | -- |
| | B16-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B16-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B16-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.046 | -- |
| | B16-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.18** | -- |
| | B16-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B16-65 | 65 | 09/27/11 | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B16-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.043 | -- |
| B17 | B17-06 | 6 | 09/27/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.046 | -- |
| | B17-11 | 11 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.053** | -- |
| | B17-16 | 16 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.14** | -- |
| | B17-21 | 21 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B17-26 | 26 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.030 | -- |
| | B17-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B17-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.030 | -- |
| | B17-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.076** | -- |
| | B17-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.082** | -- |
| | B17-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.042** | -- |
| | B17-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.047** | -- |
| | B17-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.062** | -- |
| | B17-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.067** | -- |
| | B17-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B17-75 | 75 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B17-80 | 80 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B18 | B18-25 | 25 | 09/28/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.12** | -- |
| | B18-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.059** | -- |
| | B18-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.054** | -- |
| | B18-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.11** | -- |
| | B18-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.072** | -- |
| | B18-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.12** | -- |
| | B18-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.11** | -- |
| | B18-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.12** | -- |
| | B18-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.11** | -- |
| | B18-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.027 | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

# Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
Troy Laundry Property
307 Fairview Avenue North
Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B19 | B19-25 | 25 | 09/29/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.11** | -- |
| | B19-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B19-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B20 | B20-15 | 15 | 09/29/11 | SoundEarth | **2,200** | -- | -- | **<0.1** | <0.1 | 4.6 | **22** | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.22** | -- |
| | B20-20 | 20 | 09/30/11 | | <2 | -- | -- | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-25 | 25 | | | **34** | -- | -- | <0.02 | <0.02 | 0.061 | 0.30 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-30 | 30 | | | <2 | -- | -- | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-35 | 35 | | | <2 | -- | -- | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B20-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B21 | B21-05 | 5 | 09/30/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | **0.28** | -- |
| | B21-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-20 | 20 | 10/04/11 | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B21-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

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# Summary of Soil Analytical Data for Petroleum and VOCs
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## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B22 | B22-05 | 5 | 10/03/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B22-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B23 | B23-05 | 5 | 10/05/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B23-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B24 | B24-05 | 5 | 10/05/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-55 | 55 | 10/06/11 | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B24-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

## Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B25 | B25-05 | 5 | 10/06/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B25-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B26/MW08 | B26-05 | 5 | 10/07/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-80 | 80 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-90 | 90 | 10/10/11 | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-100 | 100 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B26-110 | 110 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B27/MW09 | B27-20 | 20 | 10/11/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-80 | 80 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-90 | 90 | 10/12/11 | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-100 | 100 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B27-110 | 110 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

# Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B28/MW10 | B28-05 | 5 | 10/10/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-75 | 75 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-80 | 80 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-85 | 85 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B28-90 | 90 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B29 | B29-15 | 15 | 10/10/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-25 | 24 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B29-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B30/MW11 | B30-15 | 15 | 10/11/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-18 | 18 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.026 | -- |
| | B30-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-21.5 | 21.5 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-35 | 35 | | | 3.4 | -- | -- | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-40 | 40 | | | **730** | -- | -- | <0.1 | <0.1 | 1.5 | 5.9 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-45 | 45 | | | <2 | -- | -- | <0.02 | <0.02 | <0.02 | <0.06 | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-75 | 75 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B30-80 | 80 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B31/MW12 | B31-80 | 80 | 10/13/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B31-85 | 85 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B31-90 | 90 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B31-95 | 95 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B31-100 | 100 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

# Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B32 | -- | -- | -- | AESI | Geotech Boring - no samples collected | | | | | | | | | | | | | | |
| B33 | B33-05 | 5 | 10/13/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B33-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B34 | B34-25 | 25 | 10/14/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.029 | -- |
| | B34-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B34-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B35 | B35-05 | 5 | 10/14/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B35-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B36 | B36-05 | 5 | 10/17/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-10 | 10 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-15 | 15 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.028 | -- |
| | B36-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.039 | -- |
| | B36-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | 0.099 | -- |
| | B36-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B36-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

## Table 1
## Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |
| B37/MW13 | B37-15 | 15 | 10/18/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-20 | 20 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-25 | 25 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-30 | 30 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-35 | 35 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-40 | 40 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-45 | 45 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-50 | 50 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-55 | 55 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-60 | 60 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-65 | 65 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-70 | 70 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-75 | 75 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-80 | 80 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B37-85 | 85 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B38/MW14 | B38-95 | 95 | 10/19/11 | SoundEarth | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B38-100 | 100 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| | B38-105 | 105 | | | -- | -- | -- | -- | -- | -- | -- | <0.05 | <0.05 | <0.05 | <0.05 | <0.03 | <0.025 | -- |
| B39 | B39-3-4 | 3-4 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.0011 | 0.0029 | <0.0011 | <0.0011 | 0.0077 | **5.1** | -- |
| | B39-7-8 | 7-8 | | | -- | -- | -- | -- | -- | -- | -- | <0.0012 | <0.0012 | <0.0012 | <0.0012 | <0.0012 | **0.088** | -- |
| | B39-11-12 | 11-12 | | | -- | -- | -- | -- | -- | -- | -- | <0.0011 | <0.0011 | <0.0011 | <0.0011 | <0.0011 | 0.049 | -- |
| B40 | B40-7-8 | 7-8 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.0012 | <0.0012 | <0.0012 | <0.0012 | <0.0012 | 0.0017 | -- |
| | B40-11-12 | 11-12 | | | -- | -- | -- | -- | -- | -- | -- | <0.0011 | <0.0011 | <0.0011 | <0.0011 | <0.0011 | 0.0013 | -- |
| B41 | B41-7-8 | 7-8 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.0009 | <0.0009 | <0.0009 | <0.0009 | 0.0015 | **0.180** | -- |
| | B41-11-12 | 11-12 | | | -- | -- | -- | -- | -- | -- | -- | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | **0.130** | -- |
| B42 | B42-3-4 | 3-4 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | **0.053** | -- |
| | B42-7-8 | 7-8 | | | -- | -- | -- | -- | -- | -- | -- | <0.001 | <0.001 | <0.001 | <0.001 | <0.0012 | 0.028 | -- |
| B43 | B43-3-4 | 3-4 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.0012 | <0.0012 | <0.0012 | <0.0012 | <0.0012 | **0.220** | -- |
| | B43-7-8 | 7-8 | | | -- | -- | -- | -- | -- | -- | -- | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.015 | -- |
| B44 | B44-3-4 | 3-4 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.0009 | 0.019 | <0.0009 | <0.009 | 0.01 | **1.7** | -- |
| | B44-7-8 | 7-8 | | | -- | -- | -- | -- | -- | -- | -- | <0.0011 | 0.0013 | <0.0011 | <0.0011 | **0.092** | **5.6** | -- |
| | B44-11-12 | 11-12 | | | -- | -- | -- | -- | -- | -- | -- | <0.0011 | <0.0011 | <0.0011 | <0.0011 | 0.0009 | **0.057** | -- |
| | B44-11-12 | 15-16 | | | -- | -- | -- | -- | -- | -- | -- | <0.0011 | <0.0011 | <0.0011 | <0.0011 | 0.0007 | 0.045 | -- |
| B45 | B45-3-4 | 3-4 | 01/16/12 | AECOM | -- | -- | -- | -- | -- | -- | -- | <0.0011 | <0.063 | <0.001 | <0.001 | 0.0033 | **7.7** | -- |
| | B45-7-8 | 7-8 | | | -- | -- | -- | -- | -- | -- | -- | <0.0015 | 0.015 | <0.0015 | <0.0015 | **0.035** | **11** | -- |
| | B45-11-12 | 11-12 | | | -- | -- | -- | -- | -- | -- | -- | <0.001 | 0.0068 | <0.001 | <0.001 | 0.018 | **6.4** | -- |
| | B45-11-12 | 15-16 | | | -- | -- | -- | -- | -- | -- | -- | <0.0012 | 0.0006 | <0.0012 | <0.0012 | 0.0015 | **0.078** | -- |
| **MTCA Cleanup Level** | | | | | **100/30[a,b]** | **2,000[b]** | **2,000[b]** | **0.03[b]** | **7[b]** | **6[b]** | **9[b]** | **0.67[c]** | **160[d]** | **1,600[d]** | **11[c]** | **0.03[b]** | **0.05[b]** | **NE** |

# Table 1
# Summary of Soil Analytical Data for Petroleum and VOCs
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Sample ID | Depth (feet) | Date Sampled | Sampled By | Analytical Results (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRPH[1] | DRPH[2] | ORPH[2] | Benzene[3] | Toluene[3] | Ethylbenzene[3] | Total Xylenes[3] | Vinyl Chloride[3] | cis-1,2-DCE[3] | Trans-1,2-DCE[3] | EDC[3] | TCE[3] | PCE[3] | SVOCs[4,5] |

NOTES:

Red denotes concentration exceeds MTCA Soil cleanup level.

[1] Analyzed by NWTPH Method NWTPH-Gx.

[2] Analyzed by NWTPH Method NWTPH-Dx.

[3] Analyzed by EPA Method 8260C or 8021B.

[4] Analyzed by EPA Method 8270C.

[5] Bis(2-ethylhexyl) phthalate was the only SVOC detected, the concentrations of which are well below the MTCA Method B cleanup level of 71 mg/kg. The reported results are the highest laboratory detection limit for all SVOCs analyzed or the concentration of (2-bis(2-ethylhexyl) phthalate, if detected in the sample.

[a] 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present.

[b] MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of WAC, revised November 2007.

[c] MTCA Cleanup Regulation, Chapter 173-340 of WAC, CLARC, Soil, Method B, Carcinogen, Standard Formula Value, CLARC Website <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

[d] MTCA Cleanup Regulation, Chapter 173-340 of WAC, CLARC, Soil, Method B, Non-Carcinogen, Standard Formula Value, CLARC Website <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

Laboratory notes:

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

-- = not analyzed, measured, or calculated
< = analytical result does not exceed laboratory reporting limit
AECOM = AECOM Technology Corporation
AESI = Associated Earth Sciences, Inc.
CLARC = cleanup levels and risk calculations
DCE = dichloroethene
DRPH = diesel-range petroleum hydrocarbons
EDC = 1,2-dichloroethane (ethylene dichloride)
EPA = U.S. Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbons
mg/kg = milligrams per kilogram
MTCA = Washington State Model Toxics Control Act
ND = not detected above the laboratory reporting limit
NE= not established
NR = not reported
NWTPH = northwest total petroleum hydrocarbon
ORPH = oil-range petroleum hydrocarbons
PCE = tetrachloroethylene
SoundEarth = SoundEarth Strategies, Inc.
SVOC = semi-volatile organic compound
TCE = trichloroethylene
VOCs = volatile organic compounds
WAC = Washington Administrative Code

SoundEarth Strategies

# Table 2
## Summary of Groundwater Data
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Sample Location | Screen Interval[1] (feet) | TOC Elevation[2] (feet) | Sample Date | Sampled By | Date of Depth to Water Measurement | Depth to Water (feet below TOC) | Groundwater Elevation (feet) | Analytical Results (µg/L) | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | GRPH[3] | DRPH[4] | ORPH[4] | Benzene[5] | Toluene[5] | Ethylbenzene[5] | Total Xylenes[5] | Vinyl Chloride[5] | cis-1-2-DCE[5] | trans-1-2-DCE[5] | EDC[5] | TCE[5] | PCE[5] | SVOCs[6,7] | Total Arsenic[8] | Total Barium[9] | Total Cadmium[9] | Total Chromium[9] | Total Lead[10] | Total Selenium[11] | Total Silver[9] | Total Mercury[12] | pH[13] |
| Supply Well[14] | Unknown | -- | 10/11/94 | RETEC | 10/11/94 | 73 | -- | 420[f] | | | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 13 | <5.0 | 49 | <5.0 | <10 | 4.4 | <5.0 | <5.0 | <2 | 9.38 |
| | | | 08/26/10[d] | SoundEarth | 08/26/10 | 75.25 | -- | <100 | <50 | <250 | <0.035 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <2 | <0.1 | 3.15 | 103 | <1 | 1.35 | 4.84 | <1 | <1 | <0.2 | 8.90 |
| | | | 08/26/10[e] | SoundEarth | 08/26/10 | 75.25 | -- | <100 | 82[x] | 370 | <0.035 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <2 | <0.1 | 2.56 | 63.4 | <1 | 1.11 | 2.85 | <1 | <1 | <0.2 | 8.95 |
| P10 | 19-21 | -- | 10/07/10 | SoundEarth | 10/07/10 | 20 | -- | 170 | **940**[x] | <250 | <0.35 | <1 | <1 | <3 | <0.2 | **67** | <1 | <1 | **15** | **80** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| B07 | 23-24 | -- | 12/08/10 | SoundEarth | 12/08/10 | 23 | -- | **2,300** | 310 | 200 | NR | NR | NR | NR | NR | **920** | 1.5 | NR | **130** | **4,600** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| B14 | N/A | -- | 05/27/11 | SoundEarth | 05/27/11 | 69 | -- | <100 | **590** | 370[x] | <1 | <1 | <1 | <3 | <0.2 | 12 | <1 | <1 | **8.8** | **35** | <2 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW01 | 45-60 | 68.68 | 05/25/11 | SoundEarth | 05/25/11 | 50.59 | 18.09 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/11/11 | SoundEarth | 10/20/11 | 51.03 | 17.65 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW02 | 55-70 | 70.92 | 05/25/11 | SoundEarth | 05/25/11 | 54.84 | 16.08 | <100 | 100[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | **5.2** | <1 | 9.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/11/11 | SoundEarth | 10/20/11 | 55.08 | 15.84 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | 3.0 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW03 | 65-80 | 84.65 | 05/27/11 | SoundEarth | 05/27/11 | 68.75 | 15.90 | <100 | 130[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | 2.8 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/11/11 | SoundEarth | 10/20/11 | 68.97 | 15.68 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW04 | 50-65 | 70.69 | 05/27/11 | SoundEarth | 05/27/11 | 52.22 | 18.47 | <100 | <50 | <250 | <1 | 1.3 | <1 | <3 | <0.2 | <1 | <1 | <1 | **15** | <1 | 1.7 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/12/11 | SoundEarth | 10/20/11 | 52.82 | 17.87 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | **15** | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW05 | 65-80 | 84.04 | 05/27/11 | SoundEarth | 05/27/11 | 67.40 | 16.64 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | 1.8 | <1 | <1 | **16** | **39** | 2.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/12/11 | SoundEarth | 10/20/11 | 67.91 | 16.13 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | 1.5 | <1 | <1 | **14** | **29** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW06 | 60-75 | 74.78 | 05/31/11 | SoundEarth | 05/31/11 | 58.70 | 16.08 | <100 | 330[x] | <250 | <1 | <1 | <1 | <3 | **0.76** | **150**[ve] | <1 | <1 | **8.2** | 3.1 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/12/11 | SoundEarth | 10/20/11 | 58.91 | 15.87 | <100[g] | 83[g,x] | <250[g] | <1[g] | <1[g] | <1[g] | <3[g] | **0.76** | **120** | <1 | <1 | **11** | 3.6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW07 | 55-70 | 74.55 | 05/31/11 | SoundEarth | 05/31/11 | 56.33 | 18.22 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | 2.3 | <1 | <1 | **12** | 1.4 | <10 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | 10/12/11 | SoundEarth | 10/20/11 | 56.87 | 17.68 | <100 | 240[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | 1.8 | <1 | <1 | **11** | 2.2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW08 | 105-110 | 92.88 | 10/13/11 | SoundEarth | 10/20/11 | 77.18 | 15.70 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW09 | 105-110 | 92.92 | 10/13/11 | SoundEarth | 10/20/11 | 77.24 | 15.68 | **1,400** | 240[x] | <250 | <1 | <1 | 2.7 | 10 | <0.2 | **22** | <1 | <1 | **16** | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW10 | 75-90 | 92.73 | 10/12/11 | SoundEarth | 10/20/11 | 77.14 | 15.59 | <100 | 68[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW11 | 68-83 | 88.23 | 10/13/11 | SoundEarth | 10/20/11 | 72.43 | 15.80 | <100 | 110[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | 5.6 | <1 | <1 | 2.6 | **21** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW12 | 95-100 | 74.44 | 10/17/11 | SoundEarth | 10/20/11 | 58.71 | 15.73 | <100 | <50 | <250 | <1 | <1 | <1 | <3 | <0.2 | 1.3 | <1 | <1 | **19** | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW13 | 70-85 | 90.66 | 10/20/11 | SoundEarth | 10/20/11 | 74.69 | 15.97 | <100 | 150[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | 1.2 | **5.1** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW14 | 90-105 | 104.40 | 10/20/11 | SoundEarth | 10/20/11 | 88.81 | 15.59 | <100 | 160[x] | <250 | <1 | <1 | <1 | <3 | <0.2 | <1 | <1 | <1 | <1 | <1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **MTCA Cleanup Level** | | | | | | | | **1,000/800[a,b]** | **500[b]** | **500[b]** | **5[b]** | **1,000[b]** | **700[b]** | **1,000[b]** | **0.2[b]** | **16[c]** | **160[c]** | **5[b]** | **5[b]** | **5[b]** | **N/A** | **5[b]** | **3,200[c]** | **5[b]** | **50[b]** | **15[b]** | **80[c]** | **80[c]** | **2[b]** | **N/A** |

NOTES:

**Red** denotes concentration exceeds MTCA Method cleanup level for groundwater.

[1] Range of feet is measured from top to bottom of the screen below ground surface.

[2] TOC elevations originally surveyed by SoundEarth relative to an arbitrary benchmark with an assumed elevation of 100.00 feet. TOC elevations were resurveyed by Triad Associates on October 20, 2011 relative to the North American Vertical Datum of 1988.

[3] Analyzed by EPA Method 418.1 or Method NWTPH-Gx .

[4] Analyzed by NWTPH-Dx. The supply well samples collected in August 2010, were passed through a silica gel column prior to analysis to remove organic interference.

[5] Analyzed by EPA Method 8260C, 8021B or 8240.

[6] Analyzed by EPA Method 8270 or 8270D.

[7] Phenol was detected in the supply well sample collected in 1994 and Dimethyl phthalate was detected in samples collected from monitoring wells MW02 through MW05. The relative concentrations are presented on this table. Phenol has a MTCA Method B cleanup level of 2,400 µg/L and Dimethyl phthalate does not have a MTCA Method A or B cleanup level.

[8] Analyzed by EPA Method 7060 or 200.8.

[9] Analzed by EPA Method 6010 or 200.8.

[10] Analzed by EPA Method 7421 or 200.8.

[11] Analzed by EPA Method 7740 or 200.8.

[12] Analzed by EPA Method 7470 or 1631E.

[13] Analyzed by EPA Method 9040c or in the field.

[14] The supply well was decommissioned on July 26, 2010 by Richardson Well Drilling of Puyallup, Washington.

[a] 1,000 µg/L when benzene is not present and 800 µg/L when benzene is present.

[b] MTCA Method A Cleanup Levels, Table 720-1 of Section 900 of Chapter 173-340 of WAC, revised November 2007.

[c] MTCA Cleanup Regulation, Chapter 173-340 of WAC, CLARC, Groundwater, Method B, Non-Carcinogen, Standard Formula Value, CLARC Website <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

[d] Reconnaissance groundwater sample collected at an approximate depth of 75 feet below the observed depth to water.

[e] Reconnaissance groundwater sample collected at an approximate depth of 490 feet below the observed depth to water.

[f] Resultant concentration originally reported as a concentration of total petroleum hydrocarbons.

[g] Samples collected on October 10, 2011.

Laboratory notes:

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

[ve] Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

-- = not analyzed, measured, or calculated
< = not detected at a concentration exceeding laboratory reporting limit
µg/L = micrograms per liter
CLARC = Cleanup Levels and Risk Calculations
DCE = dichloroethylene
DRPH = diesel-range petroleum hydrocarbons
EDC = 1,2-Dichloroethane (ethylene dichloride)
EPA = U.S. Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbons
MTCA = Washington State Model Toxics Control Act
N/A = not applicable
NR = not reported
NWTPH = northwest total petroleum hydrocarbons
ORPH = heavy oil-range petroleum hydrocarbons
PCE = tetrachloroethylene
RETEC = Remediation Technologies of Seattle, Washington
SoundEarth = SoundEarth Strategies, Inc.
SVOCs = semi volatile organic compounds
TCE = trichloroethylene
TOC = top of casing
WAC = Washington Administrative Code

SoundEarth Strategies

## Table 3
## Remedial Component Screening Matrix
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Component Group | Component Options | Effectiveness (High, Moderate, Limited, None) | Implementability (No Obstacles, Minor Obstacles, Significant Obstacles) | Relative Cost (High, Moderate, Low) | Component Retained for Inclusion in Cleanup Action Alternatives? | Comments |
|---|---|---|---|---|---|---|
| **Institutional Controls** | | | | | | |
| | No Further Action with Environmental Covenant | None | Significant | Low | No | Not compatible with Property redevelopment plans and schedule. |
| **Engineering Controls** | | | | | | |
| | Capping | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Passive Vapor Barrier | Moderate | None | Low | Yes | Retained as a component of new construction to prevent vapor intrusion. |
| | Active Vapor Barrier | High | Minor | Low | No | Not considered necessary if source removal is accomplished and passive vapor barrier is implemented. |
| | Pump and Treat | Limited | Minor | Low | No | Not compatible with Property redevelopment plans and schedule. |
| **Passive Remediation** | | | | | | |
| | Monitored Natural Attenuation | Limited | Minor | Low | Yes | Not retained as the sole remedy in the absence of other technologies; but as complementary to other engineered remedies. |
| | Passive Treatment Wall (Activated Carbon/PRB) | None | Significant | High | No | The depth required for installation makes this technology difficult and costly to implement. |
| **In Situ Physical Treatment** | | | | | | |
| | SVE | High | Minor | Low | Yes | Retained as a potential soil and soil vapor pretreatment remediation technology. |
| | Air Sparging | None | N/A | N/A | No | Not effective for soil pretreatment. |
| | Air Sparging with VE | None | N/A | N/A | No | Not effective for soil pretreatment. |
| | Surfactant Washing | Limited | N/A | Moderate | No | COCs are more effectively remediated through SVE; surfactant flushing would mobilize COCs in soil. |
| | Cosolvent Washing | Limited | N/A | Moderate | No | COCs are more effectively remediated through SVE; solvent flushing could further mobilize COCs in soil. |
| | Dual-Phase Extraction | Limited | N/A | Moderate | No | Not compatible with site development plan. |
| **In Situ Thermal** | | | | | | |
| | Resistive Thermal with VE | High | Moderate | High | Yes | More costly when compared with other in situ treatment technologies; however, retained for its effectiveness and because it would be more easily implemented than other thermal components. |
| | Conductive Thermal with VE | High | Significant | High | No | Resistive thermal more easily implemented. |
| | Radio Frequency/Electromagnetic Thermal with VE | High | Significant | High | No | Resistive thermal more easily implemented. |
| | Steam Injection with VE and Groundwater Extraction | Moderate | Significant | High | No | Resistive thermal more easily implemented. |
| | Hot Air Injection with VE | Moderate | Significant | High | No | Resistive thermal more easily implemented. |
| | Hot Water Injection with VE and Groundwater Extraction | Limited | Significant | High | No | Resistive thermal more easily implemented. |
| **Source Removal** | | | | | | |
| | Excavation with Shoring | High | Significant | High | Yes | Retained as mandatory for proposed redevelopment; would require source treatment and dewatering as complementary components. |
| | Dewatering Excavation | N/A | Minor | Low | No | Not anticipated as being necessary for remediation or site development. |
| **Source Removal combined with Ex Situ Treatment, Storage, or Disposal** | | | | | | |
| | Surfactant Washing | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Neutralization | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Land farming | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Cosolvent Washing | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Incineration | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Chemical Oxidation | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Thermal Desorption | N/A | N/A | N/A | No | Ex-situ treatment not necessary for excavated soil. |
| | Land Disposal | High | Minor | Low | Yes | Retained as compatible with Property redevelopment plans and schedule. |
| | Air Stripping | High | Minor | Low | No | Effective for the ex situ treatment of groundwater; however, groundwater recovery and treatment is not compatible with site development plan. |
| | Granular Activated Carbon (liquid and vapor) | Moderate | Minor | Low | No | Effective for the treatment of groundwater; however, groundwater recovery and treatment is not compatible with site development plan. |

## Table 3
## Remedial Component Screening Matrix
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| Component Group | Component Options | Effectiveness (High, Moderate, Limited, None) | Implementability (No Obstacles, Minor Obstacles, Significant Obstacles) | Relative Cost (High, Moderate, Low) | Component Retained for Inclusion in Cleanup Action Alternatives? | Comments |
|---|---|---|---|---|---|---|
| **In Situ Chemical Oxidation/Reduction** | | | | | | |
| | Sodium Persulfate | Moderate | Moderate | Moderate | No | Permanganate considered a better oxidant for COCs. |
| | Heated Sodium Persulfate | Moderate | Moderate | Moderate | No | Not implementable for soil pretreatment. |
| | Hydrogen Peroxide | None | N/A | N/A | No | Limited effectiveness for in-situ soil treatment. |
| | Permanganate | High | Moderate | Moderate | Yes | Retained for treatment of groundwater. |
| | RegenOx (Catalyzed Sodium Percarbonate) | N/A | N/A | N/A | No | Not effective for COCs. |
| | Fenton's Reagent | Limited | Significant | High | No | Fast reaction rate limits it's effectiveness. |
| | Reducing Agents | High | Moderate | Moderate | Yes | Retained for treatment of groundwater. |
| | Activated Iron Wall | N/A | N/A | N/A | No | The depth required for installation makes this technology infeasible. |
| **Containment/Immobilization** | | | | | | |
| | Bituminization | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Emulsified Asphalt | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Modified Sulfur Cement | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Polyethylene Extrusion | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Pozzolan/Portland Cement | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Vitrification/Molten Glass | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Slurry Wall Containment | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Sheet Pile Wall Containment | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Pump and Treat for Hydraulic Containment | N/A | None | Low | No | Not anticipated as being necessary for remediation or site development. |
| **Phytoremediation** | | | | | | |
| | Hydraulic Control | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Phyto-Degradation | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Phyto-Volatilization | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Phyto-Accumulation | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Phyto-Stabilization | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| | Enhanced Rhizosphere Biodegradation | N/A | N/A | N/A | No | Not compatible with Property redevelopment plans and schedule. |
| **In Situ Bioremediation** | | | | | | |
| | Aerobic Bioremediation | Limited | Significant | High | No | Effective for treatment of vinyl chloride if necessary, but not retained because implementation is not compatible with site development plans. |
| | Anaerobic Bioremediation | High | Minor | Moderate | Yes | Retained for groundwater treatment. |

NOTES:

COCs = chemicals of concern
N/A = not applicable
PRB = permeable reactive barrier
SVE = soil vapor extraction
VE = vapor extraction

## Table 4
## Feasibility Level Cost Estimate
## Cleanup Alternative 1
## Excavation and Land Disposal of Soil with In Situ Chemical Oxidation of Groundwater
Troy Laundry Property
307 Fairview Avenue North
Seattle, Washington

| COST ITEM | QUANTITY | UNIT | UNIT PRICE | COST | TOTALS |
|---|---|---|---|---|---|
| **DIRECT CAPITAL COSTS (Remediation Costs Only)** | | | | | |
| **Site Work** | | | | | |
| **Excavation of Contaminated Soil*** | | | | | |
| Monitoring Well Decommissioning | 6 | well | $1,200 | $7,200 | |
| Onsite Laboratory | 60 | day | $1,500 | $90,000 | |
| Transportation and Disposal - Dangerous Waste F002 | 340 | ton | $220 | $74,800 | |
| Transportation and Disposal - Contained Out F002 | 97,200 | ton | $75 | $7,290,000 | |
| Dewatering Treatment System | 1 | ea | $25,000 | $25,000 | |
| Confirmation Sampling & Analysis | 1 | ea | $25,000 | $25,000 | |
| *Subtotal* | | | | | $7,512,000 |
| **Groundwater Treatment** | | | | | |
| Drill Injection Wells | 5,300 | lf | $100 | $530,000 | |
| Bulk Permanganate including est. freight and tax | 204,000 | lb | $3.75 | $765,000 | |
| Mixing Equipment | 1 | ea | $30,000 | $30,000 | |
| Install Groundwater Monitoring Wells | 3 | ea | $4,000 | $12,000 | |
| System Decommissioning | 1 | ea | $25,000 | $25,000 | |
| *Subtotal* | | | | | $1,362,000 |
| **Mobilization, Contingencies and Demobilization** | | | | | |
| Mobilization (1% of site work subtotal) | | | | $89,000 | |
| Bid (3% of site work subtotal) | | | | $267,000 | |
| Scope Contingency (10% of site work subtotal) | | | | $888,000 | |
| Cleanup and demobilization (1% of site work subtotal) | | | | $89,000 | |
| *Subtotal* | | | | | $1,333,000 |
| **DIRECT CAPITAL TOTAL** | | | | | **$10,207,000** |
| **INDIRECT CAPITAL COSTS** | | | | | |
| Remediation Design, Permitting, and Reporting (3% of direct capital) | | | | $307,000 | |
| Excavation Oversight, Including Soil Management during Shoring Installation (6% of direct capital) | | | | $613,000 | |
| *Subtotal* | | | | | $920,000 |
| **INDIRECT CAPITAL TOTAL** | | | | | **$920,000** |
| **TOTAL CAPITAL COST** | | | | | **$11,127,000** |

**PRESENT WORTH COST OF ANNUAL O&M**

| O&M COST ITEM | ANNUAL COST [1] | YEARS | REAL DISCOUNT RATE | |
|---|---|---|---|---|
| Groundwater Monitoring | $40,000 | 5 | 0.0% | $200,000 |
| **TOTAL PRESENT WORTH OF O&M COST** | | | | **$200,000** |
| **TOTAL PRESENT WORTH COST OF ALTERNATIVE 1 (SUM OF CAPITAL AND PRESENT WORTH OF O&M)** | | | | **$11,327,000** |

NOTES:

[1] Annual Costs are 2011 dollars.

*Costs associated with excavation of contaminated soil include loading, transport, and disposal and do not reflect the incremental costs associated with disposing of contaminated vs. clean material.

ea = each
lb = pounds
feet
lf = linear feet
O&M = operation and maintenance

## Table 5
## Feasibility Level Cost Estimate
## Cleanup Alternative 2
## Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater
Troy Laundry Property
307 Fairview Avenue North
Seattle, Washington

| COST ITEM | QUANTITY | UNIT | UNIT PRICE | COST | TOTALS |
|---|---|---|---|---|---|
| **DIRECT CAPITAL COSTS (Remediation Costs Only)** | | | | | |
| **Site Work** | | | | | |
| **Excavation of Contaminated Soil*** | | | | | |
| Monitoring Well Decommissioning | 6 | well | $1,200 | $7,200 | |
| Onsite Laboratory | 60 | day | $1,500 | $90,000 | |
| Transportation and Disposal - Dangerous Waste F002 | 340 | ton | $220 | $74,800 | |
| Transportation and Disposal - Contained Out F002 | 97,200 | ton | $75 | $7,290,000 | |
| Dewatering Treatment System | 1 | ea | $25,000 | $25,000 | |
| Confirmation Sampling & Analysis | 1 | ea | $25,000 | $25,000 | |
| *Subtotal* | | | | | $7,512,000 |
| **Groundwater Treatment** | | | | | |
| Drill Injection Wells | 1,900 | lf | $100 | $190,000 | |
| Bulk edible oil substrate, including freight and taxes | 75,000 | lb | $3 | $243,750 | |
| KB1 or SB9 - Bioaugmentation | 1 | ea | $30,000 | $30,000 | |
| Mixing Equipment | 1 | ea | $30,000 | $30,000 | |
| Install Groundwater Monitoring Wells | 3 | ea | $4,000 | $12,000 | |
| System Decommissioning | 1 | ea | $5,000 | $5,000 | |
| *Subtotal* | | | | | $511,000 |
| **Mobilization, Contingencies and Demobilization** | | | | | |
| Mobilization (1% of site work subtotal) | | | | $81,000 | |
| Bid (3% of site work subtotal) | | | | $241,000 | |
| Scope Contingency (10% of site work subtotal) | | | | $803,000 | |
| Cleanup and demobilization (1% of site work subtotal) | | | | $81,000 | |
| *Subtotal* | | | | | $1,206,000 |
| **DIRECT CAPITAL TOTAL** | | | | | **$9,229,000** |
| **INDIRECT CAPITAL COSTS** | | | | | |
| Remediation Design, Permitting, and Reporting (3% of direct capital) | | | | $277,000 | |
| Excavation Oversight, Including Soil Management during Shoring Installation (6% of direct capital) | | | | $554,000 | |
| *Subtotal* | | | | | $831,000 |
| **INDIRECT CAPITAL TOTAL** | | | | | **$831,000** |
| **TOTAL CAPITAL COST** | | | | | **$10,060,000** |
| **PRESENT WORTH COST OF ANNUAL O&M** | | | | | |
| **O&M COST ITEM** | **ANNUAL COST [1]** | | **YEARS** | **REAL DISCOUNT RATE** | |
| Groundwater Monitoring | $40,000 | | 5 | 0.0% | $200,000 |
| **TOTAL PRESENT WORTH OF O&M COST** | | | | | **$200,000** |
| **TOTAL PRESENT WORTH COST OF ALTERNATIVE 1 (SUM OF CAPITAL AND PRESENT WORTH OF O&M)** | | | | | **$10,260,000** |

NOTES:

[1] Annual Costs are 2011 dollars.

*Costs associated with excavation of contaminated soil include loading, transport, and disposal and do not reflect the incremental costs associated with disposing of contaminated vs. clean material.

ea = each
lb = pounds
lf = linear feet
O&M = operation and maintenance

## Table 6
## Feasibility Level Cost Estimate
## Cleanup Alternative 3
## Excavation and Land Disposal of Soil, ERH and Vapor Extraction for Groundwater
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| COST ITEM | QUANTITY | UNIT | UNIT PRICE | COST | TOTALS |
|---|---|---|---|---|---|
| **DIRECT CAPITAL COSTS (Remediation Costs Only)** | | | | | |
| **Site Work** | | | | | |
| **Excavation of Contaminated Soil*** | | | | | |
| Monitoring Well Decommissioning | 6 | well | $1,200 | $7,200 | |
| Onsite Laboratory | 60 | day | $1,500 | $90,000 | |
| Transportation and Disposal - Dangerous Waste F002 | 340 | ton | $220 | $74,800 | |
| Transportation and Disposal - Contained Out F002 | 97,200 | ton | $75 | $7,290,000 | |
| Dewatering Treatment System | 1 | ea | $25,000 | $25,000 | |
| Confirmation Sampling & Analysis | 1 | ea | $25,000 | $25,000 | |
| *Subtotal* | | | | | $7,512,000 |
| **Groundwater Treatment** | | | | | |
| Drill Electrodes | 6,600 | lf | $200 | $1,320,000 | |
| ERH Vendor Labor, Equipment & Materials (based on volume of treatment area) | 64,000 | bcy | $50 | $3,200,000 | |
| Power | 2.E+07 | kw-H | $0.07 | $1,225,000 | |
| Vapor and Water Treatment System | 1 | ea | $60,000 | $60,000 | |
| Install Groundwater Monitoring Wells | 3 | ea | $4,000 | $12,000 | |
| System Decommissioning | 1 | ea | $25,000 | $25,000 | |
| *Subtotal* | | | | | $5,842,000 |
| **Mobilization, Contingencies and Demobilization** | | | | | |
| Mobilization (1% of site work subtotal) | | | | $134,000 | |
| Bid (3% of site work subtotal) | | | | $401,000 | |
| Scope Contingency (10% of site work subtotal) | | | | $1,336,000 | |
| Cleanup and demobilization (1% of site work subtotal) | | | | $134,000 | |
| *Subtotal* | | | | | $2,005,000 |
| **DIRECT CAPITAL TOTAL** | | | | | **$15,359,000** |
| **INDIRECT CAPITAL COSTS** | | | | | |
| Remediation Design, Permitting, and Reporting (3% of direct capital) | | | | $461,000 | |
| Excavation Oversight, Including Soil Management during Shoring Installation (6% of direct capital) | | | | $922,000 | |
| *Subtotal* | | | | | $1,383,000 |
| **INDIRECT CAPITAL TOTAL** | | | | | **$1,383,000** |
| **TOTAL CAPITAL COST** | | | | | **$16,742,000** |
| **PRESENT WORTH COST OF ANNUAL O&M** | | | | | |
| **O&M COST ITEM** | **ANNUAL COST [1]** | | **YEARS** | **REAL DISCOUNT RATE** | |
| Groundwater Monitoring | $40,000 | | 2 | 0.0% | $80,000 |
| **TOTAL PRESENT WORTH OF O&M COST** | | | | | **$80,000** |
| **TOTAL PRESENT WORTH COST OF ALTERNATIVE 1 (SUM OF CAPITAL AND PRESENT WORTH OF O&M)** | | | | | **$16,822,000** |

NOTES:

[1] Annual Costs are 2011 dollars.

*Costs associated with excavation of contaminated soil include loading, transport, and disposal and do not reflect the incremental costs associated with disposing of contaminated vs. clean material.

bcy = bank cubic yard
ea = each
ERH = electrical resistance heating
Kw-H = kilowatt per hour
lf = linear feet
O&M = operation and matinenance

SoundEarth Strategies

# Table 7
## Remedial Alternatives Screening Summary
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

| | | | Washington State Department of Ecology Evaluation Criteria/Relative Ranking (1 = Low 5 = Medium 10 = High) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weighting Factors for Evaluation Criteria | | | | | | | |
| | | | 30% | 30% | 20% | 10% | 10% | | | |
| Remedial Alternatives | Satisfy MTCA Threshold Requirements | Restoration Time Frame | Protectiveness | Permanence | Effectiveness over the Long Term | Management of Short-Term Risks | Technical and Administrative Implementability | Consideration of Public Concerns | MTCA Composite Benefit Score[1] | Cost ($1,000) |
| **1 — Excavation and Land Disposal of Soil with In Situ Chemical Oxidation of Groundwater** | Yes | Approximately 5 years | 8 | 8 | 8 | 4 | 4 | 8 | **7.2** | **11,327** |
| **2 — Excavation and Land Disposal of Soil with In Situ Reductive Dechlorination of Groundwater** | Yes | Approximately 5 years | 8 | 8 | 9 | 6 | 6 | 9 | **7.8** | **10,260** |
| **3 — Excavation and Land Disposal of Soil; Electrical Resistance Heating with Vapor Extraction for Groundwater** | Yes | Approximately 4.5 years | 8 | 8 | 8 | 4 | 3 | 7 | **7.1** | **16,822** |

NOTES:

Low (1) = Remedial components are not reliable or proven, and the alternative exhibits a low degree of compliance with the evaluation criterion.

High (10) = Remedial components are proven under most field conditions, and the alternative exhibits a high degree of compliance with the evaluation criterion.

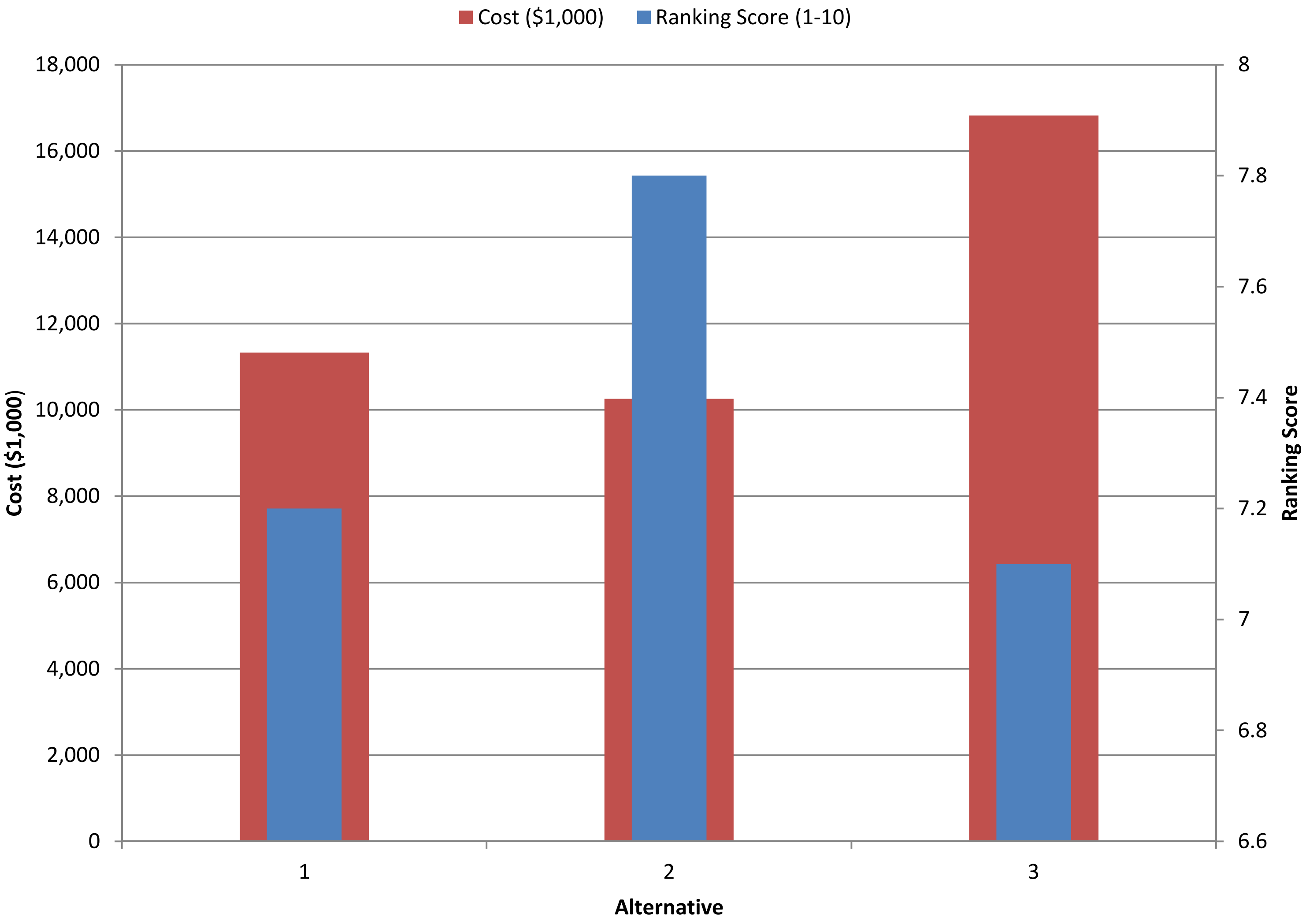
Medium (5) = Remedial components are proven under certain conditions, and the alternative exhibits a moderate degree of compliance with the evaluation criterion.

MTCA = Washington State Model Toxics Control Act

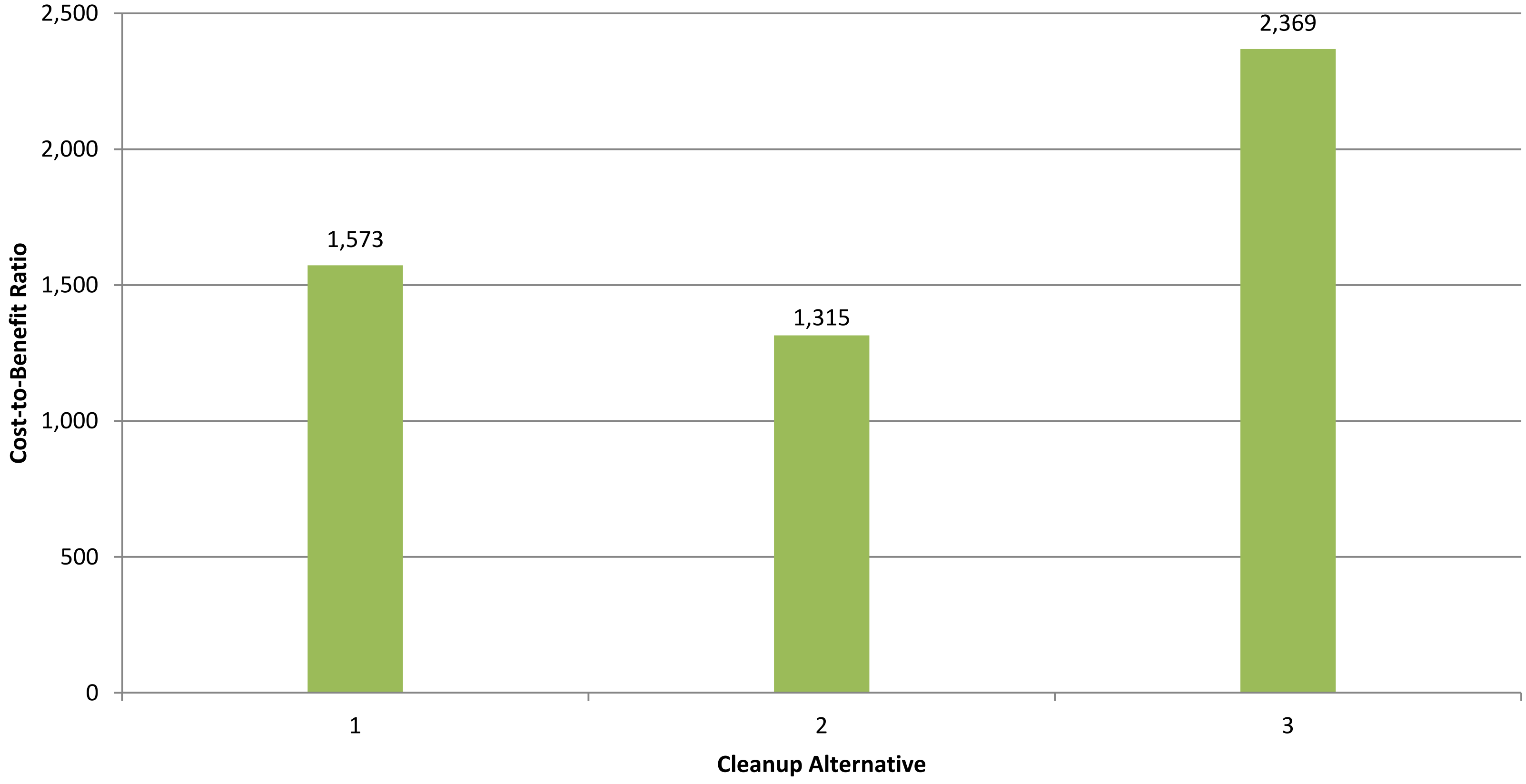
[1] The ranking scores for each alternative are equivalent to the sum of the weighted score of the five evaluation criteria. The scores provide a quantitative evaluation of criteria for "permanence to the maximum extent practicable."

# CHARTS

# Chart 1
# Cost and Relative Ranking of Cleanup Alternatives
Troy Laundry Property
307 Fairview Avenue North
Seattle, Washington

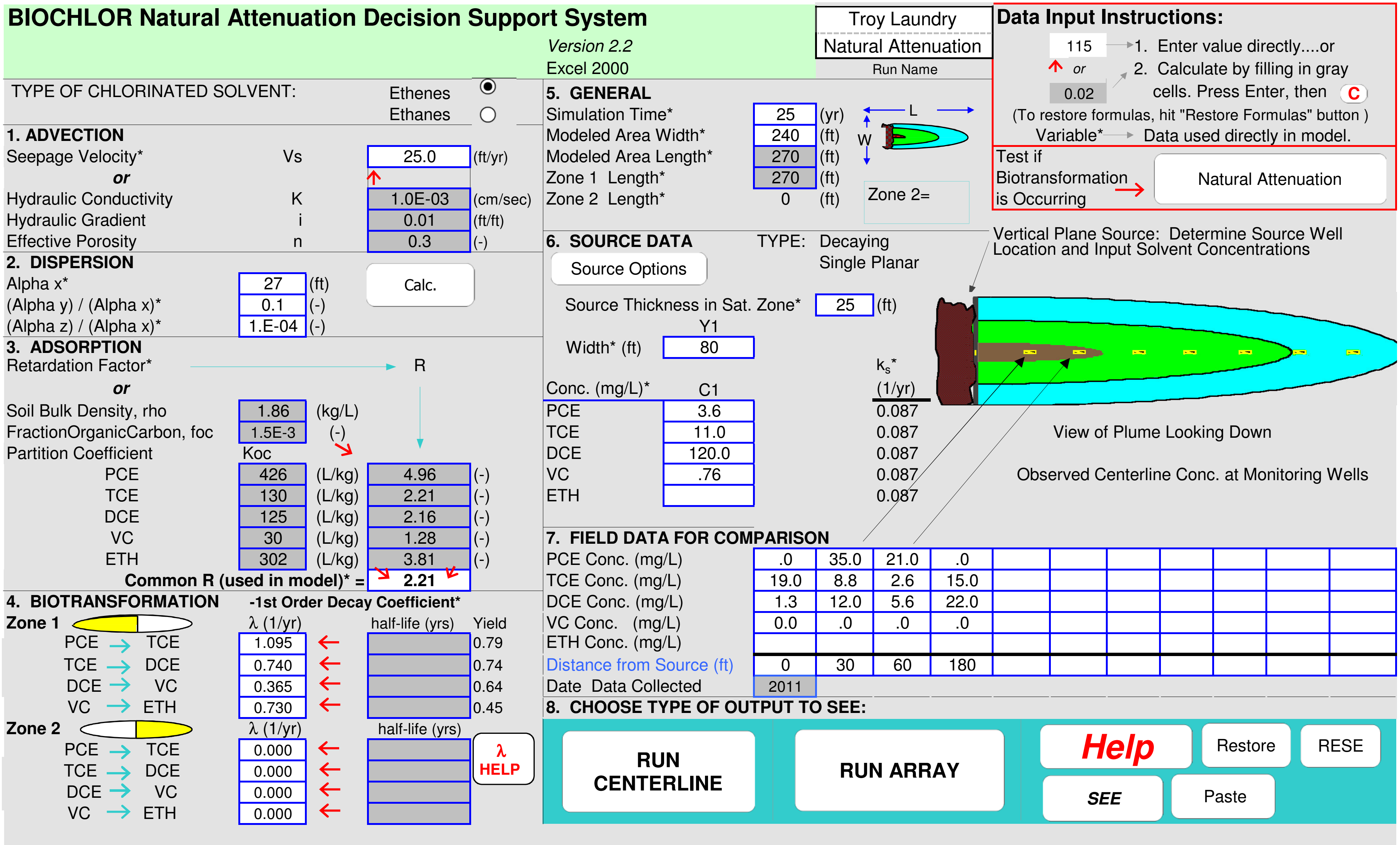


# Chart 2
# Cost-to-Benefit Ratios for Cleanup Alternatives
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington



Cost-to-Benefit Ratio = Present Worth Cost/Ranking Score

# APPENDIX A
# BIOCHLOR MODEL



**BIOCHLOR Natural Attenuation Decision Support System**

*Version 2.2*

Excel 2000

Troy Laundry
Natural Attenuation
Run Name

**Data Input Instructions:**

115 → 1. Enter value directly....or
↑ *or* 2. Calculate by filling in gray
0.02 cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button )
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation

TYPE OF CHLORINATED SOLVENT: Ethenes ● Ethanes ○

**1. ADVECTION**

| | | | |
|---|---|---|---|
| Seepage Velocity* | Vs | 25.0 | (ft/yr) |
| *or* | | ↑ | |
| Hydraulic Conductivity | K | 1.0E-03 | (cm/sec) |
| Hydraulic Gradient | i | 0.01 | (ft/ft) |
| Effective Porosity | n | 0.3 | (-) |

**2. DISPERSION**

| | | |
|---|---|---|
| Alpha x* | 27 | (ft) |
| (Alpha y) / (Alpha x)* | 0.1 | (-) |
| (Alpha z) / (Alpha x)* | 1.E-04 | (-) |

Calc.

**3. ADSORPTION**

Retardation Factor* → R

*or*

| | | | | |
|---|---|---|---|---|
| Soil Bulk Density, rho | 1.86 | (kg/L) | | |
| FractionOrganicCarbon, foc | 1.5E-3 | (-) | | |
| Partition Coefficient | Koc | | | |
| PCE | 426 | (L/kg) | 4.96 | (-) |
| TCE | 130 | (L/kg) | 2.21 | (-) |
| DCE | 125 | (L/kg) | 2.16 | (-) |
| VC | 30 | (L/kg) | 1.28 | (-) |
| ETH | 302 | (L/kg) | 3.81 | (-) |

**Common R (used in model)* = 2.21**

**4. BIOTRANSFORMATION** **-1st Order Decay Coefficient***

| Zone 1 | λ (1/yr) | | half-life (yrs) | Yield |
|---|---|---|---|---|
| PCE → TCE | 1.095 | ← | | 0.79 |
| TCE → DCE | 0.740 | ← | | 0.74 |
| DCE → VC | 0.365 | ← | | 0.64 |
| VC → ETH | 0.730 | ← | | 0.45 |

| Zone 2 | λ (1/yr) | | half-life (yrs) |
|---|---|---|---|
| PCE → TCE | 0.000 | ← | |
| TCE → DCE | 0.000 | ← | |
| DCE → VC | 0.000 | ← | |
| VC → ETH | 0.000 | ← | |

λ HELP

**5. GENERAL**

| | | |
|---|---|---|
| Simulation Time* | 25 | (yr) |
| Modeled Area Width* | 240 | (ft) |
| Modeled Area Length* | 270 | (ft) |
| Zone 1 Length* | 270 | (ft) |
| Zone 2 Length* | 0 | (ft) |

L W

Zone 2=

**6. SOURCE DATA** TYPE: Decaying Single Planar

Source Options

Source Thickness in Sat. Zone* 25 (ft)

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

| | Y1 | |
|---|---|---|
| Width* (ft) | 80 | |
| Conc. (mg/L)* | C1 | $k_s$* (1/yr) |
| PCE | 3.6 | 0.087 |
| TCE | 11.0 | 0.087 |
| DCE | 120.0 | 0.087 |
| VC | .76 | 0.087 |
| ETH | | 0.087 |

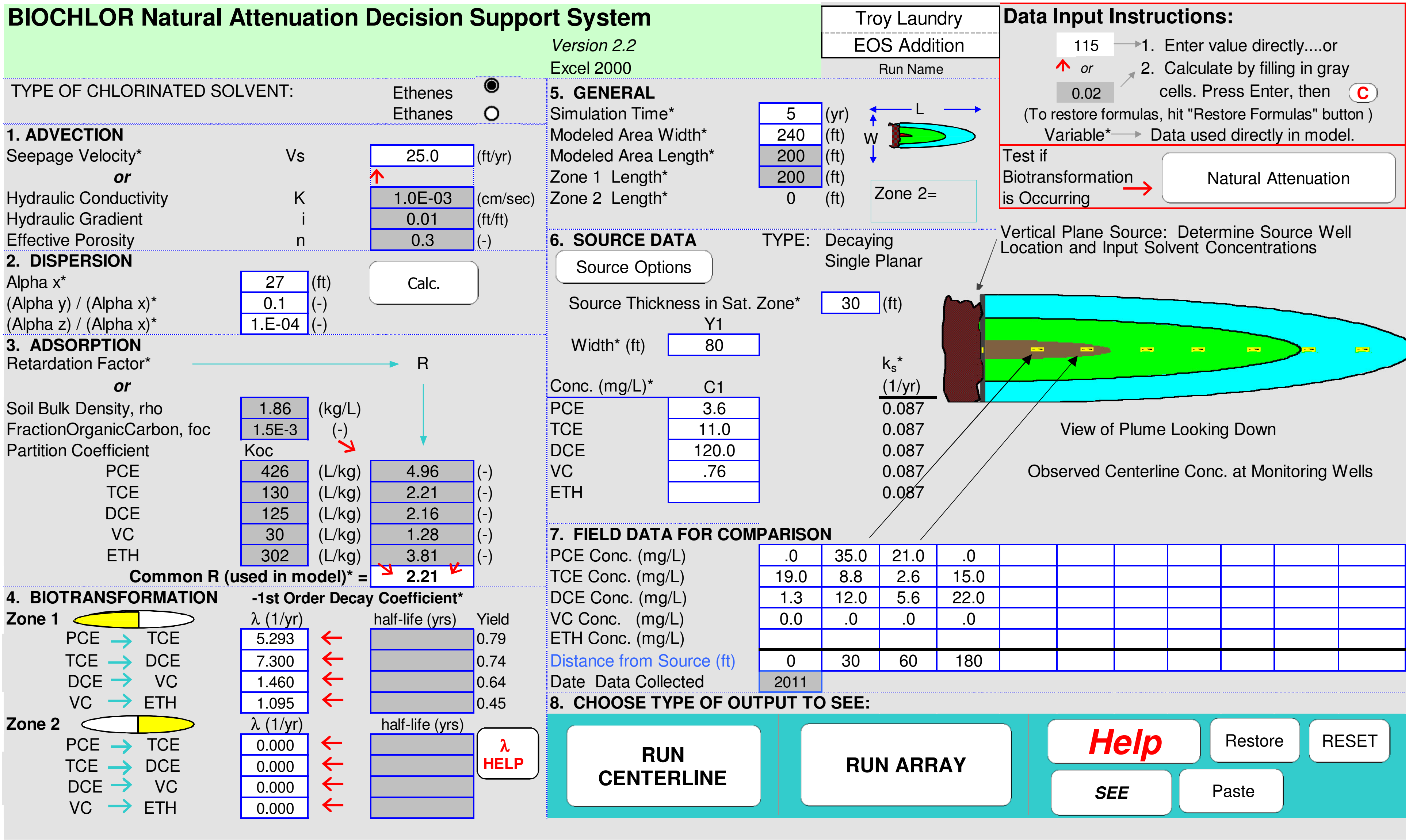
View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

**7. FIELD DATA FOR COMPARISON**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| PCE Conc. (mg/L) | .0 | 35.0 | 21.0 | .0 | | | | | | |
| TCE Conc. (mg/L) | 19.0 | 8.8 | 2.6 | 15.0 | | | | | | |
| DCE Conc. (mg/L) | 1.3 | 12.0 | 5.6 | 22.0 | | | | | | |
| VC Conc. (mg/L) | 0.0 | .0 | .0 | .0 | | | | | | |
| ETH Conc. (mg/L) | | | | | | | | | | |
| Distance from Source (ft) | 0 | 30 | 60 | 180 | | | | | | |
| Date Data Collected | 2011 | | | | | | | | | |

**8. CHOOSE TYPE OF OUTPUT TO SEE:**



# BIOCHLOR Natural Attenuation Decision Support System

*Version 2.2*
Excel 2000

**Data Input Instructions:**

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button )
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation

TYPE OF CHLORINATED SOLVENT: Ethenes ● Ethanes ○

**1. ADVECTION**

Seepage Velocity* Vs 25.0 (ft/yr)
*or*
Hydraulic Conductivity K 1.0E-03 (cm/sec)
Hydraulic Gradient i 0.01 (ft/ft)
Effective Porosity n 0.3 (-)

**2. DISPERSION**

Alpha x* 27 (ft)
(Alpha y) / (Alpha x)* 0.1 (-)
(Alpha z) / (Alpha x)* 1.E-04 (-)

**3. ADSORPTION**

Retardation Factor* → R
*or*
Soil Bulk Density, rho 1.86 (kg/L)
FractionOrganicCarbon, foc 1.5E-3 (-)

| Partition Coefficient | Koc | | R | |
|---|---|---|---|---|
| PCE | 426 | (L/kg) | 4.96 | (-) |
| TCE | 130 | (L/kg) | 2.21 | (-) |
| DCE | 125 | (L/kg) | 2.16 | (-) |
| VC | 30 | (L/kg) | 1.28 | (-) |
| ETH | 302 | (L/kg) | 3.81 | (-) |

**Common R (used in model)* = 2.21**

**4. BIOTRANSFORMATION** **-1st Order Decay Coefficient***

| **Zone 1** | λ (1/yr) | half-life (yrs) | Yield |
|---|---|---|---|
| PCE → TCE | 5.293 | | 0.79 |
| TCE → DCE | 7.300 | | 0.74 |
| DCE → VC | 1.460 | | 0.64 |
| VC → ETH | 1.095 | | 0.45 |

| **Zone 2** | λ (1/yr) | half-life (yrs) |
|---|---|---|
| PCE → TCE | 0.000 | |
| TCE → DCE | 0.000 | |
| DCE → VC | 0.000 | |
| VC → ETH | 0.000 | |

**5. GENERAL**

Simulation Time* 5 (yr)
Modeled Area Width* 240 (ft)
Modeled Area Length* 200 (ft)
Zone 1 Length* 200 (ft)
Zone 2 Length* 0 (ft)

**6. SOURCE DATA** TYPE: Decaying Single Planar

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 30 (ft)

Width* (ft) Y1 80

| Conc. (mg/L)* | C1 | $k_s$* (1/yr) |
|---|---|---|
| PCE | 3.6 | 0.087 |
| TCE | 11.0 | 0.087 |
| DCE | 120.0 | 0.087 |
| VC | .76 | 0.087 |
| ETH | | 0.087 |

**7. FIELD DATA FOR COMPARISON**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE Conc. (mg/L) | .0 | 35.0 | 21.0 | .0 | | | | | | | |
| TCE Conc. (mg/L) | 19.0 | 8.8 | 2.6 | 15.0 | | | | | | | |
| DCE Conc. (mg/L) | 1.3 | 12.0 | 5.6 | 22.0 | | | | | | | |
| VC Conc. (mg/L) | 0.0 | .0 | .0 | .0 | | | | | | | |
| ETH Conc. (mg/L) | | | | | | | | | | | |
| Distance from Source (ft) | 0 | 30 | 60 | 180 | | | | | | | |
| Date Data Collected | 2011 | | | | | | | | | | |

**8. CHOOSE TYPE OF OUTPUT TO SEE:**

# APPENDIX B
# DIRECT CONTACT CALCULATIONS FOR PCE IN SOIL

# MTCA Method B Soil Cleanup Level Calculation -
# Direct Contact Concentration for Tetrachloroethylene
## Troy Laundry Property
## 307 Fairview Avenue North
## Seattle, Washington

Calculate Method B soil cleanup levels assuming default assumption of Direct Contact
WAC 173-340-740 (b)(iii)(B) Equation 740-2

$$\text{Soil Cleanup Level (mg/kg)} = \frac{\text{Risk x ABW x AT x UCF}}{\text{CPF x SIR x AB1 x ED x EF}}$$

Default Input Values:

| | | Units | Notes |
|---|---|---|---|
| Risk = | 1.00E-06 | unitless | Excess cancer risk |
| ABW = | 16 | kg | Average body weight over the exposure duration |
| AT = | 75 | years | Averaging time |
| UCF = | 1.00E+06 | mg/kg | Conversion Factor |
| CPF = | 0.54 | (kg-day/mg) | Oral Carcinogenic Potency Factor for the Chemical of Concern |
| SIR = | 200 | mg/day | Soil Ingestion Rate |
| AB1 | 1 | unitless | Gastrointestinal Absorption Fraction |
| ED = | 6 | years | Exposure duration |
| EF = | 1 | unitless | Exposure frequency |

Soil Cleanup level = **1.85** mg/kg
For Tetrachloroethylene Direct Contact

# APPENDIX C
# PNOD ANALYTICAL RESULTS

**Carus Remediation Technologies**
Remediation Report

27 October 2011

| | | |
|---|---|---|
| Customer: | Sound Earth Strategies<br>2811 Fairview Avenue East, Suite 2000<br>Seattle, WA 98102 | Cc: K. Frasco |
| Attention: | C. Cass<br>E. Rothman | |
| From: | L. Mueller | |
| TECH # | 11-188 | |
| Subject: | RemOx® S ISCO Reagent Permanganate Natural Oxidant Demand | |

## Summary

The average RemOx® S ISCO reagent permanganate natural oxidant demand (PNOD) for the soil sample at 48 hours was determined to be 0.8 g/kg potassium permanganate ($KMnO_4$) per dry weight of soil.

## Background

One soil sample was received from Sound Earth Strategies from the Troy Laundry project located in at 307 Fairview Avenue North on October 19, 2011. The soil sample designation was B37-80. The sample was analyzed for permanganate natural oxidant demand following ASTM D7262-07 Test Method A. The measurement of the permanganate natural oxidant demand is used to estimate the concentration of permanganate that will be consumed by the natural reducing agents during a given time period of 48 hours.

## Experimental

The sample was analyzed for permanganate natural oxidant demand following ASTM D7262-07 Test Method A. A brief summary is as follows:

To determine the PNOD, the soil from the two jars was baked at 105°C for 24 hours then allowed to cool to room temperature. The soil was then blended and passed through a U.S. 10 sieve (2 mm). Reactors were loaded with 50 grams of soil and 100 mL of 20 g/L $KMnO_4$ for an initial dose of 40 g/kg $KMnO_4$ on a dry soil weight basis at a 1:2 soil to aqueous reagent ratio. Each soil dose was performed in triplicate. The reaction vessels were inverted once to mix the reagents. Residual permanganate ($MnO_4^-$) was determined at 48 hours. The demands were calculated on a dry weight basis.

## Results

The permanganate demand is the amount of permanganate consumed in a given amount of time. It should be noted that in a soil or groundwater sample, the oxidation of any compound by permanganate is dependent on the initial dose of permanganate and the reaction time available. As the permanganate dose is increased, the reaction rate and oxidant consumption may also increase. Some compounds that are not typically oxidized by permanganate under low doses can become reactive with permanganate at higher concentrations.

The 48-hour PNOD results can be seen in Table 1 (on a dry soil basis).

**Table 1:** 48-Hour PNOD *

| Soil Sample Identification | Average and Standard Deviation (g/kg) | Replicate 1 (g/kg) | Replicate 2 (g/kg) | Replicate 3 (g/kg) |
|---|---|---|---|---|
| B37-80 | 0.8 ± 0.1 | 0.9 | 0.8 | 0.8 |

*Demands were calculated on a weight $KMnO_4$/dry soil weight basis from an initial dose of 40.0 g/kg $KMnO_4$ initial dose at a 1:2 soil to aqueous solution ratio.

**Conclusions**

For this application the amount of permanganate needed will be dependent on the reaction time allowed. The soil sample had a low demand with a 48-hour permanganate demand value of 0.8 g/kg. Generally, remediation sites with a soil demand of less than 20.0 g/kg at 48 hours are favorable for *in situ* chemical oxidation with permanganate (see Table 2 for additional information).

**Table 2:** Correlation of Permanganate Natural Oxidant Demand Results*

| **PNOD (g/kg)** | **Rank** | Comment |
|---|---|---|
| <10 | Low | ISCO with $MnO_4^-$ is recommended. Soil contribution to $MnO_4^-$ demand is low. |
| 10-20 | Moderate | ISCO with $MnO_4^-$ is recommended. Soil contribution to $MnO_4^-$ demand is moderate. Economics should be considered. |
| >20 | High | ISCO with $MnO_4^-$ is technically feasible. Other technologies may provide lower cost alternatives. |

*Dry Weight Basis

RemOx® ISCO reagent is a registered trademark of Carus Corporation

CARUS®

# CHAIN OF CUSTODY RECORD

*ITEMS LISTED IN RED MUST BE COMPLETED BY CLIENT

CLIENT*: SoundEarth Strategies Inc.
PROJECT NAME: Troy Laundry
SITE LOCATION: 307 Fairview Ave N.
P.O. NUMBER: 0371-004-04
ADDRESS: 2811 Fairview Avenue East, Suite 2000
PHONE NUMBER: 206-306-1900
FAX NUMBER: 206-306-1907
DATE SHIPPED: 18 Oct 11
CITY STATE ZIP: Seattle, WA 98102
SAMPLER (PLEASE PRINT): Chris Cass
SAMPLER'S SIGNATURE: Chris Cass
PROJECT MANAGER: Erin Rothman
erinr@soundearthinc.com

REMOX® ISCO REAGENT
☐ SOLID
☐ LIQUID
☒ EITHER

ANALYSIS REQUESTED

(FOR LAB USE ONLY)
TECH # 11-188
LOGGED BY: Beth

| SAMPLE DESCRIPTION | DATE COLLECTED | TIME COLLECTED | SAMPLE TYPE SOIL | SAMPLE TYPE GW | SOIL TYPE | # OF CONT | Soil / GW Permanganate Demand | S.O.D | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B37-80 | 10/18/11 | 1430 | X | | SP | 2 | | X | | | | | | |
| | | | | | | | | | | | | | | |

TURNAROUND TIME REQUESTED (PLEASE CIRCLE) [✓ NORMAL] RUSH
(RUSH IS SUBJECT TO CARUS CHEMICAL APPROVAL)

SEND RESULTS TO:

ADDITIONAL COMMENTS:

RELINQUISHED BY: (SIGNATURE) Chris Cass
DATE 10-18-11
TIME 1535
RECEIVED BY: (SIGNATURE) Beth
DATE 10/19/11
TIME 2:40pm

RELINQUISHED BY: (SIGNATURE)
DATE
TIME
RECEIVED AT LAB BY: (SIGNATURE)
DATE
TIME

COMMENTS: (FOR LAB USE ONLY)
Arrived Stockroom ~9:30am

SAMPLE(S) RECEIVED ON ICE [✓ Y] OR N
BOTTLES RECEIVED IN GOOD CONDITION [✓ Y] OR N
BOTTLES FILLED WITH ADEQUATE VOLUME [✓ Y] OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) [✓ Y] OR N

Ship samples to: Carus Chemical Company, 1500 8th Street, Bldg 45 – Customer Service Lab, LaSalle, IL 61301

# APPENDIX D
# PERMANGANATE DOSE CALCULATIONS

# Permanganate Calculations for the Troy Laundry Site
307 Fairview Avenue North
Seattle, Washington

| | | | |
|---|---|---|---|
| Area of impacted soil = | 70,596.4 | ft$^2$ | |
| Depth of impacted soil = | 30.0 | ft | |
| Volume of impacted soil = | 2,117,892.0 | ft$^3$ | (Volume = Area x Depth) |
| | 78,440.4 | bcy | |
| | 59,972.0 | m$^3$ | |
| Density of impacted soil: | 3,250 | lb/bcy | (Reference: Caterpillar Performance Handbook 416C) |
| | 1,930 | kg/m$^3$ Bank | (Reference: Caterpillar Performance Handbook 416C) |
| Natural oxidant demand = | 0.8 | g/kg $KMnO_4$ | (Reference: Carus Remediation Report, October 27, 2011) |
| Mass of soil = | 115,745,960 | kg | (Density x Volume) |
| | 1.157E+08 | kg | (Density x Volume) |
| Required $KMnO_4$ = | 92,596,768 | g | (Mass x Natural Oxidant Demand) |
| | 92,597 | kg | |
| | 102.1 | ton | |

**Calculate the amount of $KMnO_4$ required to treat impacted groundwater:**

| | | |
|---|---|---|
| Area of impacted groundwater = | 70,596.4 | ft$^2$ |
| Depth of impacted groundwater = | 30.0 | ft |
| Porosity = | 40% | |
| Volume of impacted groundwater = | 6.337E+06 | gallons |
| Volume of impacted groundwater = | 2.399E+07 | liter (l) |
| Molecular weight of $KMnO_4$ = | 158.034 | g/g-mol |

| Groundwater contaminants | Vinyl Chloride | cis-1-2-DCE | TCE | PCE | | |
|---|---|---|---|---|---|---|
| Average concentration of contaminant within plume | 0.275 | 12.38 | 10.53 | 9.69 | ug contaminant/l groundwater | |
| molecular weight | 62.5 | 97 | 131.4 | 165.8 | g/g-mol | (Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Groundwater, 2nd Edition, January 2005) |
| Mole ratio of $KMnO_4$ to oxidize contaminant | 3.33 | 2.67 | 2.00 | 1.33 | mol KMnO4/mol contaminant | |
| Amount of KMnO4 to oxidize contaminant | 55.60 | 1,290.32 | 607.64 | 295.43 | g $KMnO_4$ | (ug contaminant/l groundwater)(g/10$^6$ug)(1/molecular weight of contaminant)(volume of groundwater)(mol KMnO4/mol contaminant)(molecular weight of KMnO4) |

$KMnO_4$ required to treat average contaminant mass in groundwater = 2,249.0 g $KMnO_4$

# APPENDIX E
# IN SITU REDUCTIVE DECHLORINATION DESIGN WORKSHEET

EOS Remediation, Inc.

# EOS® BARRIER DESIGN WORKSHEET

U.S. Version 2.1e, Rev. Date: February 6, 2008
www.EOSRemediation.com

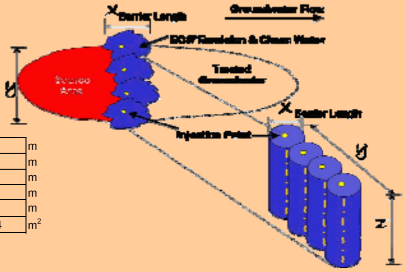
Help

| | |
|---|---|
| Site Name: | Troy Laundry Property |
| Location: | Seattle Washington |
| Project No.: | 0731-004 |

## Step 1: Select a Substrate from the EOS® Family of Bioremediation Products

Substrate Selected (pick from drop down list) EOS® 598B42 (Preferred for Chlorinateds)

For Product Literature Click Here ➤



## Step 2: EOS® Consumption During Contaminant Biodegradation / Biotransformation

### Section A: Treatment Area Dimensions

| | | | | |
|---|---|---|---|---|
| Length of treatment area parallel to groundwater flow, "x" | 20 | ft | 6.1 | m |
| Width of treatment area perpendicular to groundwater flow, "y" | 550 | ft | 167.6 | m |
| Minimum depth to contamination | 70 | ft | 21.3 | m |
| Maximum depth of contamination | 95 | ft | 29.0 | m |
| Treatment thickness, "z" | 25 | ft | 7.6 | m |
| Treatment zone cross-sectional area, A = y * z | 13,750 | $ft^2$ | 1277.4 | $m^2$ |

### Section B: Groundwater Flow Rate / Site Data

Soil Characteristics

| | | | | |
|---|---|---|---|---|
| Nominal Soil Type (pick from drop down list) | Sand | | | |
| Total Porosity (accept default or enter *n*) | 0.30 | (decimal) | | |
| Effective Porosity (accept default or enter $n_e$) | 0.23 | (decimal) | | |
| Soil bulk density; (1-n)*2.65 g/cc (accept calculated or enter dry bulk density) | 1.86 | g/cc | 116 | lbs / $ft^3$ |

Hydraulic Characteristics

| | | | | |
|---|---|---|---|---|
| Hydraulic Conductivity (accept default or enter *K*) | 2.82 | ft/day | 9.9E-04 | cm/sec |
| Hydraulic Gradient (accept default or enter *i*) | 0.01 | ft/ft | | |

Note: Since the hydraulic gradient ($i = dh/dx$) is negative, we ask you to enter $-i$ in the EOS® Design Tool so that you can enter a positive number for convenience.

| | | | | |
|---|---|---|---|---|
| Non-reactive Transport Velocity, $V_x = -(K \times i) / n_e$ | 0.12 | ft/day | 0.037 | m/day |
| Groundwater flow rate through treatment zone, $Q = -KiA$ | 2900.37 | gallons/day | 10,979.86 | L/day |

### Section C: Calculated Contact Length

| | | | | |
|---|---|---|---|---|
| Contact time ($\tau$) between oil and contaminants (accept default or enter $\tau$) | 60 | typical values 60 to 180 days, see comment | | |
| Calculated Contact Length ($x$) = $\tau * V_x$ | 7.4 | ft | 2.2 | m |

| | | | | |
|---|---|---|---|---|
| Treatment zone volume | 275,000 | $ft^3$ | 7,787.1 | $m^2$ |
| Treatment zone groundwater volume (volume * effective porosity) | 473,110 | gallons | 1,791,041 | L |

### Section D: Design Lifespan For One Application

| | | | | |
|---|---|---|---|---|
| Section D: Design Lifespan For One Application | 15 | year(s) | typical values 5 to 10 years | |
| Estimated total groundwater volume treated over design life | 16,352,636 | gallons | 61,905,759 | L |

### Section E: Electron Acceptors

| Inputs | Typical Value | GW Conc. (mg/L) | MW (g/mole) | $e^-$ equiv./ mole | Stoichiometry *Contaminant/H₂* *(wt/wt H₂)* | Hydrogen Demand *(g H₂)* |
|---|---|---|---|---|---|---|
| Dissolved Oxygen (DO) | 0 to 8 | 5 | 32.0 | 4 | 7.94 | 38998.22154 |
| Nitrate Nitrogen ($NO_3^-$ - N) | 1 to 10 | 10 | 62.0 | 5 | 12.30 | 50314.42239 |
| Sulfate ($SO_4^{2-}$) | 10 to 500 | 50 | 96.1 | 8 | 11.91 | 259822.5006 |
| Tetrachloroethene (PCE), $C_2Cl_4$ | | 4.6 | 165.8 | 8 | 20.57 | 13845.94942 |
| Trichloroethene (TCE), $C_2HCl_3$ | | 1 | 131.4 | 6 | 21.73 | 2849.318987 |
| cis-1,2-dichloroethene (c-DCE), $C_2H_2Cl_2$ | | 0.5 | 96.9 | 4 | 24.05 | 1287.236823 |
| Vinyl Chloride (VC), $C_2H_3Cl$ | | 0.1 | 62.5 | 2 | 31.00 | 199.6675597 |
| Carbon tetrachloride, $CCl_4$ | | | 153.8 | 8 | 19.08 | |
| Chloroform, $CHCl_3$ | | | 119.4 | 6 | 19.74 | |
| *sym*- tetrachloroethane, $C_2H_2Cl_4$ | | | 167.8 | 8 | 20.82 | |
| 1,1,1-Trichloroethane (TCA), $CH_3CCl_3$ | | | 133.4 | 6 | 22.06 | |
| 1,1-Dichloroethane (DCA), $CH_3CHCl_2$ | | | 99.0 | 4 | 24.55 | |
| Chloroethane, $C_2H_5Cl$ | | | 64.9 | 2 | 32.18 | |
| Perchlorate, $ClO_4^-$ | | | 99.4 | 8 | 12.33 | |
| Hexavalent Chromium, Cr[VI] | | | 52.0 | 3 | 17.20 | |
| User added | | | | | | |
| User added | | | | | | |
| User added | | | | | | |

### Section F: Additional Hydrogen Demand and Carbon Losses

| Generation (Potential Amount Formed) | Typical Value | GW Conc. (mg/L) | MW (g/mole) | $e^-$ equiv./ mole | Stoichiometry *Contaminant / H₂* *(wt/wt H₂)* | Hydrogen Demand *(g H₂)* | DOC Released *(moles)* |
|---|---|---|---|---|---|---|---|
| Estimated Amount of $Fe^{2+}$ Formed | 10 to 100 | 50 | 55.8 | 1 | 55.41 | 55864.28022 | |
| Estimated Amount of Manganese ($Mn^{2+}$) Formed | | 5 | 54.9 | 2 | 27.25 | 11357.31453 | |
| Estimated Amount of $CH_4$ Formed | 5 to 20 | 10 | 16.0 | 8 | 1.99 | 311145.6476 | |
| Target Amount of DOC to Release | 60 to 100 | 100 | 12.0 | | | | 515408.87 |

**Design Safety Factor:** 2.0 typical values 1 to 3

**Calculations assume:**

1.) all reactions go to completion during passage through emulsified edible oil treated zone; and,
2.) perfect reaction stoichiometry.

### EOS® Requirement Calculations Based on Hydrogen Demand and Carbon Losses

| | | |
|---|---|---|
| Stoichiometric Hydrogen Demand | 3,285.0 | pounds |
| DOC Released | 58,851.4 | pounds |

**EOS® Requirement Based on**
**Hydrogen Demand and Carbon Loss**

73,821 lbs