SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington 98102

DRAFT CLEANUP ACTION PLAN

Property:
Avtech Corporation
3400 Wallingford Avenue North
Seattle, Washington

Prepared for:
AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington

Report Date:
March 14, 2014

DRAFT – ISSUED FOR REGULATORY REVIEW

Draft Cleanup Action Plan

AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington 98109

Avtech Corporation
3400 Wallingford Avenue North
Seattle, Washington 98103

Project No.: 0789-004

Prepared by:

DRAFT

____
Tyler Oester, PE
Associate Engineer

DRAFT

____
Rob Roberts
Associate Scientist

Reviewed by:

DRAFT

____
Terry Montoya, PE
Principal Engineer

DRAFT

____
John Funderburk
Principal

March 14, 2014

SoundEarth Strategies

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/L	micrograms per liter
AMLI	AMLI Residential Partners
ARAR	applicable or relevant and appropriate requirement
asl	above sea level
Avtech	Avtech Corporation
bgs	below ground surface
CAP	Draft Cleanup Action Plan
CFR	Code of Federal Regulations
COC	chemical of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSM	conceptual site model
CUL	cleanup level
DPD	Department of Planning and Development
Ecology	Washington State Department of Ecology
EAI	Environmental Associates Inc.
EPA	U.S. Environmental Protection Agency
ERM-West	ERM-West Inc.
FS	feasibility study
GPR	ground-penetrating radar
HASP	Health and Safety Plan
HSA	hollow-stem auger
ISCO	in situ chemical oxidation
kg	kilograms

ACRONYMS AND ABBREVIATIONS (CONTINUED)

mg/kg	milligrams per kilogram
msl	mean sea level
MTCA	Washington State Model Toxics Control Act
NAVD88	North American Vertical Datum 1988
North Block	Parcels 1 through 3 of the Property, located on the north side of North 34th Street
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCS	petroleum-contaminated soil
PID	photoionization detector
the Property	3400 Wallingford Avenue North, Seattle, Washington
psi	pounds per square inch
PVC	polyvinyl chloride
PWOD	permanganate water oxidant demand
RAO	remedial action objective
RCW	Revised Code of Washington
REC	recognized environmental condition
RI	remedial investigation
RI/FS Report	Remedial Investigation/Feasibility Study Report
ROW	right-of-way
SAP	Sampling and Analysis Plan
the Site	groundwater contaminated with TCE beneath the Avtech Property as well as beneath portions of the adjoining 34th Avenue North right-of-way, and soil contaminated with TCE and PCE on the North Block of Avtech.

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SOD	soil oxidant demand
SoundEarth	SoundEarth Strategies, Inc.
South Block	Parcels 4 through 6 of the Property, located on the south side of North 34th Street
SPU	Seattle Public Utilities
TCE	trichloroethene
TESC	temporary erosion and sediment control
TPH	total petroleum hydrocarbons
TSDF	treatment, storage, and disposal facility
USC	United States Code
UST	underground storage tank
VCP	Voluntary Cleanup Program
VOC	volatile organic compound
WAC	Washington Administrative Code

EXECUTIVE SUMMARY

SoundEarth Strategies, Inc. has prepared this Draft Cleanup Action Plan for the Avtech Corporation Property located at 3400 Wallingford Avenue North in Seattle, Washington (the Property), on behalf of AMLI Residential Partners. The Property is currently enrolled in the Washington State Department of Ecology's Voluntary Cleanup Program (Voluntary Cleanup Program Project No. NW2739, Facility/Site No. 71755531). This Draft Cleanup Action Plan was developed to meet the requirements of a cleanup action plan as defined by the Washington State Model Toxics Control Act (MTCA) regulation in Parts 350 through 380 of Chapter 340 of Title 173 of the Washington Administrative Code.

The Property is a 2.04-acre commercial property spanning six parcels on the north and south sides of North 34th Street. The Property was initially developed by the early 1900s with four single-family residences. A two-story factory building (Building 2) was constructed on the north side of North 34th Street in 1909. Building 2 contained a shoe manufacturer from 1909 to the 1940s and Grandmas Cookies in the 1950s and 1960s. Avtech Corporation, a manufacturer of aviation electronics, occupied Building 2 from 1974 to 2011.

Two furniture workshop buildings were constructed on the south side of North 34th Street in the 1930s, with an additional single-story warehouse constructed in 1965. Avtech occupied the South Block buildings from the 1980s to 2011.

Based on the results of the investigations summarized in later sections of this report, subsurface soil beneath the Site consists primarily of localized near-surface anthropogenic fill soil overlying Vashon-age glacial till, which overlies glacial advance outwash deposits. Groundwater was encountered within the advance outwash deposits during site explorations. This water-bearing zone was typically encountered at depths ranging from approximately 21.5 to 45 feet below ground surface and appeared to extend beyond the maximum depth explored of 55 feet below ground surface. Groundwater migration direction has been consistently toward the southeast.

The results of the remedial investigation indicate that the site is defined by the lateral and vertical extent of contamination that has resulted from a release of trichloroethene on the north side of North 34th Street. Sampling conducted to date indicates that soil is impacted by trichloroethene in the loading dock area of Building 2 at depths ranging from 9 to 20 feet below grade. Soil is likely impacted at other depths, as indicated by the presence of trichloroethene in groundwater. Concentrations of tetrachloroethene, lead, and polycyclic aromatic hydrocarbons have also been confirmed in soil at the Site in localized areas at concentrations that slightly exceed applicable MTCA Method A cleanup levels

Groundwater containing trichloroethene concentrations exceeding the MTCA Method A cleanup level is present on the southern half of the North Block and has migrated to the south, across North 34th Street to the South Block. Groundwater contamination may also extend to the east, beneath Burke Avenue North.

Based on the results of the remedial investigation and completion of a conceptual site model, a 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.

EXECUTIVE SUMMARY (CONTINUED)

The three following cleanup action alternatives were developed through screening all applicable remedial technologies for the Site conditions and the development scenario for the Property, and then each alternative was evaluated in the course of the feasibility study:

- Cleanup Action Alternative 1, Excavation of Soil with In Situ Chemical Oxidation of Groundwater by Permanganate
- Cleanup Action Alternative 2, Excavation of Soil with Groundwater Treatment by a Zero Valent Iron Permeable Reactive Barrier
- Cleanup Action Alternative 3, Excavation of Soil with a Groundwater Pump and Treat System

Based on the results of the feasibility study, Cleanup Action Alternative 1 is the recommended alternative for the Site because it ranks comparatively high in environmental benefit and is both technically feasible and cost effective. Cleanup Action Alternative 1 satisfies requirements of the MTCA and significantly reduces risk from contamination to the maximum extent practicable by removal of the source by excavation and in situ chemical oxidation to address residual groundwater contamination beneath the Property and rights-of-way.

This Draft Cleanup Action Plan has been prepared based on the results of the Feasibility Study Report and presents the methods proposed to remediate the contaminated soil and groundwater beneath the Site.

As part of a planned redevelopment, the Property will be excavated from lot-line to lot-line and a large portion of trichloroethene-impacted source soil will be removed solely due to the redevelopment excavation. The redevelopment excavation will also remove localized areas of soil impacted with polycyclic aromatic hydrocarbons and lead. The depth of the trichloroethene source area remedial excavation is approximately 6 feet deeper than the proposed redevelopment excavation. The goal between the redevelopment excavation and the remedial excavation is to remove all of the soils that exceed the MTCA Method A cleanup level for trichloroethene, which is protective of groundwater. The total volume of contaminated soil within the remediation excavation area will be approximately 4,000 tons. Trichloroethene-impacted soil will be excavated and directly loaded into trucks for transport to off-Property land disposal at a permitted Subtitle D landfill (assumes a contained-out waste designation).

A chemical injection will be completed once the existing buildings have been demolished. A potassium permanganate solution will be injected into approximately 59 wells. Approximately 1,000 gallons will be injected into each injection well. Mixing and injecting will be accomplished by a temporary injection system. The permanganate solution can be injected at a flow rate of 5 gallons per minute per well. The injection system would be capable of injecting into 10 wells at once. At this rate, approximately 7 working days would be required to inject the design volume of 59,000 gallons of permanganate solution. Confirmation groundwater samples will be used to demonstrate that the remediation objectives were attained at the conclusion of remediation. Included in this alternative is a second contingency injection if additional reduction in groundwater concentrations is required. Seven of the injection borings will be used to further characterize soil in the west side of Building 2 following demolition and prior to excavation activities. Two additional monitoring wells will be installed on Burke Avenue North to further bound the eastern edge of the plume. The insitu chemical oxidation remediation will be modified to address any new contamination, if found, based on these new monitoring wells.

EXECUTIVE SUMMARY (CONTINUED)

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, investigation results, cleanup action objectives, implementation of the selected cleanup action, and associated compliance monitoring is contained in this report.

1.0 INTRODUCTION

SoundEarth Strategies, Inc. (SoundEarth) has prepared this Draft Cleanup Action Plan (CAP) for the for the Avtech Corporation (Avtech) Property located at 3400 Wallingford Avenue North in Seattle, Washington (the Property) on behalf of AMLI Residential Partners, LLC (AMLI). The general location of the Property is shown on Figure 1. The Property includes Parcels 1 through 3 on the north side of North 34th Street (North Block) and Parcels 4 through 6 on the south side of North 34th Street (South Block), as shown on Figure 2. Both blocks were occupied by Avtech for manufacturing of aviation electronics.

This CAP was developed to meet the requirements of a cleanup action plan, as defined by the Washington State Model Toxics Control Act (MTCA) regulation in Parts 350 through 380 of Chapter 340 of Title 173 of the Washington Administrative Code (WAC 173-340-350 through 173-340-380). In accordance with WAC 173-340-120(4)(a) and 173-340-350(6), AMLI has performed a remedial investigation (RI) sufficient to define the extent of contamination and characterize the Site (defined below) for the purpose of developing and evaluating cleanup action alternatives summarized in the Draft Remedial Investigation/Feasibility Study Report (RI/FS Report), prepared by SoundEarth (2014) and detailed in this CAP.

The Site is defined by the nature and extent of contamination associated with one or more releases of hazardous substances prior to any cleanup of that contamination. Based on the information gathered to date, the Site includes soil contaminated with of trichloroethene (TCE), tetrachloroethene (PCE), lead, and polycyclic aromatic hydrocarbons (PAHs). TCE and PCE impacts are likely from past degreasing activities at the former Avtech facility. The PAH contamination is near-surface and is likely from airborne emissions from the former gasworks plant to the south. The PAH concentration is typical for urban areas (Ecology FAQs September 2011). Lead contamination is near-surface and likely from a release of lead-based paint. Groundwater is impacted by TCE beneath the North Block and the south-adjoining North 34th Street right-of-way (ROW), and limited portions of the South Block, Varsity Inn property, and Burke Avenue North ROW.

The Site was accepted into Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP) on June 11, 2013 (VCP Project No. NW2739).

1.1 DOCUMENT PURPOSE AND OBJECTIVES

The purpose of this CAP is to satisfy the specific requirements of MTCA in accordance with the WAC 173-340-380, 173-340-400, and 173-340-410. This CAP presents historical information regarding the source and extent of impacts beneath the Site and outlines the proposed plan to address the impacts that remain beneath the Site.

This CAP has been organized into the following sections:

- **Section 2.0, Background.** This section discusses the Site location and description, the geologic and hydrogeologic setting of the Site, previous investigations, the distribution of contaminated soil and groundwater, the chemicals of concern (COCs) based on the investigations conducted at the Site, the media of concern, and the Site definition.

- **Section 3.0, Technical Elements.** This section presents the remedial action objectives (RAOs), applicable or relevant and appropriate requirements (ARARs), COCs, media of concern, points of compliance, and the development of cleanup standards.
- **Section 4.0, Selected Cleanup Action.** This section describes the selected cleanup action (including rationale for selection) and presents the cleanup action objectives.
- **Section 5.0, Cleanup Action Implementation Plan.** This section describes the components of the cleanup action, including the cleanup action implementation documents, construction activities, and anticipated schedule for implementing the cleanup action for the Property. This section also summarizes the anticipated schedule for the cleanup action and restoration time frame.
- **Section 6.0, Compliance Monitoring.** This section describes the protection, performance, and confirmational monitoring that will be conducted as part of the cleanup action.
- **Section 7.0, Expected Restoration Time Frame.** This section describes the expected time frame for the elements of the selected cleanup action.
- **Section 8.0, Documentation Requirements.** This section describes the documentation to be provided as part of the cleanup action and includes a discussion of document management, waste disposal tracking information, and compliance reports.
- **Section 9.0, Bibliography.** This section lists references used in the preparation of this CAP.
- **Section 10.0, 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, hydrogeology, hydrology, and land use pertaining to the Site. The historical and site documentation in this section is provided in the RI/FS Report.

2.1 SITE LOCATION AND DESCRIPTION

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 consists of six tax parcels (King County parcel numbers 408330-6660, 408330-6670, 408330-6695, 408330-7105, 408330-7155, and 408330-7160). The Property covers approximately 88,920 square feet (2.04 acres) of land and is bisected by North 34th Street (creating North and South Blocks). The Property is located at 3400 Wallingford Avenue North in Seattle, Washington, approximately 1 mile north of downtown Seattle, Washington, as shown in Figure 1. Figure 2 shows a plan view/layout of the Property. According to King County's iMAP website, the Property is located at an approximate elevation ranging from 55 feet above mean sea level at the southeast corner to 95 feet above mean sea level at the northwest corner.

Potable water and sewer service are provided to the Property by Seattle Public Utilities. Puget Sound Energy provides natural gas and Seattle City Light provides electricity to the Property.

According to City of Seattle's Arterial Classifications Zoning Map, the North 34th Street ROW is zoned as a principal arterial and the Burke Avenue North ROW is zoned as a non-arterial street. A 132-inch outside-diameter sewer line is located under North 34th Avenue, between the northern and southern portions of the Property, at depths of about 50 feet to 65 feet below ground surface (bgs).

2.2 LAND USE HISTORY OF THE SITE

Between 1901 and 1909, three single-family residences were constructed on the North Block and two single-family residences were constructed on the South Block. Building 2 was constructed on Parcel 3 in 1909 and was initially occupied by the Zimmerman-Degen Shoe Factory. The original heat system was coal, with a furnace room located in the basement at the east end of the building.

In the 1930s, the Property contained single-family residences on Parcels 1, 2, 5, and 6, the shoe factory on Parcel 3, and a warehouse building on Parcel 4. In 1934, a wood-framed furniture manufacturing building was also constructed on Parcel 4. According to historical newspaper accounts, a building was destroyed on Parcel 4 in 1936, likely due to a blaze starting at a sawdust collector at the furniture factory. It was not stated which of the two workshops the fire had damaged.

In 1946, a one-story, masonry-framed garage building was constructed on Parcel 3, north of Building 2. The tax records indicate that a 550-gallon tank was located in the vicinity of the garage, which was located near the northwestern corner of Parcel 3. The contents of the tank were unlisted in the tax records. The garage was incorporated into a warehouse building constructed in 1957 on Parcel 3.

By 1950, Building 2 was occupied by Grandma's Baking Company. A one-story, reinforced-concrete-framed garage and machine shop was built as an addition to the 1912-vintage building. The addition was listed as heated by natural gas and was constructed along the Wallingford Avenue North frontage. In 1958, City of Seattle Department of Planning and Development (DPD) records indicate that a 1,000-gallon tank was installed at Building 2. The contents and location of the tank were not listed.

In the 1960s, a one-story, unheated masonry warehouse was constructed on Parcel 5 (Building 5). The residence previously occupying Parcel 5 was demolished at this time. A paint spraying booth was shown within Building 3 on Parcel 4. Building 4 was listed as a cabinet shop, and Building 3 was listed as storage and shipping facilities for the cabinet shop. Building 5 was a plywood manufacturer's warehouse. By 1965, aerial photographs indicate Building 2 was expanded again to include the current solder room space.

In 1974, DPD records indicate that alterations were made to Building 2 to accommodate Avtech's occupancy of the building. The current solder room was listed as a "fabrication shop." The current shipping and receiving was not present at the time.

The shipping and receiving area for Building 2 was present by 1986. The 1986 plan shows a gasoline underground storage tank (UST) on the east side of the loading dock. The northwest corner of the Building 2 basement is shown as the "metal treatment" room. The 1970s-era Fabrication Shop is shown as the "machine shop" in the 1986 plan.

A 1989 letter from Avtech to the City of Seattle land use office includes a detailed list of all chemicals transported to Avtech's facilities, as well as their estimated use frequency and total volume annually used. The letter also detailed that Avtech's liquid chemical wastes were removed from the Property every 90 days by a hazardous waste transportation company, that chromate waste from the chromate plating room was discharged to the sanitary sewer to be received by Metro, and that an industrial waste discharge permit was held by Avtech for this purpose. Chemical wastes included TCE, acetone, toluene, ammonium hydroxide, xylenes, methyl isobutyl ketone, varnish, nitric acid, paint etcher, Freon, ethanol, and hydraulic oil.

Avtech acquired and occupied all of the South Block buildings by 1986, except for Building 5, which was acquired in 1989. Building 5 was occupied by the Budweiser Hydroplane racing team repair and service shop.

A meth lab operated out of the basement of the residence at 3424 Wallingford Avenue North (Building 1). The meth lab, which was reportedly capable of producing up to 100 pounds of meth per week, was discovered and raided by police on November 17, 1990. The residence included 18 gallons of diethyl ether at the time of the police raid. The state reportedly was responsible for the cleanup operation, and the drug laboratory was listed under federal databases as a hazardous materials cleanup site. The charged individual in the meth lab case, Terrell King, was the listed occupant in reverse directories for the Property from 1986 until 1990. Avtech was the owner of the residence located on Parcel 1 at the time of the meth laboratory raid. King County Health Department received a final decontamination report concerning Building 1 on May 9, 1991, from Morris Environmental Services. The report indicated that decontamination was successful and that Building 1 posed no significant threat to an occupant. The letter further cited Avtech's use at Building 2 of TCE, methylene chloride, and toluene.

A 1989 annual Dangerous Waste Report submitted to Ecology identified 3,000 pounds of waste TCE generated by Avtech. Other wastes included paint thinning solvents and ammonium hydroxide.

In 1990, a construction permit indicated that a spray booth was installed at Building 3. Seattle Fire Department records indicated that Building 4 was emitting visible clouds of solvents from the facility due to Avtech's operations, which smelled of ketone and/or paint fumes. An unpermitted paint spray booth located within Building 3 was observed in a previous inspection cited in this letter.

DPD records indicate that a chromate process room was located in the basement of Building 2 in 1993. Present on the first floor were a spray booth, a "ballast area," a "PCB Assy" room, a print shop, a paint shop, a chemical storage room, an engineering laboratory, a burn-in room, and an assembly floor.

In 2007, Buildings 3 and 4 were used by Avtech Corporation as a mechanical and electrical engineering facility, including numerous welding stations, two paint booths, storage areas, and various other electrical assembly and testing stations.

2.3 FUTURE LAND USE

The planned development project will include the construction of two separate residential buildings with subgrade parking that will extend lot-line to lot-line. Multiple levels of below-grade parking are planned across the development property. The lowest level of parking in the TCE remediation area will have an excavation base at approximately 66 feet (approximately 19 feet below existing grade). 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 the 60s in the summer to the 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 December, when the area receives an average rainfall total of 6.06 inches.

2.4.2 Topography

The Site and vicinity lie within the Puget Trough or Lowland portion of the Pacific Border Physiographic Province. 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 (asl). 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.

The Site is located on southeast-facing hill side, with elevations ranging between 55 feet at southeast corner of the South Block, to 97 feet at the northwest corner of the North Block. Lake Union is located to the south, with the closest location approximately 650 feet to the southeast (USGS 1983).

2.4.3 Groundwater Use

According to the Ecology Water Well Logs database no water supply wells are present within approximately 2 miles of the Site.

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

This section summarizes the regional geology and hydrogeology in the Site vicinity, and the geologic and hydrogeologic conditions encountered beneath the Site.

2.5.1 Regional Geology and Hydrogeology

According to *The Geologic Map of Seattle—A Progress Report* (Troost et al. 2005), the surficial geology in the vicinity of the Site consists of deposits corresponding to the Vashon Stade of the Fraser Glaciation and pre-Fraser glacial and interglacial periods. In the immediate Site vicinity, surficial deposits have been mapped as Vashon-age glacial till. The Vashon till generally consists of a dense to very dense mixture of silt to cobble-sized particles that often contains vertical fractures, sand lenses, and sub-horizontal bedding features. Localized sub-glacial melt-out deposits within the till can contain sand and gravel layers that grade into the till or the underlying advance outwash. Although coarse-grained layers or lenses within the Vashon till may be locally saturated, the till is generally regarded as an aquitard due to its higher silt content and low permeability, which limits recharge to the underlying advance outwash.

The Vashon till is underlain by Vashon-age advance outwash deposits that typically consist of well-sorted sand and gravel that were deposited in front of the advancing ice sheet. The silt content (including silt interbeds) often varies within the advance outwash deposits, with greater amounts of silt often encountered near the top and base of this unit. (Troost et al. 2005). The advance outwash deposits often grade into the underlying Lawton Clay at the base, and/or is underlain by older glacial and interglacial deposits (Troost and Booth 2008).

The Vashon advance outwash deposits often comprise the regional shallow aquifer in the Seattle area. Localized deposits of recessional outwash or alluvial deposits overlying the Vashon till often comprise shallower water table aquifers or perched water-bearing zones above the Vashon advance outwash aquifer. Perched water-bearing zones within alluvial soils or weathered till can also be encountered above the unweathered Vashon till. Saturated layers and lenses of coarser-grained sediments within the Vashon till comprise water-bearing zones of limited extent and storage capacity.

2.5.2 Site Geology

Based on the results of the investigations summarized in this RI/FS Report, subsurface soil beneath the Site consists primarily of local near-surface anthropogenic fill overlying Vashon-age glacial till overlying Vashon-age advance outwash deposits.

The locations of the borings and wells advanced during explorations at the Site are shown in Figure 2. Cross sections showing subsurface soil characteristics and geologic units encountered in the explorations are presented in Figures 3 through 5. Detailed boring logs with well construction details are included in the RI/FS Report.

Anthropogenic fill or disturbed native soils consisting of loose sands to silty sands were encountered locally in some of the property borings to depths of up to about 7 feet bgs. SoundEarth also anticipates that fill soils are present associated with backfilled walls, under building foundations, and utility corridors that were not encountered in the soil borings.

The near-surface fill soils, where present, are underlain by Vashon glacial till deposits that were encountered in all of Site soil borings that extended through the upper fill soils. In general, these deposits consisted of dry-damp to moist, very dense silty sand with variable gravel and cobbles, and local thin sand-rich and silt-rich horizons. The glacial till is often cemented. Glacial till deposits extend to depths ranging from approximately 25 feet bgs (boring B09) to approximately 40 feet bgs (boring B16) across the Site.

The Vashon-age advance outwash deposits were encountered in nearly all of the borings throughout the Site that were in excess of 35 feet deep. In general, these deposits consisted of damp to wet, very dense sand to sand with some silt with variable gravel and local silty sand and silt-rich horizons. The hard silt-rich interbeds are typical of the transition zone between the advance outwash sand deposits and the overlying glacial till. The advance outwash deposits were encountered at depths of approximately 25 feet bgs (boring B09) to about 40 feet bgs (boring B16), and appear to extend to the total depth explored in all of the deeper Site borings (up to 55 feet bgs).

2.5.3 Site Hydrology

Near-surface perched groundwater conditions were not encountered in the Site explorations. A shallow water-bearing zone was encountered below the Property near the contact between the glacial till and the underlying advance outwash deposits that appear to comprise the shallow water-bearing zone beneath the Site. The presence of some silt interbeds in the transition zone between the glacial till and the outwash deposits might result in localized perched conditions in the upper section(s) of the advance outwash. Boring logs for 5 of the 15 monitoring wells showed a moist, non-saturated fine-grained soil stratum at or near the bottom of the borings, while the 10 other borings converted into wells were terminated in saturated conditions.

Groundwater depths in the wells in 2013 have ranged from 21.49 feet to 44.74 below tops of well casings, and elevations ranging from 31.27 feet to 64.01 feet North American Vertical Datum 1988 (NAVD88). The groundwater flow direction in the shallow water-bearing zone is toward the south to south-southeast, with a gradient ranging from 0.142 feet per foot to 0.147 feet per foot between wells MW10 and MW11 for the 2013 depth-to-groundwater events.

A 1908-vintage, hand-dug, 132-inch outer-diameter sewer line is located at a depth of approximately 50 feet bgs (invert elevation 26 feet NAVD88), aligned along the center of North 34th Street. Subsequent studies completed by the City of Seattle Engineering Department indicated that voids were present under the North 34th Street ROW, possibly the result of settlement associated with installing the sewer line. The potential hydraulic influence of the sewer line and associated voids on groundwater flow in the shallow water-bearing zone beneath the Site has not been determined.

SoundEarth completed slug tests on wells MW09, MW12, and MW13 in July of 2013 to estimate hydraulic conductivities of the shallow water-bearing zone encountered beneath and downgradient of the Property. Both falling head and rising head slug tests were completed and analyzed in each of the wells. Average hydraulic conductivity estimates for each of the wells range from about 0.52 to 1.11 feet per day.

The hydraulic conductivity estimates and observed groundwater gradients were used to estimate groundwater velocities (seepage velocities) in the vicinity of wells MW09, MW12, and MW13. A porosity of 0.2 was assumed for calculations given the physical characteristics of the glacially-consolidated outwash deposits. The hydraulic gradient was calculated using groundwater elevations measured from April 24 to 26, 2013. Hydraulic gradients ranged from 0.07 to 0.12 feet per foot, and groundwater velocities were estimated to average from 0.31 to 0.66 feet per day.

2.6 PREVIOUS INVESTIGATIONS

This section summarizes the results of previous investigations conducted at the Property. Information regarding the previous investigations conducted by others at the Site and on the adjoining upgradient property was obtained from the following reports:

- *Phase 1 Environmental Site Assessment and Compliance Review, Avtech Corporation, 3400 Wallingford Avenue, Seattle, Washington*, by GaiaTech Incorporated GaiaTech), dated March 11, 2003 (GaiaTech 2003).

- Phase 1 Environmental Site Assessment and Limited Compliance Review, Avtech Corporation, 3400 Wallingford Avenue North, Seattle, Washington, by ERM-West. Inc. (ERM-West), dated December 2006 (ERM-West 2006).

2.6.1 2003 GaiaTech Phase I Assessment

GaiaTech Incorporated completed a Draft Phase I Environmental Site Assessment (ESA; GaiaTech 2003) of the Property in 2003. The GaiaTech report indicated that previous reports for the Property included a 1995 Phase I Environmental Audit by Environmental Associates Inc. (EAI), a 1998 Supplemental Environmental Studies Report by EAI, a 1998 Environmental Assessment by Pilko & Associates, and a 2003 Environmental Review conducted by Strata Environmental.

The GaiaTech report indicated that a gasoline UST located near the Building 2 loading dock was removed in 1989 (GaiaTech referred to Building 2 as “Building 1” in the report). Sampling of the UST area was not conducted. In 1995, three fuel oil USTs ranging from 300 to 1,760 gallons were removed. The 1,760-gallon UST was located next to the former gasoline tank area. Three soil samples collected from the tank excavation did not contain detectable petroleum hydrocarbons. A 500-gallon UST was located on the southern end of the South Block (the specific location was not given). According to facility representatives, petroleum-impacted soil was overexcavated in this area, though no report of the cleanup was provided. A 300-gallon UST was located at the residence on the North Block. Petroleum impacted soil was reportedly not encountered.

A 1998 subsurface investigation conducted by EAI in the former gasoline and 1,760-gallon fuel oil UST area was described as “north and northeast of Building 1” (current Building 2). Four borings (B-1 through B-4) were drilled. Total petroleum hydrocarbons (TPH) were identified at a depth of 8 feet in one boring (Boring B-3 at 400 milligrams per kilogram [mg/kg]). No other TPH, benzene, toluene, ethylbenzene, or total xylenes were detected in the four borings. GaiaTech (2003) did not include a site plan showing the locations of the borings.

GaiaTech noted that Avtech stored chemicals in a curbed storage area, including isopropyl alcohol (150 gallons), paint thinners (75 gallons), paint (30 gallons), and oils (110 gallons). GaiaTech did not identify any significant waste handling or disposal practices at Avtech.

GaiaTech (2003) identified the following potential environmental impacts for the Property:

- The former UST area at Boring B-3 (the report noted that the TPH concentration was above the MTCA Method cleanup level (200 mg/kg at the time).
- Historical operations, including shoe, boat, and furniture manufacturing.

2.6.2 2006 ERM-West Phase I Assessment

ERM-West completed a Draft Phase I Environmental Assessment of the Property in December 2006 (ERM-West 2006). At the time of the report, Avtech was a medium-quantity Resource Conservation and Recovery Act waste generator. Five waste streams were identified: isopropyl alcohol, mixed solvents, spent lab packs, chromate solid waste, and lead waste. The report concluded that “In general, the facility operations appear to be orderly and well maintained; however, certain permits and report have not been obtained/submitted that are required for environmental compliance.” The ERM-West report obtained by SoundEarth did not include a site plan.

ERM-West (2006) identified the following recognized environmental conditions (RECs) for the Property:

- The former presence of four USTs, which were removed from the Property between 1989 and 1995, with confirmed soil impacts in the vicinity of the diesel UST east of the fabrication shop.
- Petroleum-contaminated soil (PCS) was encountered in one of four borings advanced by EAI in 1998. The PCS was encountered to the northeast of Building 2 (location not given).
- The environmental quality of groundwater beneath the Property was not evaluated in the course of the UST removal or subsurface investigation activities conducted at the Property.
- Etching was observed on the concrete floor of the basement of Building 2, where the chromate plating line operated for approximately 25 years. The plating line reportedly discharged into the municipal sewer system through a single drain line, the integrity of which was not evaluated.
- Paint spraying occurred within Building 3 on the Property for approximately 40 years. Cabinet coating paints and solvents were likely also used as part of the paint spraying operation.
- The Property is situated proximal to and downwind of Gas Works Park, which was formerly a gasification plant that may have resulted in adverse environmental impacts to the Property from air-fall of material generated by the former plant.

2.6.3 2011–2012 SoundEarth Phase I Assessment

SoundEarth was commissioned by AMLI Residential Partners, LLC to complete a Phase I ESA of the Property. At the time of a Property visit conducted by SoundEarth in September 2011, Mr. Scott Graebke and Mr. Jim Jenkins, facilities manager and manufacturing engineer with Avtech, respectively, were interviewed. Mr. Graebke and Mr. Jenkins were both aware of the use and storage of chemicals at the Property. Mr. Graebke provided SoundEarth with the industrial wastewater permit for the chromate process room and with material safety data sheets of all chemicals stored at the Property. Mr. Graebke and Mr. Jenkins were reportedly not aware of UST decommissioning records or any subsurface investigations or remedial efforts that may have been conducted at the Property.

Cutting oil, lacquers, lubrication oil, compressor oil, toluene, xylenes, mineral oil, paints, paint thinners, methyl ethyl ketone, petroleum solvents, glues, resins, and plastic coatings were used and stored at the Property. At the time of the site visit, interior portions of Buildings 2, 3, and 4 were still used for storage of lubrication oil, lacquer, and waste petroleum. These materials were reported by Mr. Graebke to be removed by January 2012. Some cutting oil and lubrication oil staining was observed on the ground of Building 3 in the vicinity of former equipment. Drums of used oil were stored to the west of Building 6 awaiting disposal by a hazardous materials handler. The drums contained cutting oil formerly used in metal cutting machines in Building 6.

The chromate process room was present on the second floor of Building 4. Mr. Graebke indicated that the chromate process room discharged to the sanitary sewer in accordance with the industrial wastewater permit held by Avtech. SoundEarth made an inquiry with Mr. Doug

Hilderbrand, Industrial Waste Compliance Investigator for King County Metro's Industrial Waste Division. Mr. Hilderbrand was familiar with the Avtech facility, having toured it several times through the years. He was not aware of any significant problems regarding waste handling or discharges to the Metro system.

SoundEarth also made an inquiry with Nortar Inc. Ecology site manager Maura O'Brien. Ms. O'Brien indicated that, according to most recent data available, subsurface soil and groundwater contamination resulting from the historical operation of a tar products facility located to the west of the South Block did not extend to the east of Wallingford Avenue North toward the Property.

The following RECs were identified during the course of the SoundEarth Phase I ESA:

- The former industrial uses of the Property.
- The former use and storage of petroleum hydrocarbons in USTs located in the vicinity of Building 2.
- The former use and storage of heating oil for former residences on the Property.
- The former presence of a clandestine methamphetamine production laboratory at the Property.
- Air-fall contamination resulting from the nearby historical operation of the coal gasification plant.

2.7 REMEDIAL INVESTIGATION

SoundEarth conducted subsurface assessment work at the Site between December 2011 and July 2013. The objectives of the initial field program for the Property were to further assess the potential for RECs to have impacted the Property. Subsequent field programs were conducted to assess the extent and potential source of TCE contamination.

Soil data is summarized in Tables 1 through 5. The locations of soil borings, groundwater monitoring wells and other Site features are shown on Figure 2. Subsurface cross sections are shown on Figures 3 through 5. Groundwater elevations and flow directions are shown on Figure 6. The soil and groundwater analytical results for COCs exceeding MTCA Method A cleanup levels are summarized on Figures 7 and 8. The soil descriptions and observations were recorded in boring logs and laboratory analytical reports for the Site are included in the RI/FS Report.

2.7.1 2011–2012 Phase II Environmental Site Assessment

Two subsurface investigations comprised the Phase II ESA conducted by SoundEarth at the Property in 2011 and 2012. The first phase was conducted between December 2011 and January 2012 to evaluate the potential for subsurface environmental impacts that may have resulted from RECs identified in SoundEarth's Phase I ESA. Elevated concentrations of TCE were identified in groundwater and soil near a potential source area on the northern half of the Property. A supplemental subsurface investigation was conducted in April 2012 to further evaluate the extent of impacts identified during the initial Phase II ESA.

Elements of the field work included conducting a ground-penetrating radar (GPR) survey for abandoned USTs, conducting a camera survey of accessible sewer lines, advancing 15 directpush soil borings and 20 hollow-stem auger (HSA) borings, completing 15 of the HSA borings as monitoring wells, collecting representative soil and groundwater samples from the borings and wells, and measuring groundwater elevations.

The results of drilling confirmed the presence of glacial till underlying the Property. Soil borings encountered minor amounts of fill and/or reworked native soils overlying very dense silty sand with variable gravel that extended to depths of approximately 27 to 45 feet bgs. The subsurface generally exhibited decreased silt content with greater depth. Wet soil conditions were noted in the borings at elevations of approximately 58 feet (northern end of the site) to 40 feet asl (southern end of the Site). No petroleum odors or sheens were noted. Photoionization detector (PID) readings from soil samples were generally less than 5 parts per million per volume, with most readings showing less than 1.0 part per million by volume. The following summarizes the findings of the 2011–2012 Phase II ESA.

- Groundwater along the south side of Building 2 is impacted by TCE at concentrations exceeding the MTCA Method A cleanup level. Soil is also impacted by TCE on the south and east sides of Building 2 at depths ranging from 20 to 35 feet.
- A concentration of lead slightly exceeding the MTCA Method A cleanup level was detected in a near-surface soil sample collected near Building 1 (the former residence/methamphetamine laboratory) and may be associated with lead paint. Another shallow soil sample collected near Building 1 contained a concentration of lead that was elevated but below the cleanup level.
- Concentrations of benzo(a)pyrene exceeding the MTCA Method A cleanup level were detected in a surface/near-surface soil sample collected in an unpaved area south of Building 4 and in a near-surface sample near Building 1. These detections could be the result of combustion material air-fall from the former coal gasification plant located nearby to the south.
- The GPR survey identified two magnetic anomalies indicating potential heating oil USTs were identified near the former residence on Parcel 2. The anomalies were approximately 4-feet square and identified at depths of approximately 4 feet (typical for heating oil tanks). The potential UST locations indicated by GPR anomalies are shown on Figure 2. No potential USTs were identified in the other areas surveyed.
- A camera survey of the sewer lines at the Property was conducted to identify degraded sewer lines that could potentially release contaminants into the Property subsurface. The sewer leading from the former chromate process room appeared intact; however, a potential hole was observed off the Property near the junction with the main beneath Burke Avenue North. An array of sewer lines shown on City of Seattle sewer cards for the solder room (former machine shop) in Building 2 appear to have been decommissioned. The wave solder area was equipped with a storage tank and pump leading to a ceiling-hung line, apparently discharging to sewer lines on the west side of the building. The sewer discharge for Building 3 could not be traced completely to the building exterior. No line breaks were observed over the traced area. No line breaks were observed in the Building 6 sewer cleanout.

- Two large air compressors were located at the facility. One sample of compressor oil was collected from each compressor and submitted for analysis of polychlorinated biphenyls (PCBs). Neither sample contained detectable concentrations of PCBs.

2.7.2 2013 Supplemental Phase II Soil Assessment

To further evaluate the location and depth of TCE-impacted soil at Building 2, SoundEarth advanced seven shallow interior borings in the soldering room (borings P101 through P105) and former chromate process room (P106 and P107). The interior borings were advanced to refusal by a limited access tractor rig or hand-held probes. Four deep HSA borings were advanced outside Building 2 adjacent to the potential source areas (borings B101 through B104). Borings B101, B103, and B104 were drilled at a 30-degree angle to access areas beneath the buildings. No solvent odors or sheens were noted during sampling. PID readings from soil samples were generally less than 2 parts per million per volume (background levels), with most readings showing less than 0.5 part per million by volume. Analytical results are discussed below.

- A concentration of TCE exceeding the Method A MTCA cleanup level was detected in soil collected at a depth of 9 feet in boring B104. This boring was located approximately 10 feet south of April 2012 boring B14, in which a concentration of 2.8 mg/kg TCE was detected at a depth of 20 feet. TCE was not detected in soil samples collected from boring B102 located 20 to 30 feet northeast of B14 and B104, or in B101 located 40 feet to the southeast. Therefore, the TCE-impacted soil area was likely limited to the B14/B104 area, and possibly extended beneath the northeastern portion of Building 2 (shipping area).
- Soil beneath the former chromate process room at the west end of building did not appear to be impacted by TCE. Four shallow borings (P106, P107, P07, and P08 conducted in January 2012) and deep angle boring B103 did not encounter detectable concentrations of TCE.
- Shallow soil beneath the former soldering room did not appear to be impacted by TCE. Deep angle boring B103, which was advanced beneath the northeast corner of the room, also did not encounter TCE-impacted soil. However, the western half of Building 2 is upgradient to TCE-impacted monitoring well MW04; therefore, TCE-impacted soil appeared to be present in other areas beneath the western half of Building 2.

2.7.3 2013 Supplemental Subsurface Soil Assessment—Loading Dock Area

A subsurface assessment of the Loading Dock area was conducted to further assess the extent and concentrations of TCE in soil at the loading dock area. This included the use of a limited-access, HSA drilling rig. Borings SB201 through SB204 were advanced inside the shipping and receiving room, and boring SB205 was advanced outside in the loading dock parking area. All borings were advanced to a depth of 20 to 22 feet. However, refusal was encountered at a depth of 8 feet in SB202 (gravelly conditions).

Concentrations of TCE slightly exceeding the MTCA Method A cleanup level were detected in soil collected at depths of 15 to 20 feet on the southern half of the shipping and receiving room (Borings SB201 and SB204). Previous soil samples collected from this area that contained detectable TCE were in boring B14 at 20 feet (2.8 mg/kg) and boring B104 at 9 feet (0.12 mg/kg).

TCE and other volatile organic compounds (VOCs) were not detected in any of the other samples that were submitted for analysis from the five borings completed during this investigation.

2.7.4 2013 Groundwater Monitoring

Quarterly groundwater monitoring events were conducted in January, April, and July 2013. The events were conducted to evaluate the environmental quality, flow direction, and gradient of groundwater beneath the Site, and to establish conditions before conducting future remedial activities.

The monitoring events included measuring depths to groundwater in monitoring wells MW01 through MW15. Groundwater samples were typically collected from monitoring wells MW04, MW11, MW12, and MW13, located along North 34th Street; wells MW05, MW06, and MW07, located on the downgradient parcels to the south of 34th Street; and from MW09 in the Building 2 loading dock area.

Groundwater samples were collected in accordance with the U. S. Environmental Protection Agency (EPA) *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures* (April 1996). Purging and sampling of each monitoring well was performed using a bladder pump or peristaltic pump and dedicated polyethylene tubing at low-flow rates. The intake was placed approximately 2 to 3 feet below the surface of the groundwater or mid-screen in each monitoring well. During purging, water quality was monitored using a YSI water quality meter equipped with a flow-through cell. The water quality parameters that were monitored and recorded included; temperature, pH, specific conductance, dissolved oxygen, turbidity, and oxidation-reduction potential. Each monitoring well was purged until a minimum subset of pH, specific conductivity, and dissolved oxygen and/or turbidity stabilized.

Samples were submitted for analysis of VOCs by EPA Method 8260c. Groundwater data for the monitoring periods is summarized in Table 6, with TCE concentrations summarized on Figure 8.

The groundwater contours for each of the quarters indicate groundwater is generally flowing to the south-southeast. Groundwater elevations typically range from 63 feet in MW10 near the northwest corner of the North Block, to 32 feet in MW05 at the southeast corner of the South Block.

For the most recent quarter (Third Quarter/July 2013) gradient flowed south-southeast with an average gradient of 0.07 feet per foot between wells MW10 and MW05. However, groundwater in well MW11, located on the south side of North 34th Street, is consistently several feet lower than expected based on position. This is likely due to the presence of a 132-inch outside-diameter sewer main located beneath North 34th Street. The sewer main is a 1908-vintage brick-lined tunnel with an invert elevation of 26 feet (approximately 50 to 54 feet below grade).

Groundwater analytical results for the all of the monitoring events in 2012 as well as the Quarterly 2013 events are summarized in Figure 8 and Table 6. Third Quarter results are summarized below:

- Concentrations of TCE exceeding the MTCA Method A cleanup level of 5 micrograms per liter (µg/L) were detected in groundwater collected from monitoring wells MW04, MW07, MW09, MW11, MW12, and MW13. The highest concentration of TCE detected was 150 µg/L in MW04.

- The concentration of TCE in well MW13 (37 µg/L) was higher than what was observed during previous rounds of monitoring (TCE ranged from 1.0 to 2.5 µg/L between April 2012 and April 2013).
- Concentrations of TCE in downgradient wells MW05 and MW06 remained below the MTCA Method A cleanup level.
- All other VOCs were below their respective laboratory reporting limits and/or MTCA Method A cleanup levels in the groundwater samples collected during the Third Quarter 2013 groundwater monitoring event).

2.7.5 Slug Testing

Slug testing was conducted on July 10 and 11, 2013, to estimate hydraulic conductivities of the water table aquifer encountered beneath and downgradient of the Property. A total of three wells were tested: MW09, MW12, and MW13. At least one set of both falling head and rising head slug tests were completed and analyzed in each of the wells.

The slug consisted of a 5-foot-long, 1-inch-diameter polyvinyl chloride (PVC) pipe filled with clean sand. Water levels were monitored during the slug tests using an Instrumentation Northwest PT2X vented pressure transducer that incorporates automatic logging of water level data using Instrumentation Northwest software Aqui4Plus. The pressure transducer data logger was programmed to record readings at the following intervals during the tests:

- 0 to 2 minutes: 1 second intervals
- 2 to 5 minutes: 5 second intervals
- 5 to 15 minutes: 15 second intervals
- Greater than 15 minutes: 1 minute intervals.

An electronic water-level meter was also used to obtain periodic manual water-level measurements during the slug tests. Before conducting the tests, each well was opened and allowed to equilibrate with the atmosphere for at least 30 minutes. The pressure transducer was placed at a depth of approximately 1 foot above the bottom of the well. Water levels were monitored after placing the pressure transducer in the well to confirm that the level had re-stabilized before inserting the slug.

The falling head test (slug in) commenced by quickly lowering the slug into the monitoring well until the slug was completely submerged (approximately 1 foot below initial water level). The falling head test continued until the measured water levels returned to within at least 95 percent of the initial water level. The rising head test (slug out) commenced by quickly removing the slug from the well, and monitoring the rising water levels until the levels returned to within at least 95 percent of the water level measured at the start of the test.

All equipment placed in the monitoring wells was decontaminated following similar procedures as used for decontaminating groundwater sampling equipment at the Site. Decontamination water was placed in the designated 55-gallon drum(s) being used on the Property for temporary storage of decontamination and well purge water from other Site field activities.

Following field testing, the water level data were downloaded from the pressure transducers, compiled, and processed for analysis. Data processing included selecting the time interval of interest, reducing the measurement frequency where appropriate, and converting the water levels to displacements (change versus the initial water level). Time series files of the recorded displacements for each test were then exported to AquiferWin32 version 4.05 (Environmental Simulations, Inc. 2012) for analysis.

The Bouwer and Rice (1976) analysis was applied to the resulting rising and falling head (water level) initially in all of the wells. This analytical solution assumes the following:

- Aquifer is confined or unconfined.
- Aquifer is homogeneous and of uniform thickness.
- Aquifer has infinite areal extent.
- Aquifer potentiometric surface is initially horizontal.
- Well fully or partially penetrates the aquifer.
- Groundwater flow to the well is steady.
- A volume of water or slug is instantaneously injected into, or is discharged from, the well.

These aquifer and well assumptions were generally met for the slug testing and analysis with respect to the Site data needs and project objectives. The primary discrepancy with the listed assumptions pertains to the heterogeneous nature of the aquifer.

Estimates of hydraulic conductivity were obtained by manually best-fit matching of the data to a linear line using the AquiferWin32 software program. Effects from the drainage of the sand pack around the well casing, resulting from the incomplete submergence of the well screen were observed and corrected for as noted in Bouwer (1989). The first line is the hydraulic conductivity of the sand pack and the second straight line is the aquifer. Therefore, the second straight line is used for analysis.

Because the screened interval was not fully submerged the falling water-level tests (dropping the slug) will also create artificial results. Water will be able to flow into the vadose zone (area above the water table) instead of into the aquifer, which will also increase hydraulic conductivity. Therefore, for these analyses only the rising water level tests were analyzed.

The time for water levels to recover during slug tests ranged from about 9 to 50 minutes. Average hydraulic conductivity estimates for each of the wells range from about 0.52 to 1.11 feet per day.

Groundwater velocities were calculated for each well based off of the average hydraulic conductivity of the rising test for the given well. A porosity of 0.2 was assumed for calculations. The hydraulic gradient was calculated based off of groundwater elevations taken from April 24 to April 26, 2013. Hydraulic gradients ranged from 0.07 to 0.12 feet per foot and groundwater velocities averaged from 0.31 to 0.66 feet per day.

2.7.6 In Situ Chemical Oxidation Pilot Test

On September 28, 2013, SoundEarth conducted an in situ chemical oxidation pilot (ISCO) test to evaluate the efficacy of ISCO using potassium permanganate as a remedial technology. The ISCO pilot test consisted of injecting eight 150-gallon batches of potassium permanganate into four monitoring wells (MW03, MW04, MW12, and MW13). The wells are located on the north side of North 34th Street, immediately downgradient of TCE impacted areas beneath the former Avtech manufacturing building.

SoundEarth's portable injection skid was used to mix and inject a 2.2 percent potassium permanganate solution. The solution was prepared in the injection skid's 175-gallon batch tank by adding approximately 12.5 kilograms (kg) of potassium permanganate powder to 150 gallons of tap water. Mixing was accomplished by circulating with the skid's 0.5 horsepower pump.

Two 150 gallon batches of 2.2 percent potassium permanganate were injected into each selected monitoring well for a total of 300 gallons and 25 kg permanganate. The injection pressure was approximately 20 pounds per square inch (psi) on each well. The injection skid was capable of injecting at up to 30 psi, but field personnel limited the injection pressure to 20 psi to minimize the injection pressures and maximize flow rate. Each batch was injected in roughly 30 minutes, resulting in an injection flow rate of 5 gallons per minute. No day-lighting or well failure was observed. No groundwater elevation changes were observed in adjacent monitoring wells.

The relatively low injection pressures and high flow rate indicate that large volumes of permanganate solution could be injected with relative ease.

2.7.7 Permanganate Oxidant Demand Testing

The natural oxidant demand of the soil and groundwater at the Site are important parameters to consider when designing a full-scale permanganate ISCO program. Two soil samples of saturated zone soil cuttings collected from borings B-14 and B-18 were sent to Carus Corporation for analysis of permanganate natural oxidant demand. The permanganate natural oxidant demand average of 0.5 grams permanganate per kg dry soil suggests that this Site would be favorable for ISCO with permanganate. A groundwater sample from MW-11 was also sent to Carus Corporation for analysis of permanganate water oxidant demand. The 48-hour permanganate water oxidant demand for the sample was 0.021 grams permanganate per liter of groundwater. Although a moderately high demand, ISCO with permanganate is still recommended. Both the permanganate natural oxidant demand and permanganate water oxidant demand results indicate that the natural oxidant demand at the Site is so low as to be favorable for permanganate ISCO.

2.7.8 Summary of Data Gaps

The borings and monitoring wells completed as part of the RI represent SoundEarth's reasonable efforts to evaluate the Site. The eastern extent of the TCE plume was not bounded along Burke Avenue North. Soils deeper than 6 feet have not been sampled in the former machine shop/soldering room due to overhead drilling limitations. These data gaps will be addressed following building demolition and before the cleanup action. No other data gaps were identified for this RI.

2.8 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) identifies suspected sources of contamination, affected media, transport mechanisms, contaminant fate, potential receptors, and exposure pathways. A CSM serves as a basis for developing technically feasible cleanup alternatives and for selecting a final cleanup action. A CSM is dynamic and may be refined throughout implementation of a cleanup action as additional information becomes available. Figure 9 provides a visual representation of the information presented below.

This section discusses the components of the CSM developed for the Site, based on completion of the various phases of investigation conducted by SoundEarth and others. Included in the following sections is a discussion of the confirmed and suspected source areas, affected media, COCs, contaminant fate and transport, the preliminary exposure assessment, and the CSM summary.

2.8.1 Confirmed and Suspected Source Areas

The source area is the location of a release of the COCs that have affected soil and groundwater quality at the Site. Subsurface investigations conducted at the Site in 2012 and 2013 defined the nature and extent of the COCs in the affected media. The results from subsurface investigations at the Site have identified one primary source area for COCs. The source area is located proximate to the northeast corner of Building 2 and is defined by elevated concentrations of TCE in the soil and groundwater proximate to the Shipping and Receiving Room and a TCE groundwater plume that extends from the monitoring well MW04 to approximately 230 feet downgradient between MW07 and MW05 (Figure 8). The vertical lateral extent of subsurface contamination is presented in Figure 4.

2.8.2 Chemicals of Concern

Based on the findings from the investigations conducted at the Site, the primary COCs for the Site are TCE, PCE, lead and PAHs in soil, and TCE in groundwater.

2.8.3 Media of Concern

Based on results from previous investigations, concentrations of TCE, PCE, lead, and PAHs have been confirmed in soil at the Site at concentrations that exceed applicable MTCA Method A cleanup levels (CULs). Concentrations of TCE have been confirmed in groundwater at concentrations that exceed applicable MTCA Method A CULs. Other than portions of Burke Avenue North immediately north of North 34th Street, the distribution of these contaminants in the affected media has been investigated sufficiently for definition of the Site under MTCA and subsequent evaluation of remedial alternatives.

2.8.4 Conceptual Site Model Summary

Soil and/or groundwater beneath the Site contain concentrations of TCE, PCE, lead and PAHs in soil and TCE in groundwater that exceed applicable MTCA Method A CULs. MTCA exceedances in soil are limited to the areas shown on Figure 7. TCE exceedances in groundwater originating at Building 2 on the north block extend across North 34th Street to the south block of the Avtech facility (Figure 8).

There are two general types of receptors that are potentially at risk from exposure associated with the presence of TCE in soil and groundwater at the Site. The receptors include terrestrial wildlife (birds and burrowing animals) and humans (commercial, utility, construction, and environmental workers). Because the Site qualifies for a Terrestrial Ecological Evaluation exclusion based on WAC 173-340-7491, mitigating the potential human health risk, if any, associated with exposure to TCE in the affected medium at the Site will be the primary objective of any cleanup action implemented. The potential exposure pathways for soil at the Site include direct contact, inhalation of airborne soil, and inhalation of vapors. The potential exposure pathways for groundwater and the potential receptors include direct contact with contaminated groundwater and inhalation of volatile organics. The primary receptors for these exposure pathways include environmental field personal and construction and utility workers. During redevelopment of the Site, direct contact with soil and groundwater, inhalation of airborne soil, and inhalation of vapors pathways are potentially complete for construction, utility, and environmental workers. At the completion of the redevelopment, engineering, institutional controls, and groundwater treatment will eliminate the direct contact and inhalation pathways at the Site for commercial workers and residents.

3.0 TECHNICAL ELEMENTS

The RAOs developed for the Site were used to define the technical elements for the screening evaluation and to select remedial alternatives as part of the feasibility study (FS) conducted for the Site and discussed in Section 4.0, below. The technical elements include ARARs, COCs, media of concern, and cleanup standards.

3.1 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 CULs (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 CULs.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

There are two RAOs for this Site. The first RAO consists of bringing the Property into compliance with the applicable soil and groundwater cleanup criteria for each of the COCs. The second RAO is to bring those portions of the Site located outside of the Property boundary into compliance with soil and groundwater cleanup criteria for each of the COCs and obtain a determination of No Further Action for the Property.

3.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Under WAC 173-340-350 and 173-340-710, applicable requirements 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 regulations define 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(4) will be used to determine if a requirement is relevant and appropriate.

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

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 – <u>Guidance To Be Considered</u>	*Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*, Review DRAFT, October 2009, Publication 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 Code of Federal Regulations [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

Preliminary ARAR	Citation or Source
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

3.3 CHEMICALS AND MEDIA OF CONCERN

The COCs for the Site are those compounds that were detected at concentrations exceeding their respective CULs. The depth of the planned excavation for the Property is expected to incorporate all soil that exhibits COC concentrations exceeding applicable cleanup levels. The soil will be transported off the Site for disposal at an appropriate land disposal site. The media and associated COCs are shown in the table below.

Media of Concern	Chemicals of Concern
Soil	TCE, PCE, lead, PAHs
Groundwater	TCE

NOTES:
PAHs= polycyclic aromatic hydrocarbons
TCE = trichloroethene
PCE = perchloroethene, also known as tetrachloroethene

3.4 CLEANUP STANDARDS

The selected cleanup alternative must comply with the MTCA cleanup regulations specified in WAC 173-340 and with applicable state and federal laws. The CULs selected for those portions of the Site located within the Property boundary and for the greater Site are consistent with the RAOs, which state that the remedial objective is to reduce concentrations of COCs in soil and groundwater beneath the Site to below their applicable groundwater CULs. In addition to mitigating risks to human health and the environment, achieving the RAOs will allow Ecology to issue a certificate of completion for the Property. The associated media-specific CULs for the identified COCs are summarized in the Sections 3.4.1 and 3.4.2 below.

3.4.1 Cleanup Levels

The CULs for the media and COCs are tabulated below, including the source of the cleanup standard. The proposed CUL for impacted soil beneath the Property is the MTCA Method A Standard Formula Value for COCs. The proposed cleanup levels for groundwater at the Site are the MTCA Method A CULs for Unrestricted Land Use for COCs that have a Method A CUL.

Proposed Cleanup Levels for Soil

COC	Cleanup Level (mg/kg)	Source
TCE PCE Lead PAHs	0.030 0.050 250 0.1	MTCA Method A, Unrestricted; WAC 173-340-740(2)(b)(i)

NOTES:
COC = chemical of concern
cPAH = carcinogenic polycyclic aromatic hydrocarbon
mg/kg = milligrams per kilogram
MTCA = Washington State Model Toxics Control Act
WAC = Washington Administrative Code

Proposed Cleanup Levels for Groundwater

COC	Cleanup Level (µg/L)	Source
TCE	5	MTCA Method A, Table Value; WAC 173-340-720(3)(b)(i)

NOTES:
µg/L = micrograms per liter
COC = chemical of concern
MTCA = Washington State Model Toxics Control Act
WAC = Washington Administrative Code

3.4.2 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 CULs have been attained at the defined points of compliance, the impacts present beneath the Site will no longer be considered a threat to human health or the environment.

3.4.2.1 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 MTCA Method A CULs will be overexcavated and removed from the Property.

3.4.2.2 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.

4.0 SELECTED CLEANUP ACTION

This section summarizes the feasible remedial alternatives reviewed during the FS and outlines the components associated with the selected cleanup alternative.

4.1 EVALUATION OF FEASIBLE CLEANUP ALTERNATIVES

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 7 of the RI/FS Report summarizes the remedial component screening process. The remedial components that passed the screening process include the following:

- **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.

- **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. This technology was retained for use with groundwater remedies that will not reduce groundwater concentrations below the vapor intrusion screening level before building occupancy.
- **Permeable Reactive Barrier.** A permeable reactive barrier is an in situ engineering control designed to passively treat contaminated groundwater. Groundwater flows through a permeable reactive barrier wall containing a mixture of zero-valent iron and sand and gravel. The zero-valent facilitates the reduction (dechlorination) of chlorinated compounds dissolved in the groundwater. This technology was retained for further evaluation for the passive treatment of the dissolved-phase plume.
- **Pump and Treat.** Pump and treat is a proven technology for the remediation of dissolved-phase COCs. A pump and treat remediation system includes groundwater extraction wells with submersible pumps and an aboveground treatment technology such as air-stripping or granular activated carbon. The groundwater is extracted, treated, and discharged to the sanitary sewer.
- **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-dichloroethene, 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.
- **Excavation and Land Disposal of Contaminated Soil (Source Removal).** This method involves overexcavation of contaminated soil to remove a significant portion of the ongoing source of COCs to the groundwater (Figures 10 and 11). 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. Source excavation is common to all the remedial alternatives.

4.2 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 two levels of below-ground parking and constructing a multistory apartment building. Most of the Property will be excavated to depths of approximately 10 to 19 feet bgs. The TCE source area will be overexcavated to a depth of approximately 25 feet bgs (elevation 60 feet above mean sea level [msl]). Excavating the Property to this depth will remove all soil exhibiting COCs above the respective cleanup levels, thereby eliminating the principal source of groundwater contamination. Additional soil borings to be conducted on the western side of Building 2 following demolition and prior to commencement of excavation activities may identify deeper TCE-impacted soil. The total depth of the remedial excavation would be revised to reflect the additional soil data if necessary.

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

The three alternatives included the following:

- Cleanup Action Alternative 1, Excavation of Soil with In Situ Chemical Oxidation of Groundwater by Permanganate.
- Cleanup Action Alternative 2, Excavation of Soil with Groundwater Treatment by a Zero Valent Iron Permeable Reactive Barrier.
- Cleanup Action Alternative 3, Excavation of Soil with Groundwater Pump and Treat System.

4.3 SELECTED ALTERNATIVE DESCRIPTION

The alternatives were evaluated in accordance with the MTCA criteria for protectiveness, permanence, long-term effectiveness, short-term risk management, and implementability. Table 7 from the RI/FS Report shows how each cleanup action alternative was evaluated and ranked for each of the MTCA criteria above. All of the cleanup action alternatives provide similar measure of protectiveness for human health and environment as a result of source removal. Cleanup Action Alternative 1 provides the shortest remedial time frame due to the direct oxidation of COCs, is readily implementable, and does not involve long-term operation and maintenance costs. A disproportionate cost analysis was also conducted for the alternatives. Cleanup Action Alternative 1 exhibited the lowest cost-to-benefit analysis compared to competing alternatives.

After performing the comparative analysis and ranking of alternatives, Cleanup Action Alternative 1, Excavation of Soil with In Situ Chemical Oxidation of Groundwater by Permanganate is the recommended alternative. Figure 12 provides an illustration of the conceptual implementation of this cleanup action alternative.

Cleanup Action Alternative 1 entails three successive steps:

(1) Source soil removal as part of the redevelopment excavation.

(2) Overexcavation of additional source soils beneath the redevelopment excavation depth.

(3) Chemical oxidation injections to address residual soil and groundwater contamination beneath the North and South Blocks and the North 34th Street ROW.

This combination of remedial methods is the recommended alternative because it achieves the RAOs, meets the requirements set forth in WAC 173-340-360(3) and WAC 173-340-370, and is the most favorable with respect to the established evaluation and ranking criteria. Cleanup Action Alternative 1 also exhibits the lowest cost-to-benefit ratio compared to the comparative alternatives. Cleanup Action Alternative 1 includes the following components (elevation and depth are presented in feet above msl).

4.3.1 Redevelopment Excavation

Redevelopment of the Site will require lot-line to lot-line excavation of both the North Block and South Block to depths of approximately 10 to 19 feet bgs, which will remove a large portion of TCE mass in the soil. Approximately 1,700 tons of TCE-impacted soil is estimated to be removed as part of the redevelopment excavation. An estimated 240 tons of lead- and PAH-impacted soil is estimated to be removed as well. Impacted soil will be segregated from clean soil and transported for disposal at a permitted Subtitle D landfill.

4.3.2 Remedial Excavation

The depth of the remedial excavation varies between 12 and 6 feet below the redevelopment excavation elevation (60 feet msl). Based on the estimated depth of individual areas, the mass of soil within the remedial excavation area would be approximately 2,100 tons. Soil would be excavated directly loaded into trucks for off-Property land disposal at a permitted Subtitle D landfill.

4.3.3 In Situ Chemical Oxidation

A chemical injection will be completed once the existing buildings have been demolished. A potassium permanganate solution will be injected into approximately 59 wells. Seven of the wells will be drilled and installed in the west half of the Building 2 area following demolition for soil sampling to further assess the source area prior to the remedial excavation described above (pre-excavation boring/well locations shown on Figure 12). Approximately 1,000 gallons will be injected into each injection well. Mixing and injecting will be accomplished by a temporary injection system. The potassium permanganate will chemically oxidize the TCE to non-toxic end products. A second contingency injection is proposed if COCs in compliance monitoring wells remain above the MTCA Method A cleanup levels after 2 years.

4.3.4 Institutional Controls

The removal of all soil contamination via excavation, treatment of groundwater, and the below-ground parking garage slab and venting system will prevent intrusion and/or collection of unsafe levels of COC vapors into the parking garage and above-grade building.

4.4 CLEANUP ACTION OBJECTIVES.

As discussed above, the objectives of the cleanup action for the Site established in consideration of the future use of the Site include the following:

- Excavate soil containing TCE 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 and avoid conflicts with future planned use.
- Acquire No Further Action Likely letters for the Source Property and the Site from Ecology.

5.0 CLEANUP ACTION IMPLEMENTATION PLAN

This section provides a description of the cleanup action components that would be implemented to remediate soil and groundwater beneath the Site containing concentrations of COCs exceeding the cleanup levels.

5.1 CLEANUP ACTION IMPLEMENTATION DOCUMENTS

A detailed Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) were prepared as part of the CAP and are appended to this report. The purpose of the SAP is to ensure that the sample collection, handling, and analysis conducted after completion of the cleanup action will result in data that meet the data quality objectives for the cleanup action at the Site. The SAP includes requirements for sampling activities, including sampling frequency and location, analytical testing, documentation, and quality assurance/quality control for compliance monitoring. The SAP also defines the data quality objectives and standard operating procedures for the cleanup action and details regarding sample collection and analysis, including sample collection procedures, analytical methods, quality assurance/quality control procedures, and data quality reviews (Appendix A).

The purpose of the HASP is to outline the Site-specific health and safety requirements for the cleanup action. The HASP includes guidelines to reduce the potential for injury during implementation of the cleanup action, as well as incident preparedness and response procedures, emergency response and evacuation procedures, local and project emergency contact information, appropriate precautions for potential airborne contaminants and Site hazards, and expected characteristics of the waste generated by the proposed work (Appendix B).

5.2 CONSTRUCTION ACTIVITY SUMMARY, EXCAVATION AND LAND DISPOSAL OF CONTAMINATED SOIL

This section summarizes the construction activities and procedures included in the cleanup action. The excavation contractor will mobilize to the site and set up operational areas necessary to implement the cleanup action. The limits of the remedial excavation are shown on Figures 10 and 11. Site work will generally proceed as described in the following sections.

5.2.1 Site Preparation and Mobilization

Before initiating construction activities, temporary erosion and sediment control (TESC) measures will be established as part of the larger construction excavation project. Once all TESC measures are implemented in accordance with the construction project plan, construction equipment and supplies will be mobilized to the Site.

5.2.2 Demolition and UST Decommissioning

A hazardous materials survey will be completed for all the buildings on the Property before demolition. If abatement measures are necessary, the contractor will perform these activities prior to the demolition of the buildings.

Any USTs encountered will be decommissioned and a UST site assessment will be conducted under the oversight of a Washington State certified UST site assessor. The UST will be removed in accordance with the *Guidance for Site Checks and Site Assessment for Underground Storage Tanks* (Ecology 2003), *Underground Storage Tank Regulations* (WAC 173-360), and *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2011).

5.2.3 Well Decommissioning

Monitoring wells within the footprint of the excavation area will be decommissioned by a licensed well driller or under the supervision of a professional engineer, in accordance with the Ecology Water Well Construction Act (1971), RCW 18.104 (WAC 173-160-460). The wells will be abandoned in place using bentonite clay. A summary of the existing monitoring wells to be decommissioned is provided in Table 7.

5.2.4 Shoring Installation

Shoring will be installed around the entire perimeter of the Site to facilitate redevelopment. The shoring will consist of soil nail walls throughout with the exception of the wall on the north side of the north building, which will be of soldier pile construction. The shoring design will be incorporated into the future development plans and are not presented in this CAP.

5.2.5 Excavation

The bulk excavation will begin after the completion of the following items:

- Installing TESC measures.
- Establishing site security and fencing.
- Demolishing existing buildings.
- Preparing ingress and egress pathways.
- Decommissioning necessary monitoring wells.
- Decommissioning and removal of any USTs encountered.
- Installing the shoring system.

Four excavation areas have been identified for the cleanup action and their soil will be managed and sampled based on the type and extent of contamination (Excavation Area A, B, C1, C2, and D). Excavation Area A, located on the North Block, encompasses TCE-Contaminated soil. Approximately 3,800 tons of TCE-impacted soil and drill cuttings will be excavated and disposed of at a Subtitle D landfill. These soils do not require disposal as listed dangerous waste as determined by Ecology (Contained-in Determination Letter dated February 4, 2014) and will be disposed of as non-hazardous waste following the guidelines outlined in the aforementioned determination. Additional impacted soils may be identified based on the eight pre-excavation borings advanced after building demolition. Excavation Area B, also located on the North Block, encompasses the area where lead-contaminated soil has been encountered. Excavation areas

C1 and C2, located on the North and South Blocks, respectively, encompass the areas where PAH-contaminated soil has been encountered. Excavation Area D, located on the North block, encompasses the area where the GPR survey encountered an anomaly, potentially representing a heating oil UST. The locations of the excavation areas are presented on Figure 10.

Performance soil samples will be periodically collected and submitted to a laboratory for analysis of COCs for characterization and documentation purposes. TCE-impacted soil above Method A cleanup levels within the redevelopment excavation will be removed and disposed of during site preparation and grading activities.

The remedial excavation will commence once the redevelopment excavation is complete on the North Block. Any sidewalls of the remedial excavation deeper than 4 feet will be sloped at a 1:1 maximum slope. The contractor will make an effort to minimize the cross contamination of clean soil during the excavation of the remedial excavation area by directly loading the contaminated soil, if feasible, and minimizing tracking of soil across the site; by establishing site controls, such as tire and truck wash stations and by limiting the excavation daily to only remove contaminated soil to ensure proper decontamination of equipment before excavating clean soil, if feasible.

5.2.5.1 Contingency Plan to Address Unknown Contamination

The presence of aesthetic impacts and conditions encountered by site employees and equipment operators during the construction excavation activities at the site may be indicative of conditions associated with contaminated media. Equipment operators will be instructed to use these criteria to alert the site superintendent and construction manager of potential issues of previously unidentified contamination at the Site, in accordance with the communication plan (Figure 13). Any of the following occurrences are considered common sense criteria that may require a mitigation or remediation response. These criteria include, but are not limited to the following:

- Obvious petroleum staining, sheen, or colored hues in soil or standing water.
- The presence of petroleum products or leachate of other chemicals.
- The presence of utility pipe lines with sludge or trapped liquid indicating petroleum or chemical discharge sludge.
- The presence of buried pipes, conduits, tanks, or unexplained metallic objects or debris.
- Materials with a granular texture that suggests industrial origin.
- Vapors causing eye irritation or nose tingling or burning.
- White, chalky compounds or fine particulate soil layers.
- Presence of gasoline- or oil-like vapor or odor.
- Burnt debris or the presence of slag-like material.

Any criteria identified by on-site personnel will be evaluated and, as appropriate, a sampling plan will be developed to properly characterize and manage the material in accordance with state and federal regulations.

Two subsurface anomalies were observed east of Building 1 during the GPR survey conducted at the Property in 2011. In the event that a previously unidentified UST is encountered during the course of the excavation activities, a UST site assessment will be conducted under the oversight of a Washington State certified UST site assessor, and the UST will be removed in accordance with the *Guidance for Site Checks and Site Assessment for Underground Storage Tanks* (Ecology 2003), *Underground Storage Tank Regulations* (WAC 173-360), and *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2011). In the event that impacts to soil are observed, performance and confirmational soil samples will be collected and analyzed to ensure that the contaminated soil is removed and properly characterized before disposal.

5.2.6 Parking Structure Construction

Construction of the subgrade parking structure will commence after the excavation is completed. Preliminary plans are to construct two levels of below-grade parking with an associated venting system. The concrete shoring and foundation system will be constructed to act as a barrier to recontamination and vapor intrusion from the groundwater plume within the ROWs. Any vapor intrusion into the subgrade parking structure will be further mitigated by the venting system typically incorporated into such structures to avoid buildup of carbon monoxide and petroleum fumes generated by running vehicle engines. The garage venting system will be designed to adequately increase the air exchange rate if vapor intrusion mitigation measures are required in the future.

5.2.7 Construction Activity Summary, Permanganate injection system

Once the final limits of the excavation are reached and prior to the completion of the mat slab foundation floor, the in situ groundwater treatment system will be installed (Figures 12, 14 and 15). The following sections describe the permanganate injection system design, well installation, injection activities, and well decommissioning.

5.2.7.1 Permanganate Injection System Design

The injection wells will be installed assuming a radius of influence of 10-feet along the perimeter of the TCE plume, throughout the source area, and along each side of the North 34th Street ROW. Approximately 1,000 gallons of 3 to 4 percent potassium permanganate solution will be injected into each well. The layout of the system will serve as a barrier to further migration of contaminated groundwater and address the groundwater plume beneath the North and South Blocks and North 34th Street ROW.

The following equation describes the oxidation of TCE ($CHCl_3$) by potassium permanganate ($KMnO_4$):

$$2KMnO_4 + CHCl_3 \rightarrow 2CO_2 + 2MnO_2 + 2K^+ + 2Cl + HCl$$

A stoichiometric ratio of 2:1 permanganate to TCE is required for the chemical mineralization of TCE. In addition to the chlorinated solvent, organics present in the soil and groundwater consume the permanganate. This natural oxidant demand can be quantified as permanganate water oxidant demand (PWOD) and soil oxidant demand (SOD) and are determined in laboratory studies performed by the Carus Corporation. The average SOD was measured to be 0.5 grams of permanganate per kg of dry soil and the average PWOD was 0.021 grams of permanganate per liter of groundwater.

Based on the estimated total mass of TCE in the groundwater plume, the PWOD, and SOD, The mass of permanganate required was conservatively determined to be approximately 20,000 pounds. Approximately 350 pounds of permanganate would be combined with water in 1,000 gallons of 4 percent solution and injected into each point. Actual injection volumes and solution percentages may vary from well to well and will be determined individually based on field conditions.

5.2.7.2 Remediation Injection Well Installation

The remedial well design and specifications are presented on Figure 14. There will be 59 injection wells advanced beneath the North and South Blocks and the North 34th Street ROW to a typical depth of 40 feet bgs. All wells will be completed by a licensed well driller and comply with the requirements of WAC 173-160, Minimum Standards for Construction and Maintenance of Wells.

Each remediation well will be constructed of 2-inch-diameter blank PVC casing, flush-threaded to a 0.010-inch slotted well screen. The bottom of each of the wells will be fitted with a threaded PVC bottom cap, and the top of each well will be fitted with a PVC female adapter and threaded plug. A hose from the permanganate injection system will attach to the injection well head.

Each remediation well will be completed with a grout/bentonite seal extending down from the top of casing, which will be the approximate elevation at the base of the excavation. The annulus of the remediation wells will be filled with #10/20 silica sand extending from the bottom of the bentonite seal to total depth. The well completion will be recorded in boring logs, examples of which are provided in Appendix A.

The injection wells will be developed by SoundEarth field staff with the use of an electric submersible pump or bailer and will consist of surging and purging until a minimum of five well volumes are removed and the groundwater no longer appears turbid. Turbidity will be measured visually by field staff conducting development activities. The installation of the injection wells will occur concurrently with construction activities. The estimated remedial time frame for groundwater restoration is 1 year following the final injection event.

SoundEarth will collect soil and groundwater compliance samples from 7 of the new wells during installation. The analytical results will be analyzed to confirm the CSM, which due to existing buildings has not fully defined the source or depth of groundwater contamination. The field program for remedial implementation at the Site would be modified in accordance with that data discussion and its conclusions.

5.2.7.3 Permanganate Injection System

To mix and inject approximately 59,000 gallons of permanganate solution, a temporary system will be constructed on site. The system will consist of a mixing pump, injection pump, batch tank, injection manifold, and ancillary piping and controls, as shown on Figure 15. The pumps, control panel and manifold will be constructed off-site prior to injection field work. Dry potassium permanganate will be mixed and injected in up to 10 wells at once. The anticipated injection flow rate determined from the pilot test conducted on September 28, 2013, is approximately 5 gallons per minute per well. SoundEarth anticipates injecting the entire volume in 2 weeks, outside of unforeseen hydraulic refusal or equipment failures. Initial injections will occur on the North Block. The system will then be disassembled and moved to the South Block.

5.2.7.4 Injection and Monitoring Well Decommissioning

Upon completion of the permanganate injection activities, all the injection wells will be retained during the construction process. These wells may be utilized for future contingency permanganate injections, if needed. Once the required confirmational monitoring is complete, the compliance monitoring wells and injection wells will be decommissioned in place with bentonite clay in accordance with the Ecology Water Well Construction Act (1971), RCW 18.104 (WAC 173-160-460).

6.0 COMPLIANCE MONITORING

There are three types of compliance monitoring identified for remedial cleanup actions performed under MTCA (WAC 173-340-410): protection, performance, and confirmational monitoring. A paraphrased definition for each is presented below (WAC 173-340-410[1]). Additional details regarding procedures for sample collection, handling, and quality assurance procedures are included in the SAP and HASP, which are attached to this report as Appendices A and B, respectively.

- **Protection Monitoring.** To evaluate whether human health and the environment are adequately protected during construction and the operation and maintenance period of an interim action or cleanup action.
- **Performance Monitoring.** To document that the interim action or cleanup action has attained cleanup standards.
- **Confirmational Monitoring.** To evaluate the long-term effectiveness of the interim action or cleanup action once cleanup standards or other performance standards have been attained.

6.1 PROTECTION MONITORING

A HASP has been prepared for the cleanup action that meets the minimum requirements for such a plan identified in federal (29 CFR 1910.120, and 1926) and state regulations (WAC 296). The HASP identifies all known physical, chemical, and biological hazards; hazard monitoring protocols; and administrative and engineering controls required to mitigate the identified hazards (Appendix B).

6.2 PERFORMANCE MONITORING

Performance monitoring includes the collection of soil samples from the sidewalls and floor of the remedial excavation, the collection of soil samples during excavation and removal of any previously unidentified contamination, and the collection of quarterly groundwater samples from the points of compliance.

6.2.1 Soil Performance Monitoring

Performance monitoring for soil will be conducted during remedial excavation activities and will be used to direct advancement of the excavation. Soil samples will be collected directly from the sidewalls and/or bottom of the remedial excavation area A detailed scope for monitoring, sampling, and analysis is discussed in the SAP (Appendix A). The analytical results will be used to assess when the points of compliance for soil have been achieved.

6.2.2 Groundwater Performance Monitoring

Upon completion of the excavation, and chemical oxidation injection, the Site groundwater will be monitored for approximately 5 years. The existing network of groundwater monitoring wells around the perimeter of the Property will be sampled quarterly for 5 years to evaluate the reduction of dissolved-phase chlorinated VOCs in groundwater across the Site. Groundwater conditions will be evaluated 2 years, or 8 quarters, after cleanup action to determine whether a second chemical oxidation injection is required to address any residual soil and groundwater contamination. Groundwater samples will be submitted to the laboratory and analyzed for COCs, as discussed in detail in Appendix A. The analytical results will be used to assess when the points of compliance for groundwater have been achieved. In addition to monitoring for COCs, groundwater samples will be analyzed for the following parameters: pH, dissolved oxygen, oxidation-reduction potential, dissolved manganese, and chloride.

6.2.3 Waste Profiling

Wastes generated during the remedial activities will require analytical testing before disposal. Generally, the treatment, storage, and disposal facility (TSDF) receiving the waste specifies the minimum number of samples and analyses before accepting wastes from a Site. Wastes that will be generated from the remedial action and destined for off-Site disposal include the following:

- Soil contaminated with PCE, TCE, lead and benzo(a)pyrene
- Contaminated groundwater from construction stormwater
- Contaminated personal protective equipment
- Decontamination solutions
- Miscellaneous solid wastes

Each waste stream will be profiled separately, in accordance with the minimum waste analyses requirements of the respective permitted TSDF. Excavated contaminated soil will be subjected to performance monitoring. If unforeseen soil conditions are encountered, additional waste profiling may be required to ensure proper classification and disposal.

6.3 CONFIRMATIONAL MONITORING

Confirmational monitoring will begin after the analytical data from the performance monitoring indicates that cleanup objectives have been achieved.

6.3.1 Soil Confirmational Monitoring

Confirmational soil monitoring is proposed for the remedial excavation area. For soil management purposes, the remedial excavation has been split into five areas:

A: TCE source area soil

B: Lead-impacted soil

C1: PAH-impacted soil on the North Block of the Site

C2: PAH-impacted soil on the South Block of the Site

D: Potential TPH-impacted soil in the vicinity of the suspected heating oil UST

Briefly, confirmation soil samples in Area A will be collected using a grid spacing of 25 feet. Bottom samples will be collected in the middle of each grid and sidewall samples collected at 25-foot intervals. Five-point composite soil samples will be collected from each of areas B, C1, C2, and D. The SAP (Attachment A) presents a detailed scope for soil confirmational sampling.

6.3.2 Groundwater Confirmational Monitoring

It is anticipated that the Site groundwater quality will be improved by virtue of removing the source area from the Property; any residual contamination will be addressed by in situ chemical oxidation by permanganate. To confirm the effectiveness of the cleanup action on groundwater quality, groundwater samples will be collected on a quarterly basis. Once four quarters of clean (e.g., concentrations of COCs are below their respective cleanup levels), post-remediation groundwater analytical data are achieved, the groundwater beneath the Site will be considered to be compliant with MTCA.

7.0 EXPECTED RESTORATION TIME FRAME

The remedial time frame is based on our experience with numerous remedial excavation and chemical oxidation injection sites. The proposed cleanup action involves source removal and in situ chemical oxidation. The network of groundwater monitoring wells around the perimeter of the Property and several on-Property compliance wells will be sampled quarterly to evaluate the reduction of dissolved-phase COCs in groundwater across the Site. Groundwater conditions will be evaluated 2 years, or 8 quarters, after the cleanup action to determine whether a second chemical oxidation injection is required to address residual groundwater contamination. It is expected that the initial injection event will adequately the dissolved-phase plume and no further injection or monitoring will be required.

8.0 DOCUMENTATION REQUIREMENTS

Documentation of the interim cleanup action is necessary to meet MTCA requirements. The applicable and relevant documentation generated for the interim cleanup action will be submitted to Ecology for review and approval. Copies of the documents will be retained in SoundEarth's files for a minimum of 3 years after completion of the interim cleanup action.

8.1 DOCUMENTATION MANAGEMENT

An established document control system to be implemented during the cleanup action includes the following elements, as appropriate: field report forms, excavation logs, sample summary forms, material import and export summary forms, groundwater purge and sample forms, sample chain-of-custody forms, waste inventory documentation, waste management labels, and sample labels. Disposal manifests for the waste generated during the cleanup action will be maintained and submitted with the project documentation.

8.2 WASTE DISPOSAL TRACKING

Specific documentation requirements will be met for transportation and disposal of the contaminated soil and groundwater during the excavation activities to ensure compliance with state and federal regulations. The waste disposal tracking documentation includes analytical data, waste profiles, waste manifests, and bills of lading.

8.3 COMPLIANCE REPORTS

A cleanup action progress report will be prepared following completion of the excavation activities to demonstrate compliance for soil at the points of compliance defined for the Site. At a minimum, the report will include the following:

- A description of the excavation and construction activities and the installation and operation of the injection system and associated piping.
- Documentation of waste disposal tracking for the excavated soil, generated wastewater, and other associated materials.
- A figure depicting the final limits of the remedial excavation and the soil sample locations, as applicable.
- A summary of compliance monitoring analytical results.
- A description of planned work and deliverables for the confirmational monitoring elements of the cleanup action.

A closure report will be prepared following completion of the final annual groundwater monitoring event. The closure report will include the following:

- A description of the groundwater monitoring activities.
- A summary of the compliance sampling analytical results for groundwater for samples collected during quarterly groundwater monitoring, including summary tables.
- A figure depicting primary Site features and points of compliance/monitoring well locations.
- SoundEarth's conclusions pertaining to the cleanup action following the completion of confirmational groundwater monitoring.

When the compliance reports have been finalized, the reports will be submitted to Ecology for review and approval, and a Certificate of Compliance will be requested for the Property.

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10.0 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 Site 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

SoundEarth Strategies

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DATE: 08/30/13
DRAWN BY: BLR
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_FIG1

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

FIGURE 1
PROPERTY LOCATION MAP

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\0789-004_2014CAP_FIG1_F.DWG

3/12/2014

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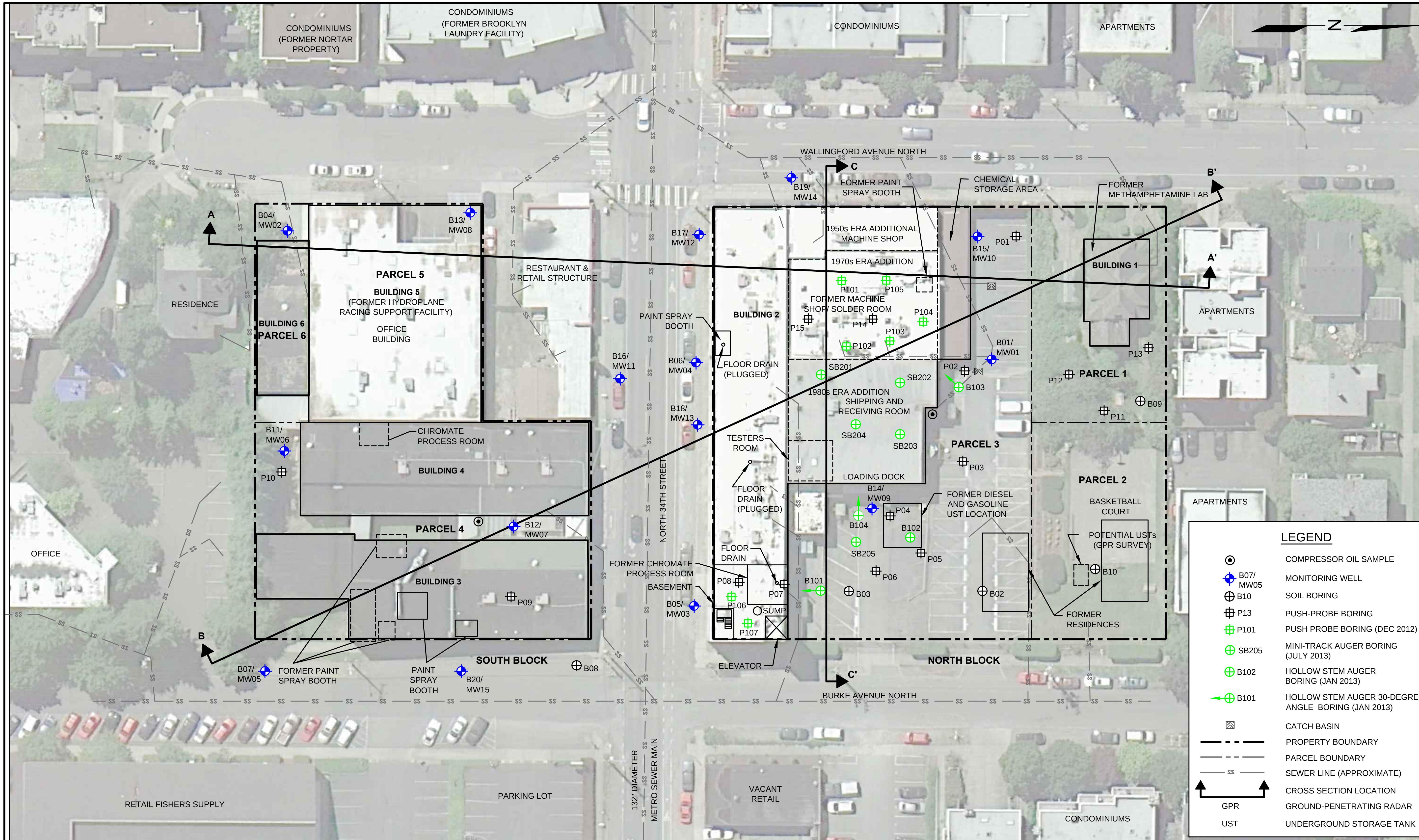

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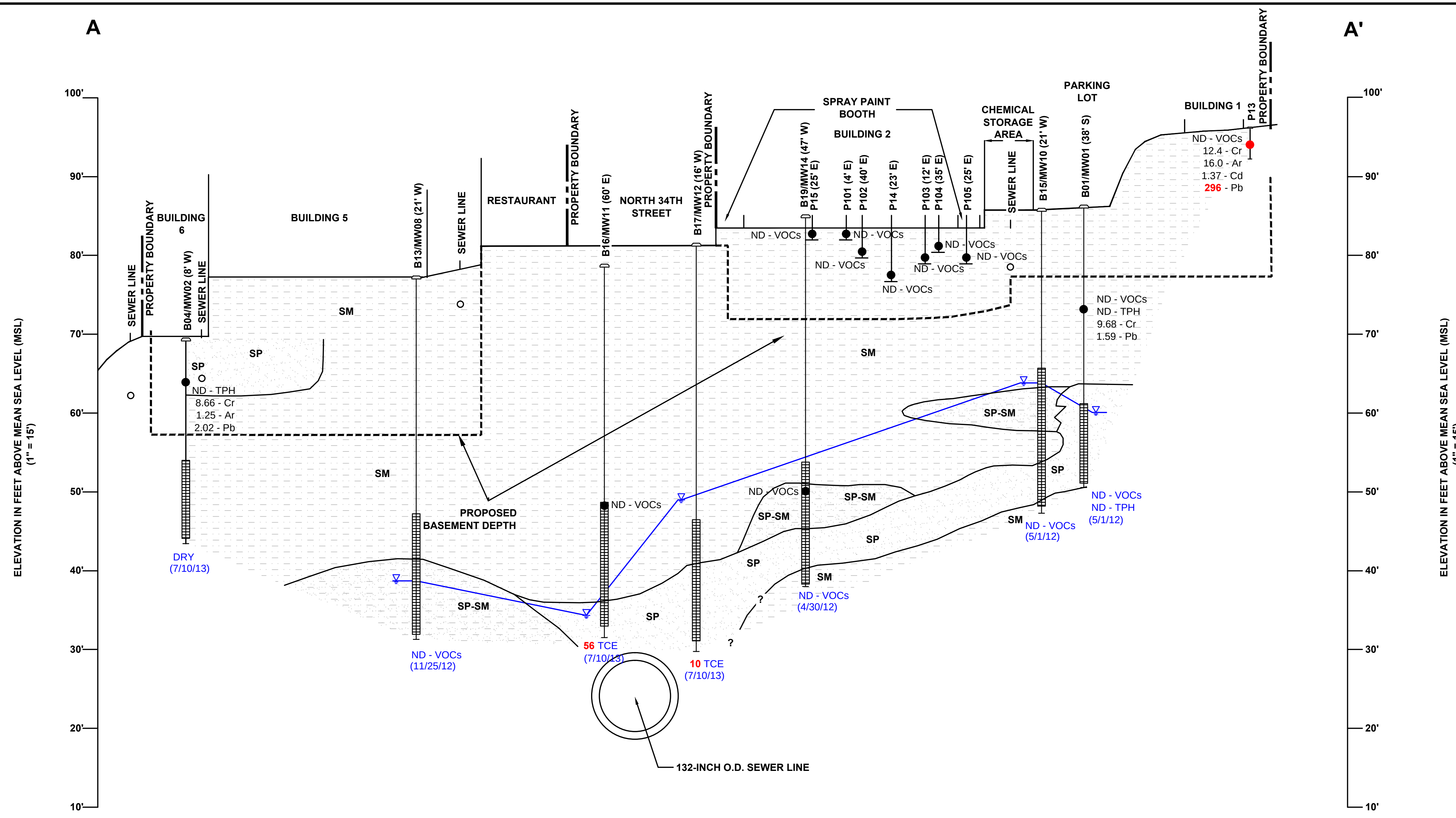
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 2
PROPERTY AND EXPLORATION LOCATION PLAN



LEGEND

(8' W) OFFSET 8' WEST

MONITORING WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (APRIL 2012)

SP - FINE SAND

SM - SILTY-FINE SAND

CONCENTRATIONS OF CHEMICALS OF CONCERN IN SOIL (mg/kg):

- ● CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL
- ● CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

SOIL RESULTS (mg/kg):

VOCs	VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
12.4	CHROMIUM (Cr)
16.0	ARSENIC (Ar)
1.37	CADMIUM (Cd)
296	LEAD (Pb)

GROUNDWATER RESULTS (µg/L):

VOCs	VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
(7/10/13)	MOST RECENT SAMPLING DATE

mg/kg	MILLIGRAMS PER KILOGRAM
µg/L	MICROGRAMS PER LITER
RED	DENOTES CONCENTRATIONS EXCEEDING MTCA METHOD A CLEANUP LEVELS
ND	NOT DETECTED
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
TCE	TRICHLOROETHENE

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REGION:

0 25 50 100
APPROXIMATE HORIZONTAL SCALE IN FEET
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FIGURE 3
GEOLOGIC CROSS SECTION A-A'

3/12/2014
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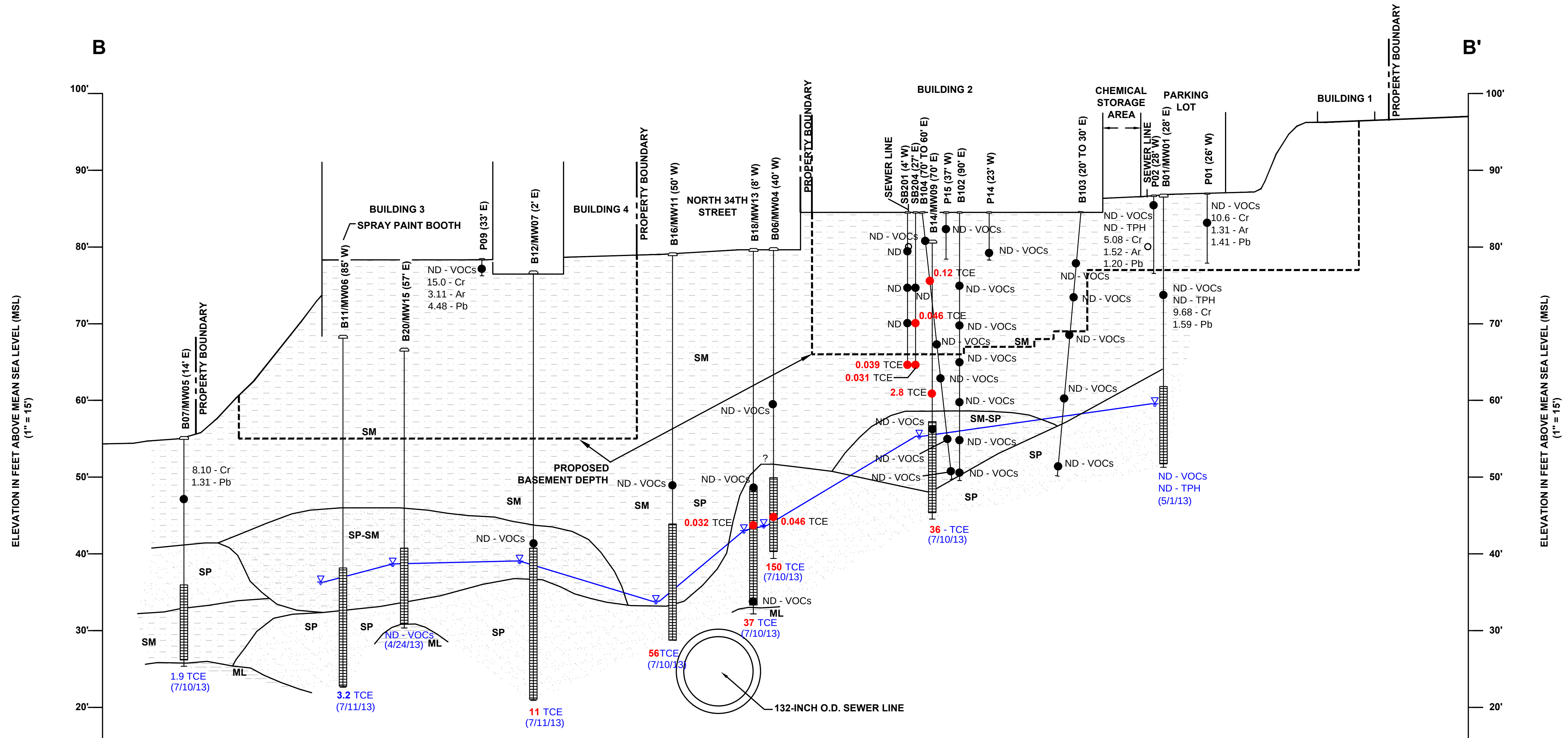

LEGEND

ML - SILT

SP - FINE SAND

SM - SILTY-FINE SAND

(8' W) OFFSET 8' WEST

MONITORING WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (APRIL 2012)

CONCENTRATIONS OF CHEMICALS OF CONCERN IN SOIL (mg/kg):

● CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL

● CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

SOIL RESULTS (mg/kg):

VOCs	VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
15.0	CHROMIUM (Cr)
3.11	ARSENIC (Ar)
4.48	LEAD (Pb)

GROUNDWATER RESULTS (µg/L):

VOCs	VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
(7/10/13)	MOST RECENT SAMPLING DATE

mg/kg	MILLIGRAMS PER KILOGRAM
µg/L	MICROGRAMS PER LITER
RED	DENOTES CONCENTRATIONS EXCEEDING MTCA METHOD A CLEANUP LEVELS
ND	NOT DETECTED
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
TCE	TRICHLOROETHENE

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0 25 50 100
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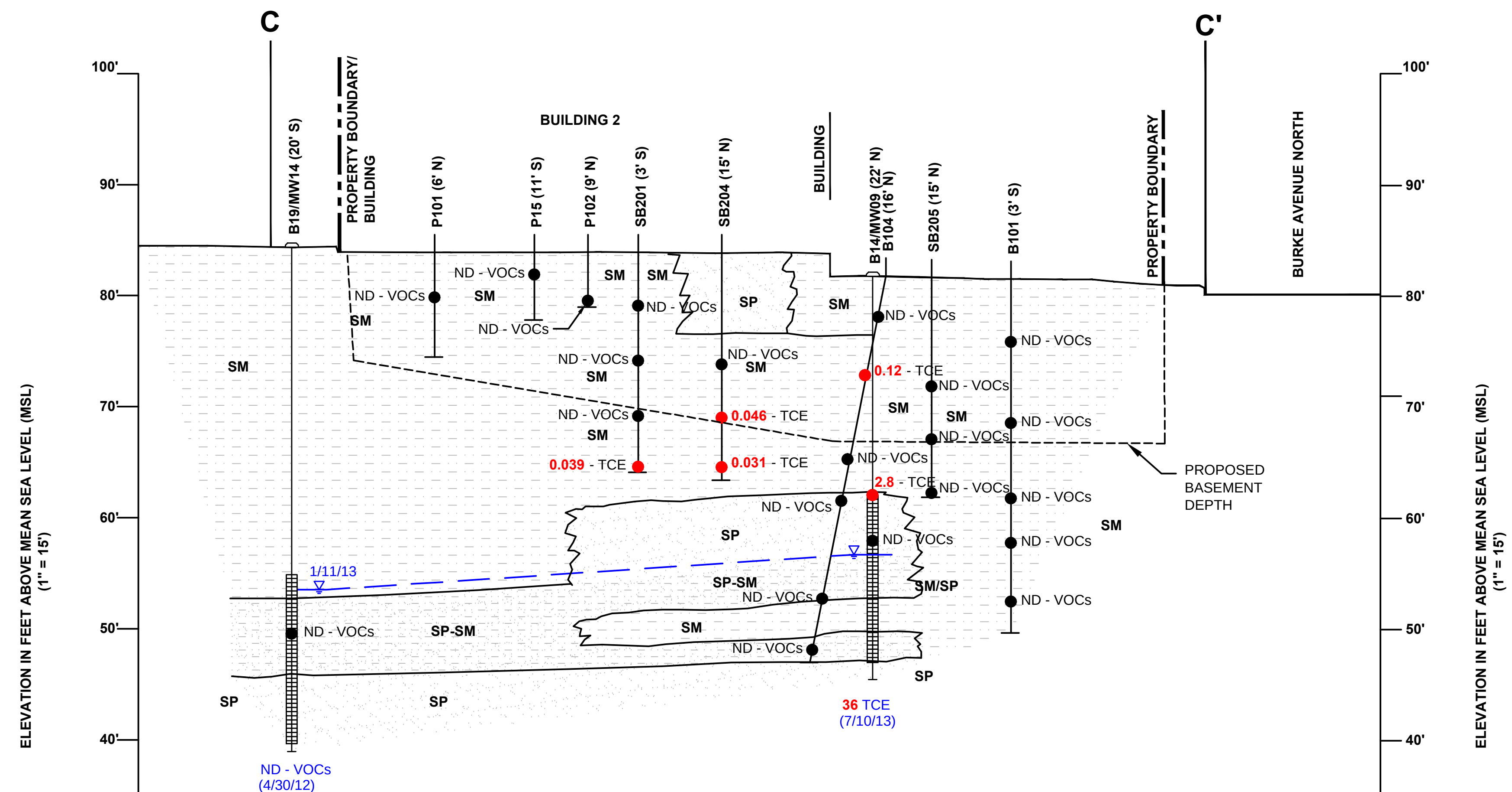
FIGURE 4
GEOLOGIC CROSS SECTION B-B'



LEGEND

(6' N) OFFSET 6' NORTH

MONITORING WELL

SCREEN INTERVAL

GROUNDWATER LEVEL (1/11/2013)

SP - FINE SAND

SM - SILTY-FINE SAND

ML - INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS

CONCENTRATIONS OF CHEMICALS OF CONCERN IN SOIL (mg/kg):

● CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL

● CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

SOIL RESULTS (mg/kg):

VOCs	VOLATILE ORGANIC COMPOUNDS
TCE	TRICHLOROETHYLENE

GROUNDWATER RESULTS (µg/L):

VOCs	VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
(7/10/13)	MOST RECENT SAMPLING DATE

mg/kg	MILLIGRAMS PER KILOGRAM
µg/L	MICROGRAMS PER LITER
RED	DENOTES CONCENTRATIONS EXCEEDING MTCA METHOD A CLEANUP LEVELS
ND	NOT DETECTED
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
TCE	TRICHLOROETHYLENE

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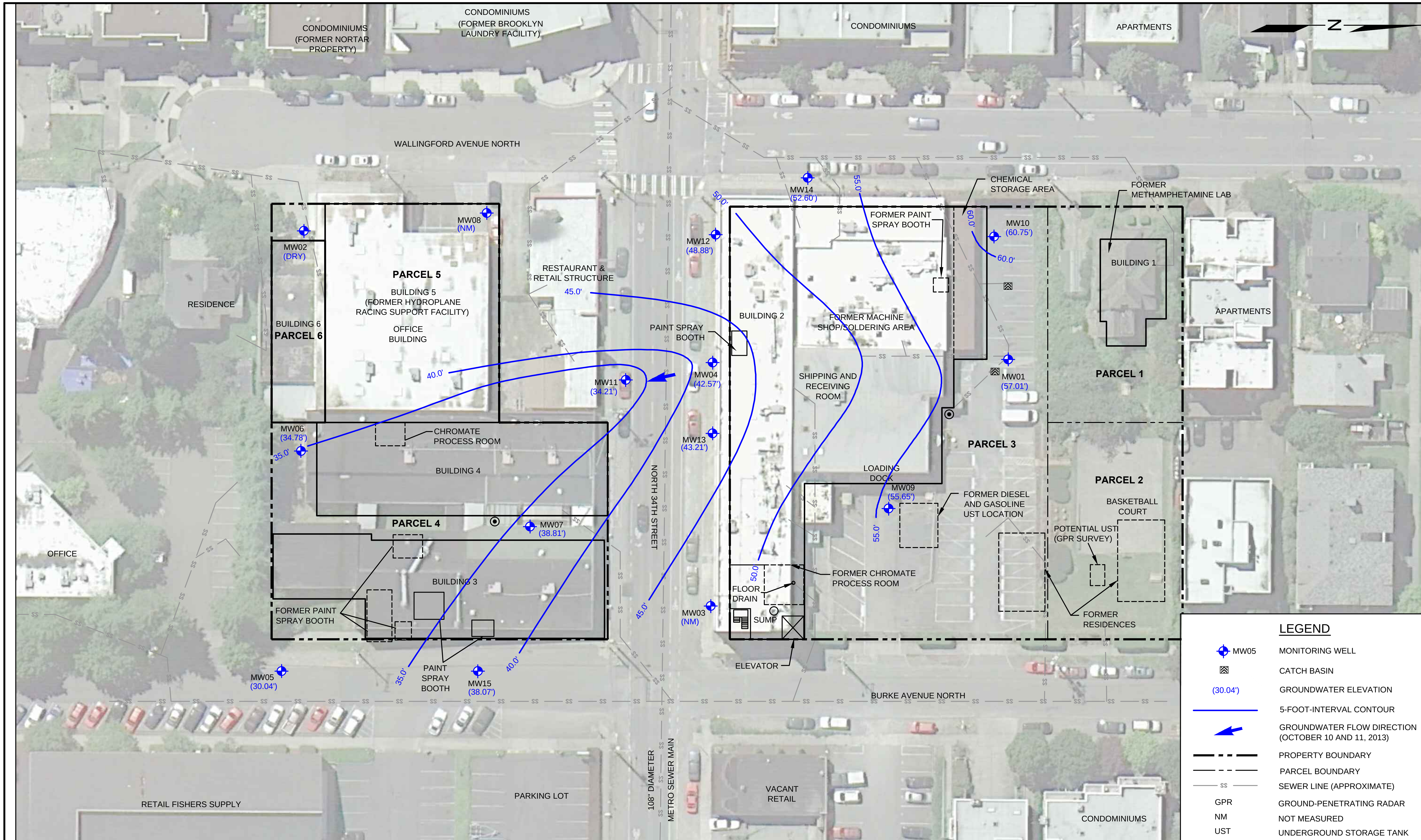
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE HORIZONTAL SCALE IN FEET
NOT FOR CONSTRUCTION OR ENGINEERING PURPOSES

FIGURE 5
GEOLOGIC CROSS SECTION C-C'



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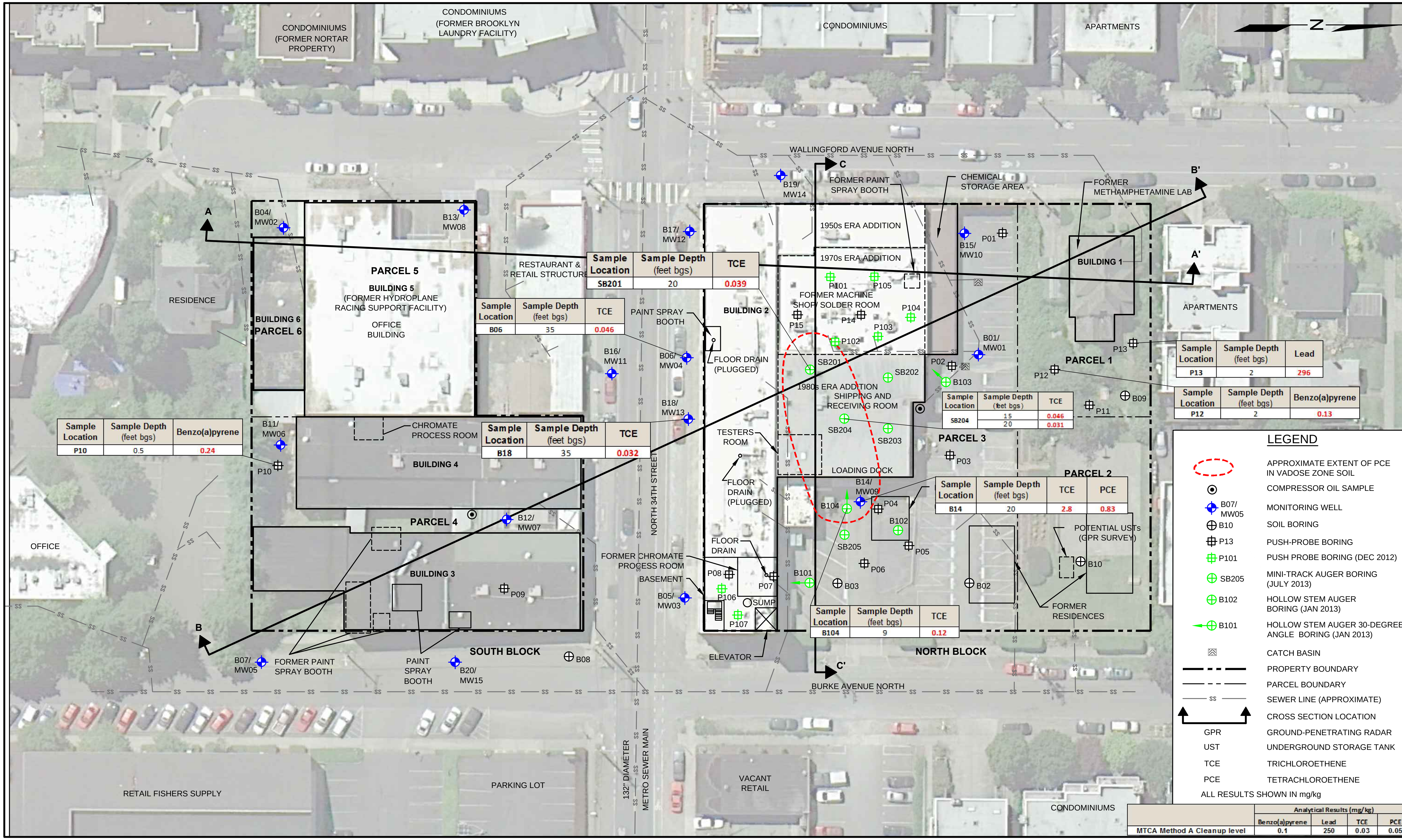
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 6
GROUNDWATER CONTOUR MAP
(OCTOBER 10 AND 11, 2013)



Sample Location	Sample Depth (feet bgs)	TCE
SB201	20	0.039

Sample Location	Sample Depth (feet bgs)	TCE
B06	35	0.046

Sample Location	Sample Depth (feet bgs)	TCE
B18	35	0.032

Sample Location	Sample Depth (feet bgs)	Benzo(a)pyrene
P10	0.5	0.24

Sample Location	Sample Depth (feet bgs)	Lead
P13	2	296

Sample Location	Sample Depth (feet bgs)	Benzo(a)pyrene
P12	2	0.13

Sample Location	Sample Depth (feet bgs)	TCE
SB204	15	0.046
	20	0.031

Sample Location	Sample Depth (feet bgs)	TCE	PCE
B14	20	2.8	0.83

Sample Location	Sample Depth (feet bgs)	TCE
B104	9	0.12

	Analytical Results (mg/kg)			
	Benzo(a)pyrene	Lead	TCE	PCE
MTCA Method A Cleanup level	0.1	250	0.03	0.05

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PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 7
MTCA EXCEEDANCES IN SOIL

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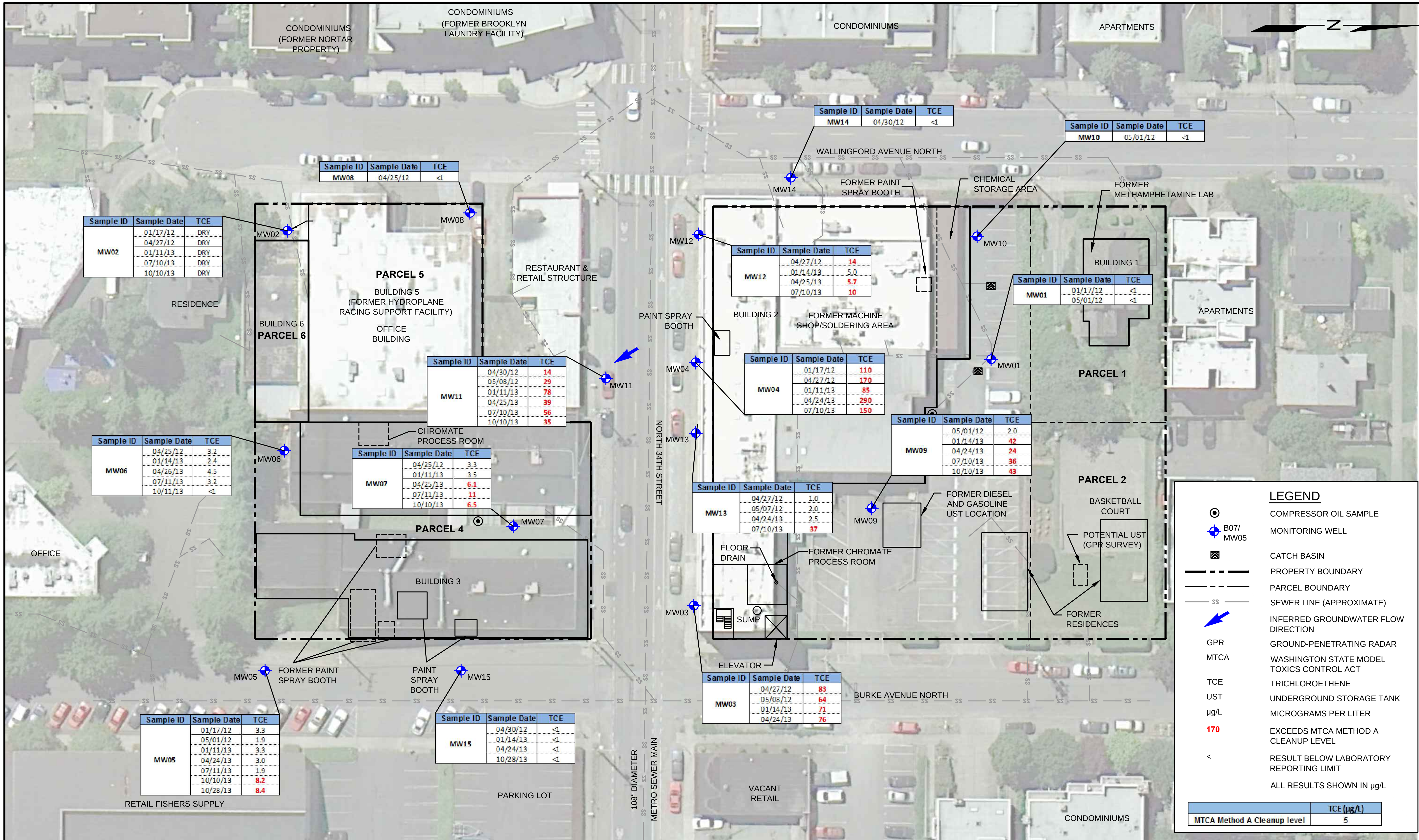

Sample ID	Sample Date	TCE
MW14	04/30/12	<1

Sample ID	Sample Date	TCE
MW10	05/01/12	<1

Sample ID	Sample Date	TCE
MW08	04/25/12	<1

Sample ID	Sample Date	TCE
MW02	01/17/12	DRY
	04/27/12	DRY
	01/11/13	DRY
	07/10/13	DRY
	10/10/13	DRY

Sample ID	Sample Date	TCE
MW12	04/27/12	14
	01/14/13	5.0
	04/25/13	5.7
	07/10/13	10

Sample ID	Sample Date	TCE
MW01	01/17/12	<1
	05/01/12	<1

Sample ID	Sample Date	TCE
MW11	04/30/12	14
	05/08/12	29
	01/11/13	78
	04/25/13	39
	07/10/13	56
	10/10/13	35

Sample ID	Sample Date	TCE
MW04	01/17/12	110
	04/27/12	170
	01/11/13	85
	04/24/13	290
	07/10/13	150

Sample ID	Sample Date	TCE
MW06	04/25/12	3.2
	01/14/13	2.4
	04/26/13	4.5
	07/11/13	3.2
	10/11/13	<1

Sample ID	Sample Date	TCE
MW09	05/01/12	2.0
	01/14/13	42
	04/24/13	24
	07/10/13	36
	10/10/13	43

Sample ID	Sample Date	TCE
MW07	04/25/12	3.3
	01/11/13	3.5
	04/25/13	6.1
	07/11/13	11
	10/10/13	6.5

Sample ID	Sample Date	TCE
MW13	04/27/12	1.0
	05/07/12	2.0
	04/24/13	2.5
	07/10/13	37

Sample ID	Sample Date	TCE
MW03	04/27/12	83
	05/08/12	64
	01/14/13	71
	04/24/13	76

Sample ID	Sample Date	TCE
MW05	01/17/12	3.3
	05/01/12	1.9
	01/11/13	3.3
	04/24/13	3.0
	07/11/13	1.9
	10/10/13	8.2
	10/28/13	8.4

Sample ID	Sample Date	TCE
MW15	04/30/12	<1
	01/14/13	<1
	04/24/13	<1
	10/28/13	<1

	TCE (µg/L)
MTCA Method A Cleanup level	5

3/14/2014

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CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_TCE

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CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 8
GROUNDWATER TCE RESULTS

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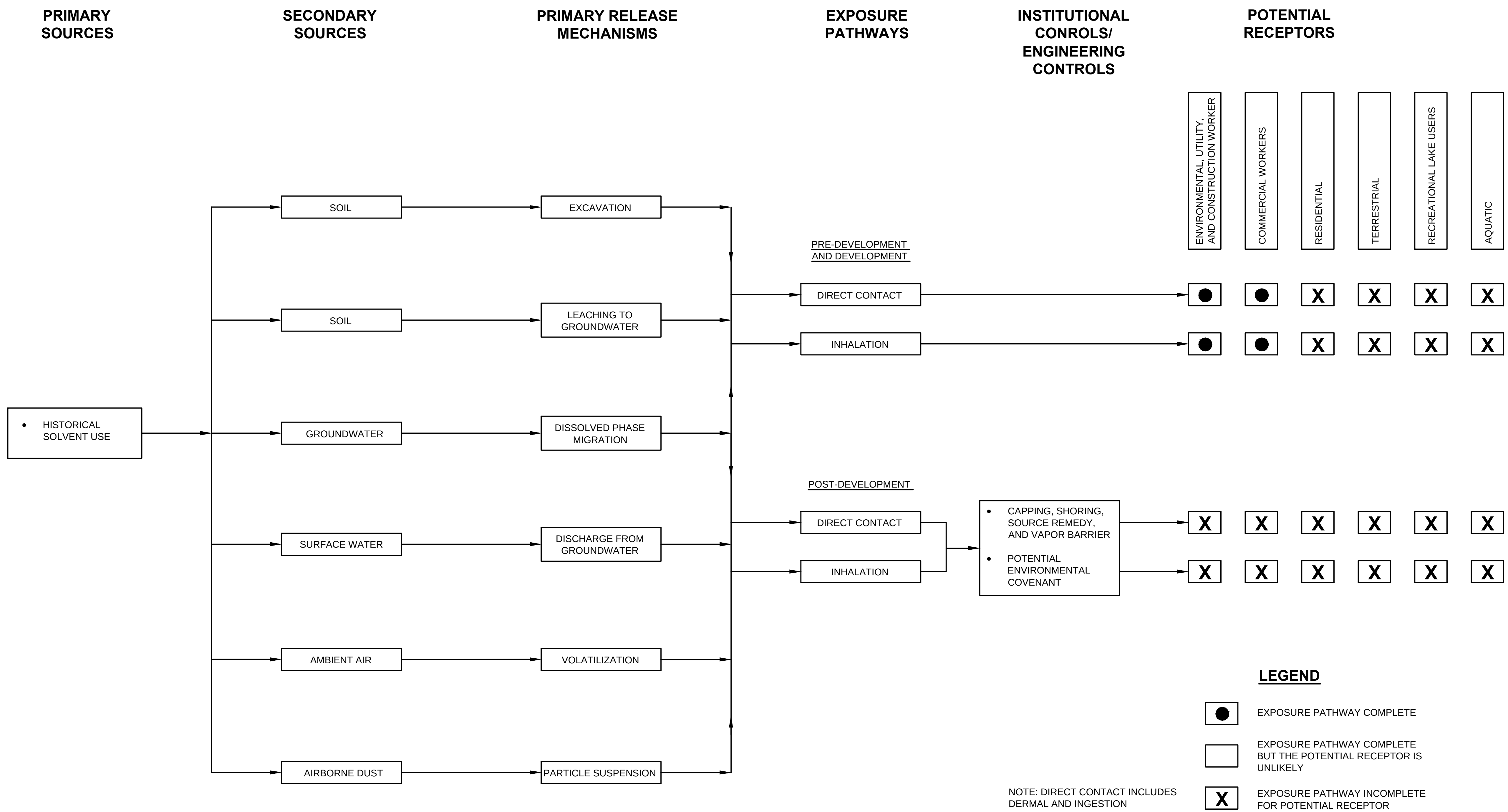

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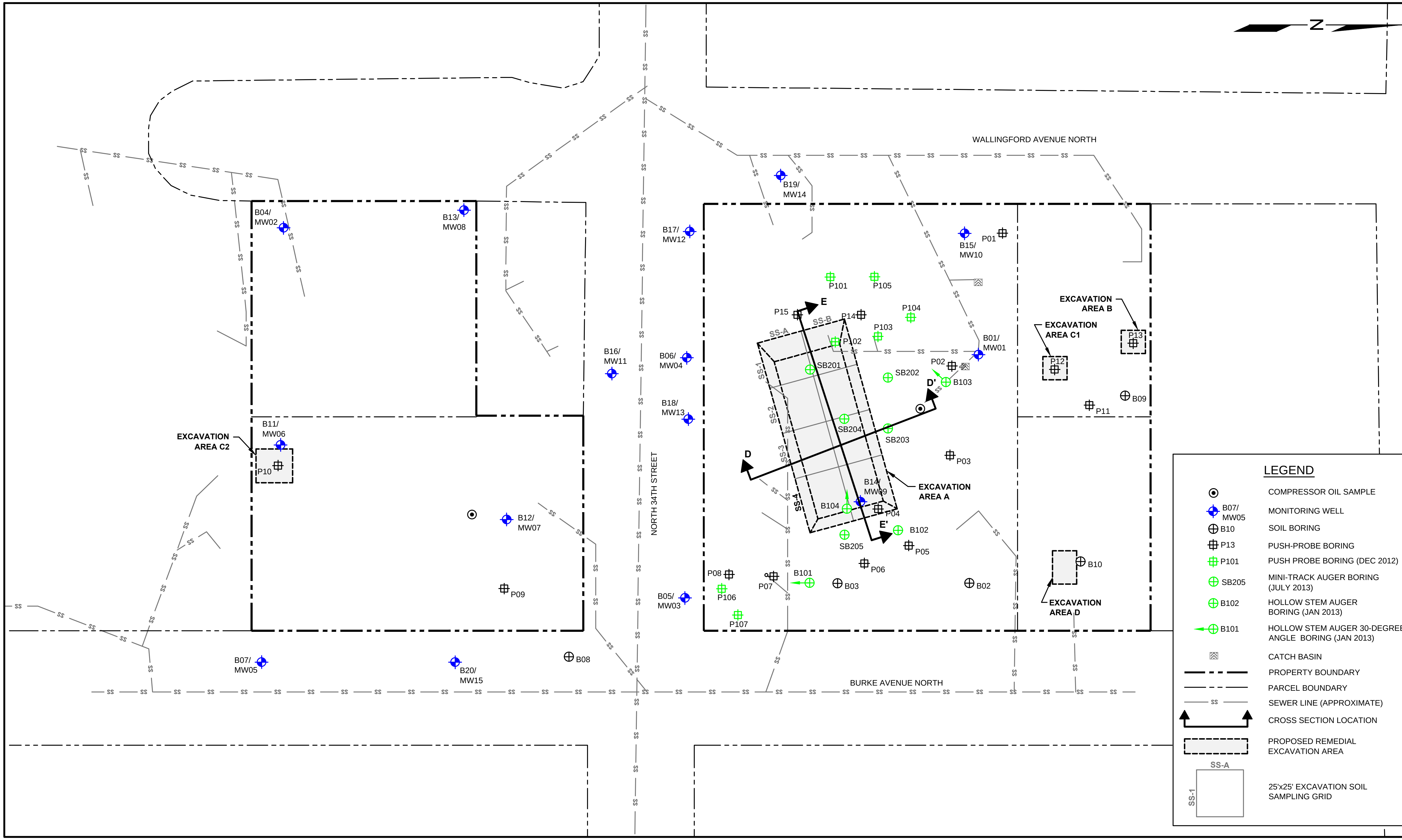
CITY, STATE: SEATTLE, WASHINGTON

REGION:

NOT TO SCALE

FIGURE 9
PRELIMINARY CONCEPTUAL SITE MODEL

3/14/2014



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CAD FILE: 0789-004_2014CAP_EXCA

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PROJECT NUMBER: 0789-004
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 10
PROPOSED REMEDIAL EXCAVATION AREAS

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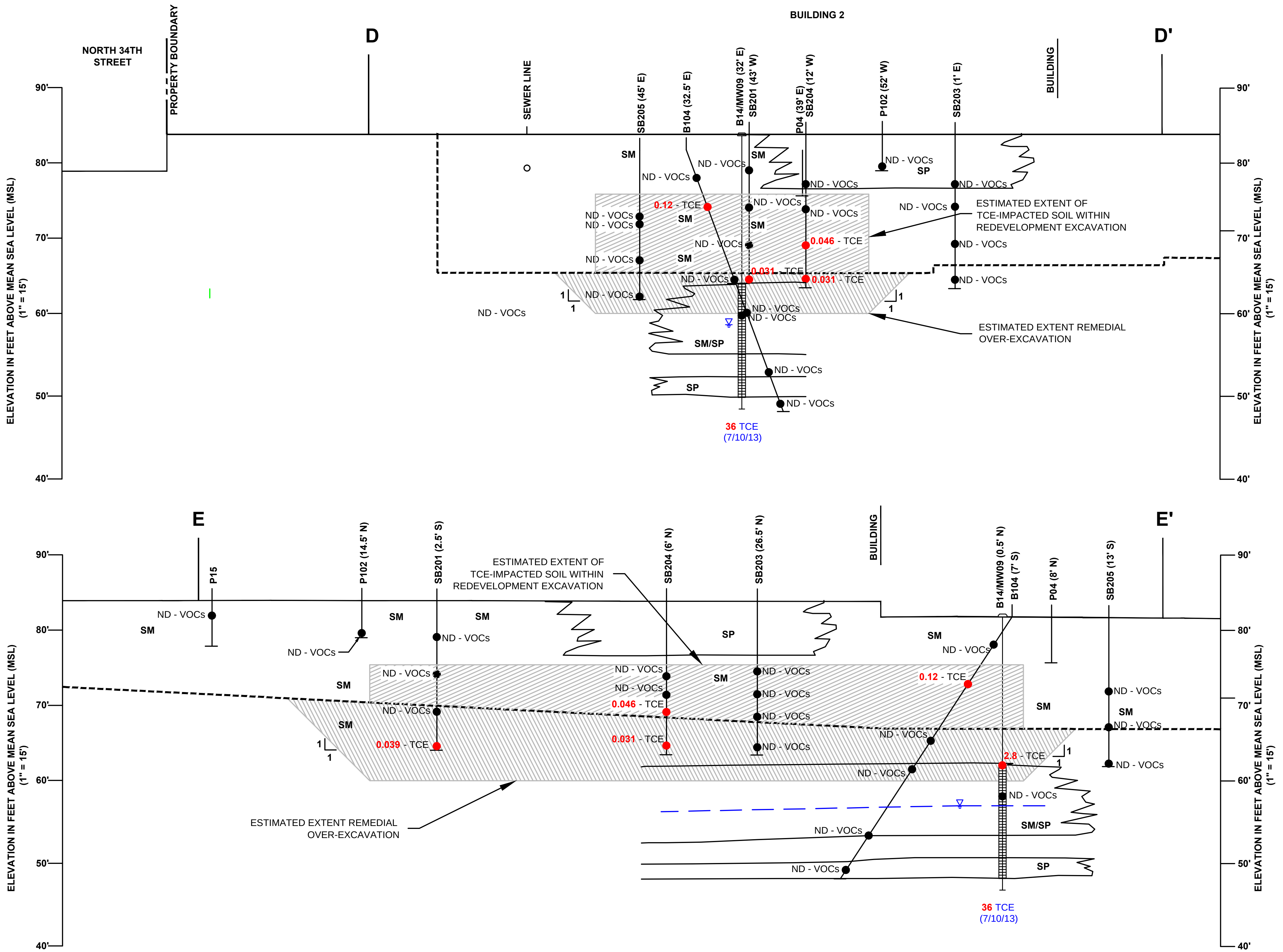

LEGEND

(6' N)	OFFSET 6' NORTH
	MONITORING WELL
	SCREEN INTERVAL
	GROUNDWATER LEVEL (1/11/2013)
	SP - FINE SAND
	SM - SILTY-FINE SAND
	DEVELOPMENT REMEDIAL EXCAVATION
	REMEDIAL OVER-EXCAVATION
	PROPOSED BASEMENT ELEVATION

CONCENTRATIONS OF CHEMICALS OF CONCERN IN SOIL (mg/kg):

- ● CONCENTRATION BELOW MTCA METHOD A CLEANUP LEVEL
- ● CONCENTRATION ABOVE MTCA METHOD A CLEANUP LEVEL

SOIL RESULTS (mg/kg):

VOCs	VOLATILE ORGANIC COMPOUNDS
TCE	TRICHLOROETHENE

GROUNDWATER RESULTS (µg/L):

VOCs	VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
(7/10/13)	MOST RECENT SAMPLING DATE
mg/kg	MILLIGRAMS PER KILOGRAM
µg/L	MICROGRAMS PER LITER
RED	DENOTES CONCENTRATIONS EXCEEDING MTCA METHOD A CLEANUP LEVELS
ND	NOT DETECTED
MTCA	WASHINGTON STATE MODEL TOXICS CONTROL ACT
TCE	TRICHLOROETHENE

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PROJECT NUMBER: 0789-004
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 15 30
APPROXIMATE HORIZONTAL SCALE IN FEET
NOT FOR CONSTRUCTION OR ENGINEERING PURPOSES

FIGURE 11

GEOLOGIC CROSS SECTIONS D-D' AND E-E'
TCE SOURCE AREA REMEDIAL EXCAVATION

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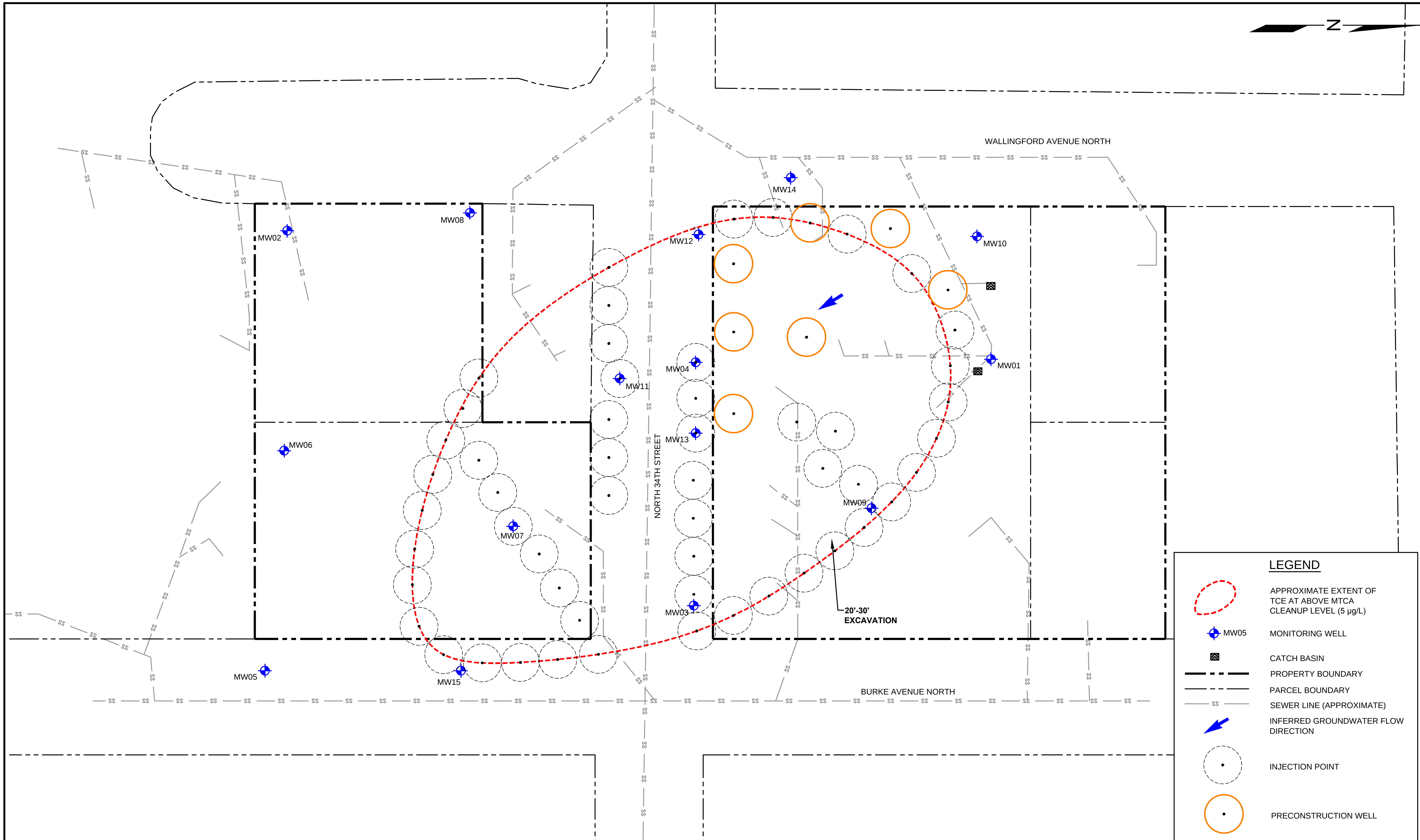
3/14/2014



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DATE: 12/05/13
DRAWN BY: BLR
CHECKED BY: TGO/CER
CAD FILE: 0789-004_2014CAP_CA1

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 12
GROUNDWATER TREATMENT CONCEPTUAL SITE PLAN, IN SITU CHEMICAL OXIDATION WITH PERMANGANATE

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\0789-004-2014CAP_CA1.DWG 3/14/2014

COMMUNICATION PLAN DURING EXCAVATION ACTIVITIES

DO SAMPLES FROM SUBSURFACE INVESTIGATION INDICATE CONTAMINATED SOIL (CS)? MAY BE PRESENT?

- *YES* → INITIATE NOTIFICATION AND DISCUSSION WITH CONTRACTOR AND DEVELOPMENT PROJECT MANAGER → PREPARE EXCAVATION PLAN AND SOIL DISPOSAL PROFILE FOR IDENTIFIED AREA(S) OF CONCERN
- *NO* ↓

DURING EXCAVATION: COMMON SENSE CRITERIA USED TO IDENTIFY DISCOVERY OF IMPACTED SOIL?

- *YES* → RESPONSE ACTION SEQUENCE
- *NO* ↓

ARE ANY UNDERGROUND STORAGE TANKS DISCOVERED?

- *YES* → RESPONSE ACTION SEQUENCE
- *NO* ↓

PREPARE CLOSURE REPORT OR OTHER PROJECT CLOSEOUT DOCUMENTATION

RESPONSE ACTION SEQUENCE:

- EARTHWORK CONTRACTOR NOTIFIES OWNERS, PROJECT MANAGER, AND SITE SUPERINTENDANT
- CALL SOUNDEARTH FIELD TEAM
- SOUNDEARTH ARRIVES ON-PROPERTY, NOTIFIES SITE SUPERINTENDENT AND EXCAVATION CONTRACTOR TO STOP WORK IN AREA
- ISOLATE AREA WITH BARRIER TAPE
- RESTRICT TRUCK AND TRACKHOE TRAFFIC TO AVOID CROSS CONTAMINATION
- INSTALL BARRIER TO VEHICLE ENTRY AS NECESSARY
- SCREEN SUSPECT SOILS WITH FIELD TESTS TO DEFINE BOUNDARIES OF INDICATED CONTAMINATION
- MARK CONTAMINATION AREA WITH WHITE PAINT LINES AND WOOD STAKES
- TAKE PHOTOGRAPHS & SKETCH LOCATION/DIMENSIONS OF IDENTIFIED AREA
- COLLECT SOIL SAMPLES FOR LAB TESTING/MARK SAMPLE LOCATIONS
- COMPLETE DAILY FIELD FORM TO RECORD ACTIVITIES, LOCATIONS, AND SAMPLES COLLECTED
- CONFIRM LAB DATA RESULTS MEET DISPOSAL PROFILE AND DETERMINE PROPER DISPOSAL
- EXCAVATE CONTAMINATED SOIL MATERIAL TO LOADING STOCKPILE; RECORD AND MARK VOLUMES BY AREA OF ORIGIN
- COMPLETE COMPLIANCE SAMPLING IN REMAINING AREA
- PREPARE BILL OF LADING/WASTE MANIFEST FOR TRANSPORT TO PERMITTED FACILITY

→ PREPARE CLOSURE REPORT OR OTHER PROJECT CLOSEOUT DOCUMENTATION

DEVELOPMENT TEAM CONTACT INFO:

- SCOTT KOPPELMAN, PROJECT CONTACT, AMLI RESIDENTIAL OFFICE: (206) 621-5610
- JOE NASCIMENTO, SITE SUPERINTENDENT, RAFN COMPANY OFFICE: (425) 702-1392

SOUNDEARTH FIELD TEAM CONTACT INFO:

- JOHN FUNDERBURK, PRINCIPAL CELL: (425)-922-9922
- ROB ROBERTS, PROJECT MANAGER CELL: (425)-985-6253
- TYLER OESTER, FIELD COORDINATOR CELL: (509)-432-3943
- SOUNDEARTH STRATEGIES MAIN NUMBER: (206) 306-1900

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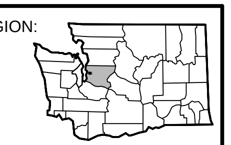
DATE: 3/12/2014
DRAWN BY: JQC
CHECKED BY: CER
CAD FILE: 0789-003_2014CAP_COMM

PROJECT NAME: AMLI AVTECH PROPERTY
PROJECT NUMBER: 0789-003
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

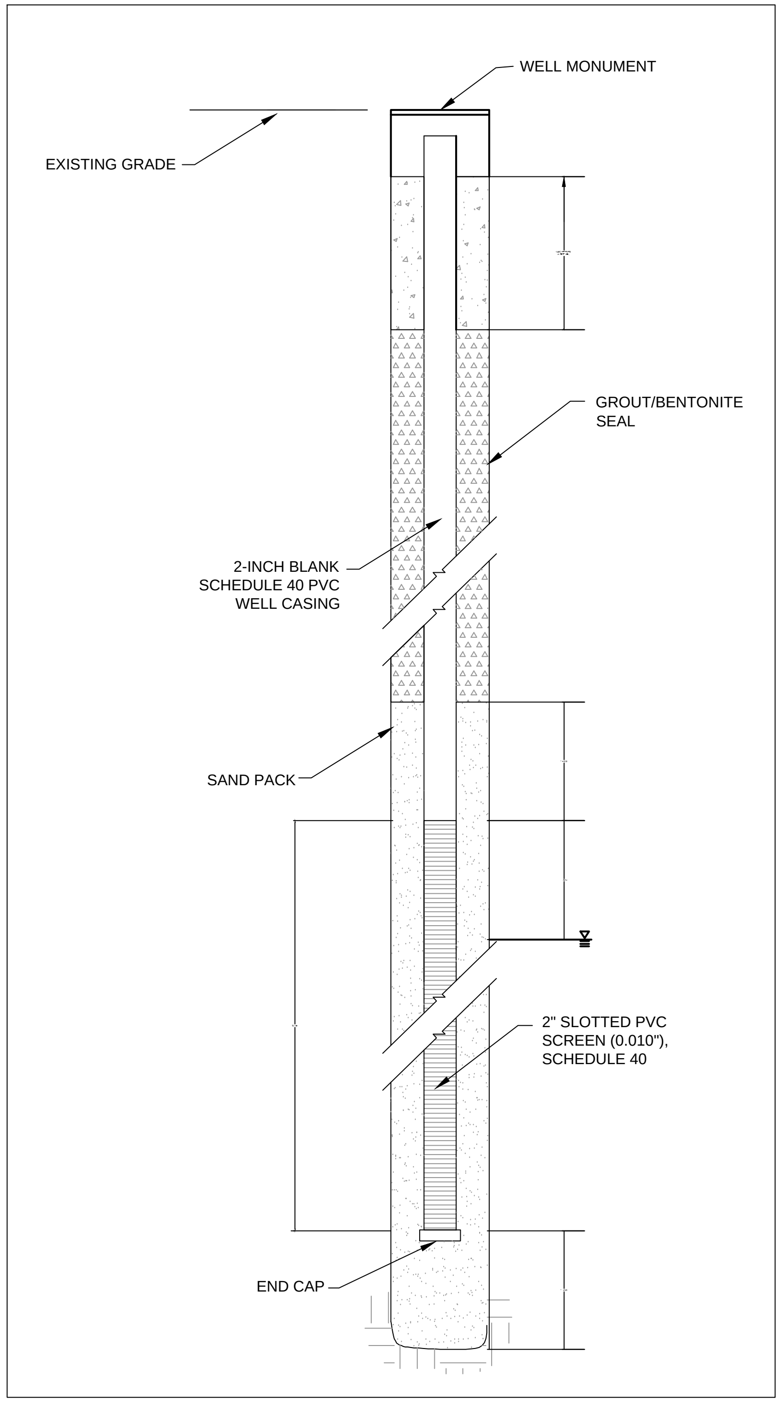
REGION:



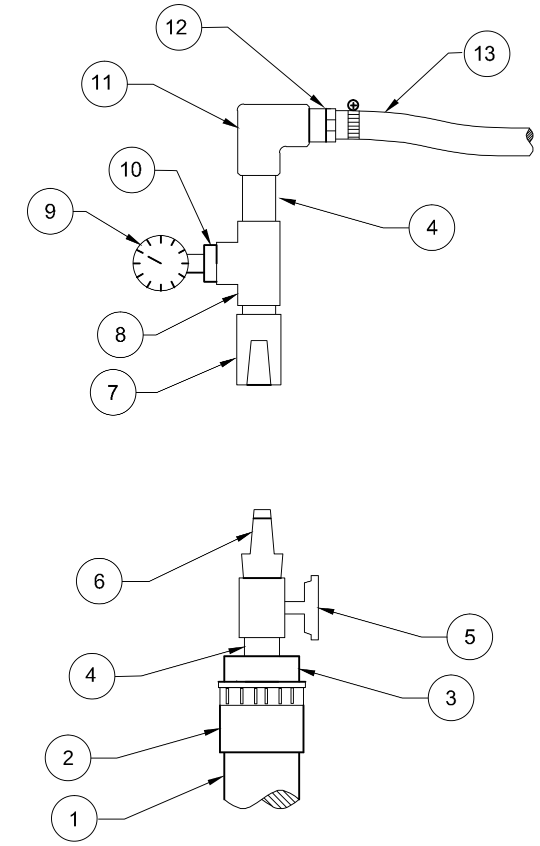
0 5 10 20 40
APPROXIMATE SCALE IN FEET 1" = 20'

FIGURE 13
COMMUNICATION PLAN

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\0789-004_2014CAP_COMM.DWG 3/12/2014



TYPICAL INJECTION WELL DETAIL



DESCRIPTION OF WELLHEAD ASSEMBLY ITEMS:

1. 2-INCH SCHEDULE 40 INJECTION WELL CASING
2. 2-INCH SCHEDULE 40 PVC FEMALE ADAPTER
3. 2-INCH x 1/2-INCH SCHEDULE 40 PVC THREADED REDUCING BUSHING
4. 1/2-INCH SCHEDULE 80 PVC CLOSE NIPPLE
5. 1/2-INCH SCHEDULE 40 PVC THREADED BALL VALVE
6. 1/2-INCH POLYPROPYLENE QUICK CONNECT INSERT X MNPT
7. 1/2-INCH POLYPROPYLENE QUICK CONNECT COUPLER X MNPT
8. 1/2-INCH SCHEDULE 40 PVC THREADED TEE
9. 0-60 PSI PRESSURE GAUGE 1/4-INCH MNPT
10. 1/2-INCH TO 1/4-INCH SCHEDULE 40 PVC THREADED REDUCING BUSHING
11. 1/2-INCH SCHEDULE 40 PVC THREADED ELBOW
12. 1/2-INCH MNPT HOSE BARB ADAPTER
13. 1/2-INCH PVC REINFORCED HOSE

TYPICAL INJECTION WELLHEAD ASSEMBLY DETAIL

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DATE: 03/05/14
DRAWN BY: JQC
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_WHD

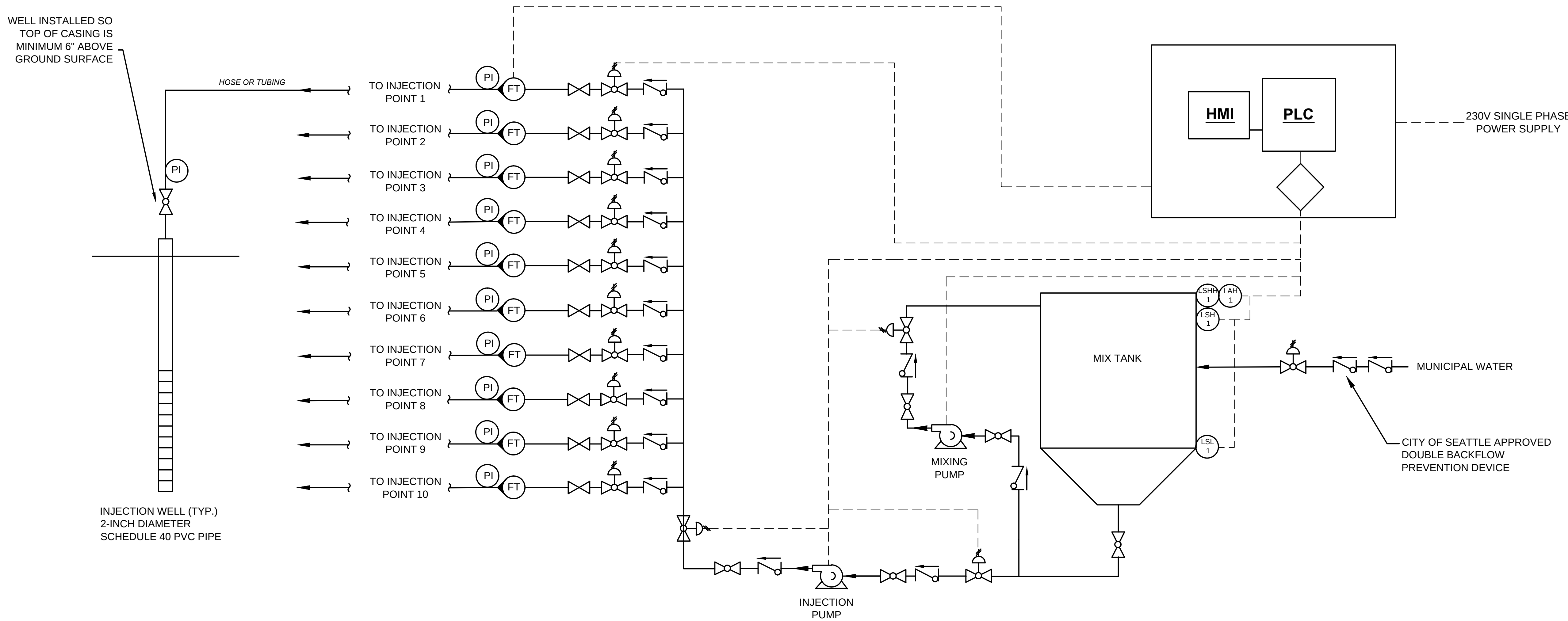
PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

NOT TO SCALE

FIGURE 14
TYPICAL INJECTION WELL AND WELLHEAD ASSEMBLY DETAILS

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\0789-004_2014CAP_WHD.DWG
3/14/2014



LEGEND

FT	FLOW TOTALIZER	LSL	LEVEL SWITCH LOW
PI	PRESSURE INDICATOR	LSH	LEVEL SWITCH HIGH
LAH	LEVEL ALARM HIGH	LSHH	LEVEL SWITCH HIGH HIGH

BALL VALVE
CHECK VALVE
GATE VALVE
AUTOMATED BALL VALVE

SoundEarth Strategies
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DATE: 03/05/14
DRAWN BY: JQC
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_PID

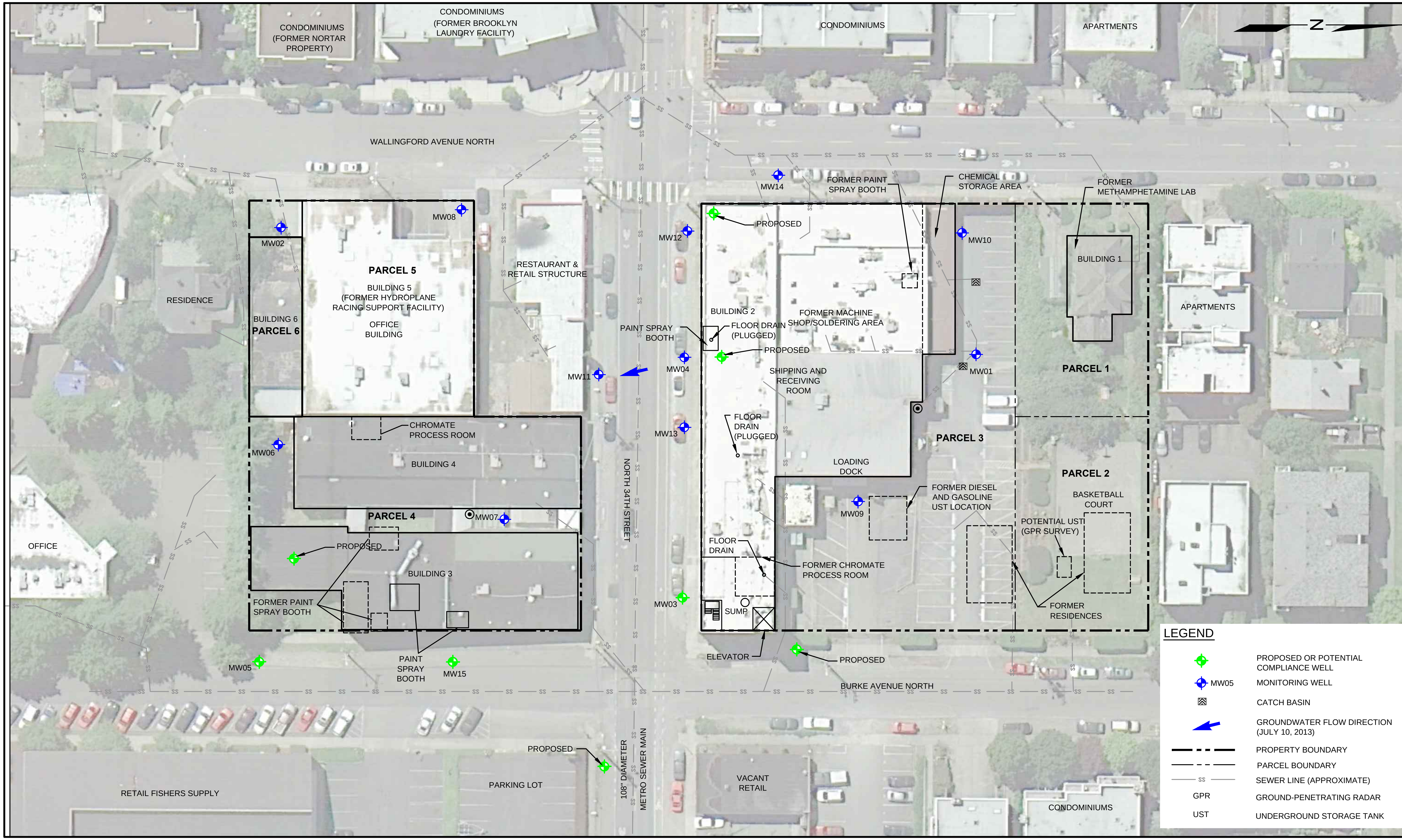
PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

NOT TO SCALE

FIGURE 15
TEMPORARY INJECTION SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\0789-004_2014CAP_PID.DWG
3/14/2014



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DATE: 02/11/14
DRAWN BY: BLR
CHECKED BY: RMT/WMC
CAD FILE: 0789-004_2014CAP_CW

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE 16
GROUNDWATER COMPLIANCE WELLS

TABLES

![SoundEarth Strategies]

DRAFT

Table 1
Summary of Soil Analytical Results for VOCs
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample Location	Sample ID	Sample Date	Sampled By	Sample Depth (feet bgs)	Analytical Results (mg/kg)										
					Vinyl Chloride[1]	1,1-Dichloroethene[1]	trans-1,2-Dichloroethene[1]	cis-1,2-Dichloroethene[1]	Carbon tetrachloride[1]	Benzene[1]	Trichloroethene[1]	Toluene[1]	Tetrachloroethene[1]	Ethylbenzene[1]	Total Xylenes[1]
P01	P01-04	01/04/12	SoundEarth	4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P02	P02-1.5	01/04/12	SoundEarth	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P04	P04-08	01/04/12	SoundEarth	8	--	--	--	--	--	<0.02	--	<0.02	--	<0.02	<0.06
	P04-15	01/04/12	SoundEarth	15	--	--	--	--	--	<0.02	--	<0.02	--	<0.02	<0.06
P05	P05-08	01/04/12	SoundEarth	8	--	--	--	--	--	<0.02	--	<0.02	--	<0.02	<0.06
P06	P06-08	01/04/12	SoundEarth	8	--	--	--	--	--	<0.02	--	<0.02	--	<0.02	<0.06
P07	P07-02	01/05/12	SoundEarth	2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P09	P09-02	01/05/12	SoundEarth	2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P10	P10-04	01/05/12	SoundEarth	4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P11	P11-04	01/05/12	SoundEarth	4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P13	P13-02	01/05/12	SoundEarth	2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P14	P14-06	04/26/12	SoundEarth	6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
P15	P15-02	04/26/12	SoundEarth	2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B01	B01-13	01/10/12	SoundEarth	13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B03	B03-10	01/10/12	SoundEarth	10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B06	B06-20	01/11/12	SoundEarth	20	<0.05[ht]	<0.05[ht]	<0.05[ht]	<0.05[ht]	<0.05[ht]	<0.03	<0.05[ht]	<0.05[ht]	<0.025	<0.05[ht]	<0.2[ht]
B06	B06-35	01/11/12	SoundEarth	35	<0.05[ht]	<0.05[ht]	<0.05[ht]	<0.05[ht]	<0.05[ht]	<0.03	**0.046**	<0.05	<0.025	<0.05[ht]	<0.2[ht]
B12	B12-35	04/23/12	SoundEarth	35	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B14	B14-20	04/24/12	SoundEarth	20	<0.05	<0.05	<0.05	0.47	<0.05	<0.03	**2.8**	<0.05	**0.83**	<0.05	<0.2
B14	B14-25	04/24/12	SoundEarth	25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B16	B16-30	04/25/12	SoundEarth	30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B18	B18-30	04/26/12	SoundEarth	30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B18	B18-35	04/26/12	SoundEarth	35	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	**0.032**	<0.05	<0.025	<0.05	<0.2
B18	B18-45	04/26/12	SoundEarth	45	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B19	B19-35	04/27/12	SoundEarth	35	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.05	<0.025	<0.05	<0.2
B101	B101-07	12/21/12	SoundEarth	7	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B101-15	12/21/12	SoundEarth	15	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B101-23	12/21/12	SoundEarth	23	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B101-28	12/21/12	SoundEarth	28	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B101-34	12/21/12	SoundEarth	34	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
B102	B102-10	12/21/12	SoundEarth	10	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B102-15	12/21/12	SoundEarth	15	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B102-20	12/21/12	SoundEarth	20	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B102-25	12/21/12	SoundEarth	25	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B102-30	12/21/12	SoundEarth	30	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B102-35	12/21/12	SoundEarth	35	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
B103	B103-07	01/02/13	SoundEarth	7	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B103-11	01/02/13	SoundEarth	11	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B103-16	01/02/13	SoundEarth	16	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B103-24	01/02/13	SoundEarth	24	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B103-35	01/02/13	SoundEarth	35	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
B104	B104-04	01/02/13	SoundEarth	4	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B104-09	01/02/13	SoundEarth	9	<0.05	<0.05	<0.05	<0.05	--	--	**0.12**	--	<0.025	--	--
	B104-17	01/02/13	SoundEarth	17	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B104-22	01/02/13	SoundEarth	22	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B104-30	01/02/13	SoundEarth	30	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
	B104-35	01/02/13	SoundEarth	35	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
MTCA Method A Cleanup Level for Soil[2]					**NE**	**NE**	**NE**	**NE**	**NE**	**0.1**	**0.03**	**7**	**0.05**	**6**	**9**

DRAFT

Table 1
Summary of Soil Analytical Results for VOCs
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample Location	Sample ID	Sample Date	Sampled By	Sample Depth (feet bgs)	Analytical Results (mg/kg)										
					Vinyl Chloride[(1)]	1,1-Dichloroethene[(1)]	trans-1,2-Dichloroethene[(1)]	cis-1,2-Dichloroethene[(1)]	Carbon tetrachloride[(1)]	Benzene[(1)]	Trichloroethene[(1)]	Toluene[(1)]	Tetrachloroethene[(1)]	Ethylbenzene[(1)]	Total Xylenes[(1)]
P101	P101-02	12/20/12	SoundEarth	2	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
P102	P102-05	12/20/12	SoundEarth	5	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
P103	P103-06	12/20/12	SoundEarth	6	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
P104	P104-04	12/20/12	SoundEarth	4	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
P105	P105-06	12/20/12	SoundEarth	6	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
P106	P106-01	12/20/12	SoundEarth	1	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
P107	P107-01	12/20/12	SoundEarth	1	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB201	SB201-05	07/09/13	SoundEarth	5	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB201	SB201-10	07/09/13	SoundEarth	10	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB201	SB201-15	07/09/13	SoundEarth	15	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB201	SB201-20	07/09/13	SoundEarth	20	<0.05	<0.05	<0.05	<0.05	--	--	**0.039**	--	<0.025	--	--
SB204	SB204-05	07/09/13	SoundEarth	5	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB204	SB204-10	07/09/13	SoundEarth	10	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB204	SB204-15	07/09/13	SoundEarth	15	<0.05	<0.05	<0.05	<0.05	--	--	**0.046**	--	<0.025	--	--
SB204	SB204-20	07/09/13	SoundEarth	20	<0.05	<0.05	<0.05	<0.05	--	--	**0.031**	--	<0.025	--	--
SB203	SB203-05	07/09/13	SoundEarth	5	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB203	SB203-10	07/09/13	SoundEarth	10	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB203	SB203-15	07/09/13	SoundEarth	15	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB203	SB203-20	07/09/13	SoundEarth	20	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB202	SB202-05	07/09/13	SoundEarth	5	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB202	SB202-08	07/09/13	SoundEarth	8	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB205	SB205-10	07/09/13	SoundEarth	10	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB205	SB205-15	07/09/13	SoundEarth	15	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
SB205	SB205-20	07/09/13	SoundEarth	20	<0.05	<0.05	<0.05	<0.05	--	--	<0.03	--	<0.025	--	--
MTCA Method A Cleanup Level for Soil[(2)]					**NE**	**NE**	**NE**	**NE**	**NE**	**0.1**	**0.03**	**7**	**0.05**	**6**	**9**

NOTES:

Red denotes concentrations exceeding MTCA cleanup level for soil.

Chemical analyses conducted by Friedman & Bruya, Inc., of Seattle, Washington.

[(1)]Analyzed by EPA Method 8260B or 8260C.

[(2)]MTCA Cleanup Regulation, Method A Cleanup Levels, Table 740-1 of Section 900 of Chapter 173-340 of the WAC, revised November 2007.

Laboratory Notes:

[ht]Analysis performed outside the method- or client-specified holding time requirement.

[lc]The presence of the compound indicated is likely due to laboratory contamination.

-- = not analyzed
< = not detected at a concentration exceeding the laboratory reporting limit
bgs = below ground surface
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams per kilogram
MTCA = Washington State Model Toxics Control Act
NE = no MTCA Method A cleanup level established for this chemical
SoundEarth = SoundEarth Strategies, Inc.
VOCs = volatile organic compounds
WAC = Washington Administrative Code

Table 2
Summary of Soil Analytical Results for Petroleum Hydrocarbons
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

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Sample Location	Sample ID	Sample Date	Sampled By	Sample Depth (feet bgs)	Analytical Results (mg/kg)						
					GRPH[1]	DRPH[2]	ORPH[2]	Benzene[3]	Toluene[3]	Ethylbenzene[3]	Total Xylenes[3]
P02	P02-1.5	01/04/12	SoundEarth	1.5	--	<50	<250	--	--	--	--
P03	P03-04	01/04/12	SoundEarth	4	--	<50	<250	--	--	--	--
P04	P04-08	01/04/12	SoundEarth	8	<2	--	--	<0.02	<0.02	<0.02	<0.06
	P04-15	01/04/12	SoundEarth	15	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
P05	P05-08	01/04/12	SoundEarth	8	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
P06	P06-08	01/04/12	SoundEarth	8	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
P07	P07-02	01/05/12	SoundEarth	2	--	<50	<250	--	--	--	--
P08	P08-02	01/05/12	SoundEarth	2	--	<50	<250	--	--	--	--
B01	B01-03	01/10/12	SoundEarth	3	--	<50	<250	--	--	--	--
B02	B02-03	01/10/12	SoundEarth	3	--	<50	<250	--	--	--	--
B03	B03-03	01/10/12	SoundEarth	3	--	<50	<250	--	--	--	--
	B03-10	01/10/12	SoundEarth	10	<2	<50	<250	<0.02	<0.02	<0.02	<0.06
B04	B04-05	01/11/12	SoundEarth	5	--	<50	<250	--	--	--	--
B08	B08-08	01/12/12	SoundEarth	8	--	<50	<250	--	--	--	--
B10	B10-0.5	01/13/12	SoundEarth	0.5	--	<50	<250	--	--	--	--
MTCA Method A Cleanup Level for Soil[4]					**100/30[5]**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**

NOTES:

Red denotes concentrations exceeding MTCA Method A cleanup level for soil.
Chemical analyses conducted by Friedman & Bruya, Inc. of Seattle, Washington.
(1)Analyzed by Method NWTPH-Gx.
(2)Analyzed by Method NWTPH-Dx.
(3)Analyzed by U.S. Environmental Protection Agency Method 8021B.
(4)MTCA Cleanup Regulation, Method A Cleanup Levels, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, revised November 2007.
(5)30 mg/kg when benzene is present and 100 mg/kg when benzene is not present.

< = not detected at a concentration exceeding the laboratory reporting limit
-- = not analyzed
bgs = below ground surface
DRPH = diesel-range petroleum hydrocarbon
GRPH = gasoline-range hydrocarbon
mg/kg = milligrams per kilogram
MTCA = Washington State Model Toxics Control Act
NWPTH = Northwest Total Petroleum Hydrocarbon
ORPH = oil-range petroleum hydrocarbon
SoundEarth = SoundEarth Strategies, Inc.

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Table 3
Summary of Soil Analytical Results for RCRA Metals and Cyanide
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample Location	Sample ID	Sample Date	Sampled By	Sample Depth (feet bgs)	Analytical Results (mg/kg)								
					Chromium(1)	Arsenic(1)	Selenium(1)	Silver(1)	Cadmium(1)	Barium(1)	Lead(1)	Cyanide(2)	Mercury(3)
P01	P01-04	01/04/12	SoundEarth	4	10.6	1.31	<1	<1	<1	29.7	1.41	--	<0.1
P02	P02-1.5	01/04/12	SoundEarth	1.5	5.08	1.52	<1	<1	<1	13.5	1.20	--	<0.1
P07	P07-02	01/05/12	SoundEarth	2	18.6	1.47	<1	<1	<1	44.3	172	--	<0.1
P08	P08-02	01/05/12	SoundEarth	2	8.75	1.36	<1	<1	<1	30.1	1.51	<0.054	<0.1
P09	P09-02	01/05/12	SoundEarth	2	15.0	3.11	<1	<1	<1	79.4	4.48	<0.053	<0.1
P10	P10-0.5	01/05/12	SoundEarth	0.5	16.7	7.90	<1	<1	<1	191	71.0	--	0.28
	P10-02	01/05/12	SoundEarth	2	--	--	--	--	--	--	--	--	<0.1
P12	P12-02	01/05/12	SoundEarth	2	12.3	12.2	<1	<1	<1	161	193	--	0.12
P13	P13-02	01/05/12	SoundEarth	2	12.4	16.0	<1	<1	1.37	163	**296**	--	0.18
B01	B01-03	01/10/12	SoundEarth	3	9.68	<1	<1	<1	<1	43.3	1.59	--	<0.1
B02	B02-03	01/10/12	SoundEarth	3	6.54	<1	<1	<1	<1	28.6	1.18	--	<0.1
B03	B03-10	01/10/12	SoundEarth	10	10.6	1.55	<1	<1	<1	29.2	1.61	--	<0.1
B04	B04-05	01/11/12	SoundEarth	5	8.66	1.25	<1	<1	<1	42.3	2.02	--	<0.1
B07	B07-08	01/12/12	SoundEarth	8	8.10	<1	<1	<1	<1	16.4	1.31	--	<0.1
B08	B08-08	01/12/12	SoundEarth	8	11.0	<1	<1	<1	<1	29.7	2.90	--	<0.1
MTCA Method A Cleanup Level for Soil(4)					**2,000**	**20**	**400**	**400**	**2**	**16,000**	**250**	**NE**	**2**

NOTES:

Red denotes concentrations exceeding the MTCA Method A cleanup level for soil.

Chemical analyses conducted by Friedman & Bruya, Inc. or AmTest Inc. of Seattle, Washington.

(1)Analyzed by EPA Method 200.8.

(2)Analyzed by Method SW846 9012m.

(3)Analyzed by EPA Method 1631E.

(4)MTCA Cleanup Regulation, Method A Cleanup Levels, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, revised November 2007.

< = not detected at a concentration exceeding the laboratory reporting limit

-- = not analyzed

bgs = below ground surface

EPA = U.S. Environmental Protection Agency

mg/kg = milligrams per kilogram

MTCA = Washington State Model Toxics Control Act

NE = no MTCA Method A cleanup level established for this chemical

RCRA = Resource Conservation and Recovery Act

SoundEarth = SoundEarth Strategies, Inc.

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Table 4
Summary of Soil Analytical Results for PCBs
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample Location	Sample ID	Sample Date	Sampled By	Sample Depth (feet bgs)	Analytical Results(1) (mg/kg) Aroclor 1221	Aroclor 1232	Aroclor 1016	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
P03	P03-04	01/04/12	SoundEarth	4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
P10	P10-0.5	01/05/12	SoundEarth	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
B02	B02-03	01/10/12	SoundEarth	3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MTCA Method A Cleanup Level for Soil(2)					**1**						

NOTES:

Chemical analysis conducted by Friedman & Bruya, Inc. of Seattle, Washington.

(1)Analyzed by U.S. Environmental Protection Agency Method 8082A.

(2)MTCA Cleanup Regulation, Method A Cleanup Levels, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, revised November 2007.

< = not detected at a concentration exceeding the laboratory reporting limit

bgs = below ground surface

mg/kg = milligrams per kilogram

MTCA = Washington State Model Toxics Control Act

PCB = polychlorinated biphenyl

SoundEarth = SoundEarth Strategies, Inc.

SoundEarth Strategies

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Table 5
Summary of Soil Analytical Results for PAHs
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample Location	Sample ID	Date Sampled	Sample Depth (feet bgs)	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene
P07	P07-02	01/05/12	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
P10	P10-0.5	01/05/12	0.5	0.027	0.079	<0.012	0.032	0.37	0.059	0.30	0.41	0.15	0.22	0.25	0.082	**0.24**	0.21	0.044	0.22
	P10-02	01/05/12	2	<0.01	<0.01	<0.01	<0.01	0.019	<0.01	0.023	0.028	0.013	0.015	0.016	<0.01	0.015	0.015	<0.01	0.013
P12	P12-02	01/05/12	2	0.012	0.016	<0.01	<0.01	0.064	0.013	0.15	0.18	0.070	0.11	0.13	0.046	**0.13**	0.12	0.018	0.14
MTCA Method A Cleanup Level for Soil[(1)]				**5**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NC**	**NC**	**NC**	**NC**	**0.1**	**NC**	**NC**	**NE**

NOTES:

Sample results reported in mg/kg.

Red denotes concentration exceeding MTCA Method A Cleanup Level.

Chemical analysis conducted by Friedman & Bruya, Inc. of Seattle, Washington.

Analyzed by U.S. Environmental Protection Agency Method 8270D SIM.

All measurements are micrograms per kilogram.

[(1)]MTCA Cleanup Regulation, Method A Cleanup Levels, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code, revised November 2007.

< = not detected at a concentration exceeding the laboratory reporting limit

bgs = below ground surface

mg/kg = milligrams per kilogram

MTCA = Washington State Model Toxics Control Act

NC = toxicity equivalency factor not calculated

NE = no MTCA Method A cleanup level established for this chemical

PAH = polycyclic aromatic hydrocarbon

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Table 6
Summary of Groundwater Data
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample ID and TOC Elevation	Sample Date	Depth to Groundwater[1] (feet)	Groundwater Elevation[2] (feet)	Analytical Results (µg/L)																			
				DRPH[3]	ORPH[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]	Vinyl Chloride[4]	cis-1,2-DCE[4]	TCE[4]	PCE[4]	MTBE[4]	Naphthalene[4]	Dissolved Chromium[5]	Dissolved Arsenic[5]	Dissolved Selenium[5]	Dissolved Silver[5]	Dissolved Cadmium[5]	Dissolved Barium[5]	Dissolved Lead[5]	Dissolved Mercury[6]
MW01	01/17/12	27.59	56.85	<50	<250	<0.35	<1	<1	<3	<0.2[pr]	<1	<1	<1	<1	<1	1.58	1.43	<1	<1	<1	3.94	<1	<0.1
84.44	05/01/12	25.02	59.42	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
	01/11/13	26.25	58.19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/25/13	24.75	59.69	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/10/13	25.55	58.89	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW02	01/17/12	DRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
69.73	04/27/12	DRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	01/11/13	DRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/25/13	DRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/10/13	DRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW03	01/17/12	DRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
75.48	04/27/12	31.18	44.30	--	--	--	--	--	--	<0.2	2.2	**83**	<1	--	--	--	--	--	--	--	--	--	--
	05/08/12	31.06	44.42	--	--	--	--	--	--	<0.2	1.9	**64**	<1	--	--	1.69	1.44	<1	<1	<1	11.9	<1	<0.1
	01/14/13	31.78	43.70	--	--	--	--	--	--	<0.2	1.7	**71**	<1	--	--	--	--	--	--	--	--	--	--
	04/24/13	30.96	44.52	--	--	--	--	--	--	<0.2	1.8	**76**	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	Inaccessible																					
MW04	01/17/12	36.70	42.77	--	--	<0.35	<1	<1	<3	<0.2[pr]	<1	**110**	<1	<1	<1	18.6	<1	<1	<1	<1	4.33	<1	<0.1
79.47	04/27/12	36.09	43.38	--	--	--	--	--	--	<0.2	<1	**170**	<1	--	--	--	--	--	--	--	--	--	--
	01/11/13	36.44	43.03	--	--	--	--	--	--	<0.2	<1	**85**	<1	--	--	--	--	--	--	--	--	--	--
	04/24/13	35.93	43.54	--	--	--	--	--	--	<0.2	<1	**290**	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	36.15	43.32	--	--	--	--	--	--	<0.2	<1	**150**	<1	--	--	--	--	--	--	--	--	--	--
MW04 (Field Dup)	01/17/12	36.70	42.77	--	--	<0.35	<1	<1	<3	<0.2[pr]	<1	**120**	<1	<1	<1	18.6	<1	<1	<1	<1	4.65	<1	<0.1
79.47	04/27/12	36.09	43.38	--	--	--	--	--	--	<0.2	<1	**170**	<1	--	--	--	--	--	--	--	--	--	--
MW05	01/17/12	24.90	30.71	--	--	<0.35	<1	<1	<3	<0.2[pr]	<1	3.3	<1	<1	<1	<1	5.31	3.55	<1	<1	22.6	<1	<0.1
55.61	05/01/12	23.40	32.21	--	--	--	--	--	--	<0.2	<1	1.9	<1	--	--	--	--	--	--	--	--	--	--
	01/14/13	24.34	31.27	--	--	--	--	--	--	<0.2	<1	3.3	<1	--	--	--	--	--	--	--	--	--	--
	04/24/13	22.86	32.75	--	--	--	--	--	--	<0.2	<1	3.0	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	23.71	31.90	--	--	--	--	--	--	<0.2	<1	1.9	<1	--	--	--	--	--	--	--	--	--	--
MW06	04/25/12	31.84	36.55	--	--	--	--	--	--	<0.2	<1	3.2	<1	--	--	--	--	--	--	--	--	--	--
68.39	01/14/13	31.86	36.53	--	--	--	--	--	--	<0.2	<1	2.4	<1	--	--	--	--	--	--	--	--	--	--
	04/26/13	30.85	37.54	--	--	--	--	--	--	<0.2	<1	4.5	<1	--	--	--	--	--	--	--	--	--	--
	07/11/13	32.01	36.38	--	--	--	--	--	--	<0.2	<1	3.2	<1	--	--	--	--	--	--	--	--	--	--
MW07	04/25/12	37.43	39.35	--	--	--	--	--	--	<0.2	<1	3.3	<1	--	--	--	--	--	--	--	--	--	--
76.78	01/11/13	37.59	39.19	--	--	--	--	--	--	<0.2	<1	3.5	<1	--	--	--	--	--	--	--	--	--	--
	04/25/13	36.52	40.26	--	--	--	--	--	--	<0.2	<1	**6.1**	<1	--	--	--	--	--	--	--	--	--	--
	07/11/13	36.97	39.81	--	--	--	--	--	--	<0.2	<1	**11**	<1	--	--	--	--	--	--	--	--	--	--
MTCA Method A Cleanup Level for Groundwater[7]				**500**	**500**	**5**	**1,000**	**700**	**1,000**	**0.2**	**NE**	**5**	**5**	**20**	**160**	**50**	**5**	**NE**	**NE**	**5**	**NE**	**15**	**2**

Table 6
Summary of Groundwater Data
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample ID and TOC Elevation	Sample Date	Depth to Groundwater[1] (feet)	Groundwater Elevation[2] (feet)	Analytical Results (µg/L)																			
				DRPH[3]	ORPH[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]	Vinyl Chloride[4]	cis-1,2-DCE[4]	TCE[4]	PCE[4]	MTBE[4]	Naphthalene[4]	Dissolved Chromium[5]	Dissolved Arsenic[5]	Dissolved Selenium[5]	Dissolved Silver[5]	Dissolved Cadmium[5]	Dissolved Barium[5]	Dissolved Lead[5]	Dissolved Mercury[6]
MW08	04/25/12	37.86	38.75	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
76.61	01/11/13	37.34	39.27	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/25/13	Inaccessible																					
	07/10/13	Inaccessible																					
MW09	05/01/12	23.19	57.98	--	--	--	--	--	--	<0.2	<1	2.0	<1	--	--	--	--	--	--	--	--	--	--
81.17	01/14/13	24.00	57.17	--	--	--	--	--	--	<0.2	1.5	**42**	<1	--	--	--	--	--	--	--	--	--	--
	04/24/13	22.87	58.30	--	--	--	--	--	--	<0.2	<1	**24**	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	23.65	57.52	--	--	--	--	--	--	<0.2	<1	**36**	<1	--	--	--	--	--	--	--	--	--	--
MW10	05/01/12	21.90	63.60	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
85.50	01/11/13	22.56	62.94	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/25/13	21.49	64.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/10/13	22.63	62.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW11	04/30/12	44.56	34.24	--	--	--	--	--	--	<0.2	<1	**14**	<1	--	--	--	--	--	--	--	--	--	--
78.80	05/08/12	44.52	34.28	--	--	--	--	--	--	<0.2	<1	**29**	<1	--	--	--	--	--	--	--	--	--	--
	01/11/13	44.74	34.06	--	--	--	--	--	--	<0.2	<1	**78**	<1	--	--	--	--	--	--	--	--	--	--
	04/25/13	43.56	35.24	--	--	--	--	--	--	<0.2	<1	**39**	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	43.90	34.90	--	--	--	--	--	--	<0.2	<1	**56**	<1	--	--	--	--	--	--	--	--	--	--
MW12	04/27/12	32.81	49.02	--	--	--	--	--	--	<0.2	<1	**14**	<1	--	--	--	--	--	--	--	--	--	--
81.83	01/14/13	33.30	48.53	--	--	--	--	--	--	<0.2	<1	5.0	<1	--	--	--	--	--	--	--	--	--	--
	04/25/13	32.76	49.07	--	--	--	--	--	--	<0.2	<1	**5.7**	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	33.08	48.75	--	--	--	--	--	--	<0.2	<1	**10**	<1	--	--	--	--	--	--	--	--	--	--
MW13	04/27/12	34.97	43.97	--	--	--	--	--	--	<0.2	<1	1.0	<1	--	--	--	--	--	--	--	--	--	--
78.94	05/07/12	34.94	44.00	--	--	--	--	--	--	<0.2	<1	2.0	<1	--	--	--	--	--	--	--	--	--	--
	04/24/13	34.88	44.06	--	--	--	--	--	--	<0.2	<1	2.5	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	35.15	43.79	--	--	--	--	--	--	<0.2	<1	**37**	<1	--	--	--	--	--	--	--	--	--	--
MW14	04/30/12	29.99	54.61	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
84.60	01/11/13	30.95	53.65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/25/13	Inaccessible																					
	07/10/13	30.56	54.04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MTCA Method A Cleanup Level for Groundwater[7]				**500**	**500**	**5**	**1,000**	**700**	**1,000**	**0.2**	**NE**	**5**	**5**	**20**	**160**	**50**	**5**	**NE**	**NE**	**5**	**NE**	**15**	**2**

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Table 6
Summary of Groundwater Data
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Sample ID and TOC Elevation	Sample Date	Depth to Groundwater[1] (feet)	Groundwater Elevation[2] (feet)	Analytical Results (µg/L)																			
				DRPH[3]	ORPH[3]	Benzene[4]	Toluene[4]	Ethylbenzene[4]	Total Xylenes[4]	Vinyl Chloride[4]	cis-1,2-DCE[4]	TCE[4]	PCE[4]	MTBE[4]	Naphthalene[4]	Dissolved Chromium[5]	Dissolved Arsenic[5]	Dissolved Selenium[5]	Dissolved Silver[5]	Dissolved Cadmium[5]	Dissolved Barium[5]	Dissolved Lead[5]	Dissolved Mercury[6]
MW15 66.09	04/30/12	27.37	38.72	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
	01/14/13	27.76	38.33	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
	04/24/13	26.69	39.40	--	--	--	--	--	--	<0.2	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
	07/10/13	Inaccessible																					
MTCA Method A Cleanup Level for Groundwater[7]				**500**	**500**	**5**	**1,000**	**700**	**1,000**	**0.2**	**NE**	**5**	**5**	**20**	**160**	**50**	**5**	**NE**	**NE**	**5**	**NE**	**15**	**2**

NOTES:

Red denotes concentrations exceeding the MTCA Method A Cleanup Level.

Sample analyses conducted by Friedman & Bruya, Inc. of Seattle, Washington.

TOC elevations surveyed by Triad Associates on May 3, 2012.

(1)Measured in feet below a fixed spot on the top of the well casing rim.

(2)Elevation datum NAVD 88, Seattle BM#2609CC 58A at 60.344' and BM#2609CC 55A at 32.066'.

(3)Analyzed by Northwest Total Petroleum Hydrocarbon Method NWTPH-Dx.

(4)Analyzed by EPA Method 8260C. All other 8260C analytes were not detected above the laboratory reporting limit.

(5)Analyzed by EPA Method 6020 or 200.8.

(6)Analyzed by EPA Method 1631E.

(7)MTCA Cleanup Regulation, Method A Cleanup Levels, Table 720-1 of Section 900 of Chapter 340 of Title 173 of the Washington Administrative Code, revised November 2007.

Laboratory Note:

pr Sample received with incorrect preservation. Results should be considered an estimate.

-- = not analyzed/not measured

< = not detected at a concentration exceeding the laboratory reporting limit

µg/L = micrograms per liter

cis-1,2-DCE = cis-1,2-dichloroethene

DRPH = diesel-range petroleum hydrocarbons

EPA = U.S. Environmental Protection Agency

MTBE = methyl tertiary-butyl ether

MTCA = Washington State Model Toxics Control Act

NE = no MTCA Method A cleanup level established for this analyte

ORPH = oil-range petroleum hydrocarbons

PCE = tetrachloroethene

TCE = trichloroethene

TOC = top of casing elevation

Table 7
Summary of Monitoring Wells to be Decommissioned
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

DRAFT

Well ID	Location	Total Depth (feet below TOC)[1]
MW01	North Block	34.29
MW02	South Block	24.30
MW06	South Block	43.93
MW07	South Block	53.81
MW08	South Block	44.02
MW09	North Block	35.46
MW10	North Block	32.88

NOTE:
[1]SoundEarth collected total depth measurements on April 30, 2012.

SoundEarth = SoundEarth Strategies, Inc.
TOC = Top of Casing

APPENDIX A
SAMPLING AND ANALYSIS PLAN

SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington 98102

Draft Sampling and Analysis Plan

APPENDIX A OF THE DRAFT CLEANUP ACTION PLAN

Property:
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Prepared for:
AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington

Report Date:
March 14, 2014

DRAFT – ISSUED FOR REGULATORY REVIEW

Draft Sampling and Analysis Plan

Avtech Property
3400 Wallingford Avenue North
Seattle, Washington 98116

Prepared for:

AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington 98109

Project No.: 0789-004

Prepared by:

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____
Audrey Hackett
Project Scientist

Reviewed by:

DRAFT

____
Rob Roberts
Associate Scientist

DRAFT

____
John Funderburk
Principal

March 14, 2014

SoundEarth Strategies

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CAP	Cleanup Action Plan
COC	chemical of concern
CUL	cleanup level
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FC	field coordinator
HASP	Health and Safety Plan
ID	identifier
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Washington State Model Toxics Control Act
NWTPH	Northwest Total Petroleum Hydrocarbon
PAHs	polycyclic aromatic hydrocarbons
PCS	petroleum-contaminated soil
PID	photoionization detector
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RPD	relative percent difference
RCW	Revised Code of Washington
SAP	Sampling and Analysis Plan
TCE	tetrachloroethene

ACRONYMS AND ABBREVIATIONS (CONTINUED)

The Site	groundwater contaminated with TCE beneath the Avtech Property as well as beneath portions of the adjoining 34th Avenue North right-of-way, and soil contaminated with TCE and PCE on the North Block of Avtech.
The Property	3400 Wallingford Avenue North, Seattle, Washington
SoundEarth	SoundEarth Strategies, Inc.
TESC	temporary erosion and sediment control
TSDF	treatment, storage, and disposal facility
UST	underground storage tank
WAC	Washington Administrative Code

1.0 INTRODUCTION

SoundEarth Strategies, Inc. (SoundEarth) has prepared this Draft Sampling and Analysis Plan (SAP) for the property located at 3400 Wallingford Avenue North in Seattle, Washington (the Property; Figure A-1). In accordance with the Washington State Model Toxics Control Act (MTCA) Cleanup Regulations as established in Section 200 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-200), the site is defined by the full lateral and vertical contamination that has resulted from a release beneath the Property (the Site). Based on the information gathered to date, the Site includes soil and groundwater contaminated with trichloroethene (TCE) beneath the Property. Soil impacted by TCE is generally in the loading dock area of Building 2 at depths ranging from 9 to 20 feet below ground surface (Figure A-2). Localized areas of surface soil containing lead near the Building 1 house (likely from lead paint) and polycyclic aromatic hydrocarbons (PAHs) at the south end of the Property (likely from the former gasworks to the south) exceeding MTCA Method A cleanup levels are also present.

This SAP was developed to supplement the requirements of the cleanup action plan (CAP) and to meet the requirements of a SAP as defined by MTCA (WAC 173-340-820).

1.1 PURPOSE AND OBJECTIVES

The purpose of the SAP is to describe the sample collection, handling, and analysis procedures to be implemented during the cleanup action in accordance with WAC 173-340-380 of MTCA. This SAP identifies specific sampling and analysis protocols, project schedule, and organization and responsibilities. It also provides detailed information regarding the sampling and data quality objectives (DQOs), sample location and frequency, equipment, and procedures to be used during the cleanup action; sample handling and analysis; procedures for management of waste; quality assurance protocols for field activities and laboratory analysis; and reporting requirements.

1.2 SAMPLING AND ANALYSIS PLAN ORGANIZATION

The SAP is organized into the following sections:

- **Section 1.0, Introduction.** This section describes the purpose of the SAP and provides a description of the Property features and location, a brief summary of the current and historical uses of the Property, and a summary of the results of previous investigations conducted at the Site.
- **Section 2.0, Project Organization and Management.** This section presents the project team, including field personnel and management.
- **Section 3.0, Summary of Cleanup Action Field Program.** This section summarizes the field activities proposed to be conducted in order to meet the objectives of the cleanup action.
- **Section 4.0, Compliance Monitoring Program.** This section describes environmental sample types to be collected during and after the cleanup action; the sampling procedures, frequency, and the handling techniques; quality assurance procedures; and decontamination procedures that will be followed.
- **Section 5.0, Analytical Testing. Sample Collection, Handling, and Quality Control Procedures.** This section describes analytical testing to be performed for the samples collected in accordance with the Compliance Monitoring Program.

- **Section 6.0, Management of Investigation-Derived Waste.** This section provides details on handling and disposal procedures that will be implemented during the cleanup action.
- **Section 7.0, Data Quality Objectives.** This section summarizes the DQOs that will need to be met to ensure the validity of the analytical results.
- **Section 8.0, Data Collection.** This section describes the type, transfer, inventory management, and validation procedures of the data that will be gathered during the cleanup action.
- **Section 9.0, Quality Control Procedures.** This section provides details regarding the quality control (QC) procedures for both field activities and laboratory analysis.
- **Section 10.0, Corrective Actions.** This section identifies the approaches that will be used to correct any protocols that may compromise the quality of the data.
- **Section 11.0, Documentation and Records.** This section outlines the documentation that will be prepared during the cleanup action. It includes a discussion of document management, waste disposal tracking, and compliance reports.
- **Section 12.0, Health and Safety Procedures.** This section summarizes the health and safety procedures outlined in the project-specific Health and Safety Plan (HASP Appendix B of the CAP).
- **Section 13.0, Bibliography**. This section lists references used in the preparation of this document.

1.3 BACKGROUND

This section provides a description of the Property features and location, a summary of historical Property use, and a summary of previous investigations conducted at the Property and adjoining parcels and ROWs.

1.3.1 Property Location and Description

The Property consists of six tax parcels, listed with the following addresses: 3320, 3326, 3400, 3422 Wallingford Avenue North; 3421 Burke Avenue North;, and 1815 North 34th Street, Wallingford Avenue North (King County Tax Parcels #408330-7155, #408330-7160, #408330-6660, #408330-6695, #408330-6670 and #408330-7105, respectively). The Property covers approximately 88,920 square feet (2.04 acres) of land and is bisected by North 34th Street. The Property is located approximately 1 mile north of downtown Seattle, Washington, as shown in Figure A-1. The Property features are presented on Figure A-2.

1.3.2 Site History

The Property was initially developed by the early 1900s with four single-family residences. A two-story factory building (Building 2) was constructed on the north side of North 34th Street (North Block) in 1909 (Figure A-2). Building 2 contained a shoe manufacturer from 1909 to the 1940s and Grandmas Cookies in the 1950s and 1960s. Avtech Corporation, a manufacturer of aviation electronics, occupied Building 2 from 1974 to 2011. Two furniture workshop buildings (Buildings 3 and 4) were constructed on the south side of North 34th Street (South Block) in the 1930s, with an additional single-story warehouse constructed in 1965. Avtech occupied the South Block buildings from the 1980s to 2011. Relevant historical Property features are presented on Figure A-2.

1.3.3 Summary of Previous Investigations

The results of previous subsurface investigations and the remedial investigation conducted at the Site between 2003 and 2006 indicate the presence of soil and groundwater contaminated with TCE. Soil is impacted by TCE generally in the loading dock area of Building 2 at depths ranging from 9 to 20 feet below grade. Trace levels of 1,2-dichlorethene and PCE were also detected in this area. Soil is likely impacted by TCE at other depths, as indicated by the presence of TCE in groundwater. Localized areas of surface soil containing lead near the Building 1 house (likely from lead paint) and PAHs at the south end of the Property (likely from the former gasworks to the south) exceeding Method A cleanup levels are also present.

Groundwater containing TCE concentrations exceeding the Washington State Model Toxics Control Act Method A cleanup level is present on the southern half of the North Block and has migrated to the south, across North 34th Street to the South Block. Groundwater contamination may also extend to the east, beneath Burke Avenue North.

2.0 PROJECT ORGANIZATION AND MANAGEMENT

This section describes the overall project management strategy for implementing the cleanup action.

To ensure efficient decision making for field sampling and laboratory analysis, key data collection decisions, decision criteria, process for decision making, quality assurance/quality control (QA/QC) procedures, and responsibilities are described below and detailed in Table A-1.

These decision and communication plans will be followed by field personal under direction of the field coordinator and task manager. Site quality control to ensure proper communication and adherence to this SAP is discussed below in Section 9.0.

The cleanup action is being conducted by SoundEarth on behalf of AMLI Residential Partners. The cleanup action for the Avtech Property will be performed under a Prospective Purchaser Consent Decree (PPCD). Washington State Department of Ecology (Ecology) is providing regulatory guidance of Site activities.

The following key personnel have been identified for the project. A summary of key personnel roles and responsibilities is provided in Table A-1.

Regulatory Agency. Ecology is the lead regulatory agency for the Site, as promulgated in MTCA. The cleanup action for the Voluntary Cleanup Program Properties is being conducted as an independent remedial action in accordance with WAC 173-340-515 of MTCA. Ecology's site manager for the project is:

Mr. John Guenther
Washington State Department of Ecology
3190 160th Avenue Southeast
Bellevue, Washington
425-649-7135
jgue461@ecy.wa.gov

Project Contact. SoundEarth has been contracted by AMLI Residential Partners to plan and implement the cleanup action at the Site. The project contact for AMLI Residential Partners is:

Scott Koppelman
AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington
206-621-5610
skoppelman@amli.com

Project Principal. The project principal provides oversight of all project activities and reviews all data and deliverables before their submittal to the project contact or regulatory agency. The project principal for SoundEarth is:

Mr. John Funderburk
SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington
206-306-1900
Fax: 206-306-1907
jfunderburk@soundearthinc.com

Project Manager. The project manager has overall responsibility for developing the SAP, monitoring the quality of the technical and managerial aspects of the cleanup action, and implementing the SAP and corresponding corrective measures, where necessary. The project manager for SoundEarth is:

Rob Roberts
SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington
206-306-1900
Fax: (206-306-1907
rroberts@soundearthinc.com

Laboratory Project Manager. The laboratory project manager will provide analytical support and will be responsible for providing certified, pre-cleaned sample containers and sample preservatives (as appropriate) and for ensuring that all chemical analyses meet the project quality specifications detailed in this SAP. Friedman and Bruya Inc., of Seattle, Washington, has been contracted by AMLI Residential Partners to perform the chemical and physical analysis for compliance samples collected during the cleanup action. The laboratory project manager is:

Mr. Mike Erdahl
Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, Washington 98119
206-285-8282
merdahl@friedmanandbruya.com

Project QA/QC Officer. The project QA/QC officer has the responsibility to monitor and verify that the work is performed in accordance with the SAP and other applicable procedures. The project QA/QC officer has the responsibility to assess the effectiveness of the QA/QC program and to recommend modifications to the program when applicable. The project QA/QC officer is responsible for assuring that the personnel assigned to the project are trained relative to the requirements of the QA/QC program and for reviewing and verifying the disposition of nonconformance and corrective action reports. The project QA/QC officer for SoundEarth is:

Ms. Audrey Hackett
SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington
206-306-1900
Fax: 206-306-1907
ahackett@soundearthinc.com

Field Coordinator. The field coordinator (FC) will supervise field collection of all samples. The FC will ensure proper recording of sample locations, depths, and identification; sampling and handling requirements, including field decontamination procedures; physical evaluation and logging of samples; and completing of chain-of-custody forms. The FC will ensure that all field staff follows the SAP, that the physical evaluation and logging of soil is based on the visual-manual classification method American Society for Testing and Materials D-2488, and that standardized methods for sample acceptability and physical description of samples be followed. The FC will ensure that field staff maintains records of field sampling events using the forms included as Attachment A-A of this SAP. The FC will be responsible for proper completion and storage of field forms. The FC for SoundEarth is:

Tyler Oester
SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington
206-306-1900
Fax: 206-306-1907
toester@soundearthinc.com

Field Staff. Members of the field staff must understand and implement the QA/QC program, coordinate and participate in the field sampling activities, coordinate sample deliveries to laboratory, and report any deviations from project plans as they relate to the cleanup action objectives as presented in the SAP. Major deviations from the SAP, such as the inability to collect a sample from a specific sampling location, obtaining an insufficient sample volume for the required analyses, or a change in sampling method, must be reported to the project manager.

Subcontractors. All subcontractors will follow the protocols outlined in this SAP and will be overseen and directed by SoundEarth. The following subcontractors have been identified:

Private Utility Locator:

Mr. Kemp Garcia
Bravo Environmental
6437 South 144th Street
Tukwila, Washington
425-424-9000

Surveyor:

Brad Freeman
Triad Associates
12112 115th Avenue Northeast
Kirkland, Washington
425-216-2140

Drilling Company:

Nick DeLeon
Cascade Drilling L.P.
19404 Woodinville-Snohomish Road
Woodinville, Washington
425-485-8908

Environmental Construction:

Paul Kemp
SoundEarth Construction LLC
2811 Fairview Avenue East, Suite 2000
Seattle, Washington
206-306-1900

Site Superintendent/General Contractor. The site superintendent is responsible for overall site security during construction activities and works directly under the client. SoundEarth will adhere to the general contractor's health and safety procedures during construction activities. The site superintendent will inform SoundEarth of potential issues of previously unidentified contamination at the Site.

Site Superintendent/General Contractor:

Mr. Joe Nascimento
RAFN Company
1721 132nd Avenue Northeast
Bellevue, Washington

425-702-6600
jnascimento@rafn.com

3.0 SUMMARY OF CLEANUP ACTION FIELD PROGRAM

The following subsections summarize the field activities that will be conducted as part of the proposed cleanup action. A detailed discussion of the field activities is presented in Section 5.0 of the CAP. A summary of the CAP schedule is provided in Table A-2.

3.1 SITE PREPARATION AND MOBILIZATION

Before initiating construction activities, temporary erosion and sediment control (TESC) measures will be established as part of the larger construction excavation project. Once all TESC measures are implemented in accordance with the construction project plan, construction equipment and supplies will be mobilized to the Site.

3.2 DEMOLITION AND UST DECOMMISSIONING

A hazardous materials survey will be completed for all the buildings on the Property before demolition. If abatement measures are necessary, the contractor will perform these activities prior to the demolition of the buildings.

Any USTs encountered will be decommissioned and a UST site assessment will be conducted under the oversight of a Washington State certified UST site assessor. The UST will be removed in accordance with the Guidance for Site Checks and Site Assessment for Underground Storage Tanks (Ecology 2003), Underground Storage Tank Regulations (WAC 173-360), and Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2011).

3.3 WELL DECOMMISSIONING

Monitoring wells within the footprint of the excavation area will be decommissioned by a licensed well driller or under the supervision of a professional engineer, in accordance with the Ecology Water Well Construction Act (1971), RCW 18.104 (WAC 173-160-460). The wells will be abandoned in place using bentonite clay. A summary of the existing monitoring wells to be decommissioned is provided in Table 7 of the CAP.

3.4 SHORING INSTALLATION

Shoring will be installed around the entire perimeter of the Site to facilitate redevelopment. The shoring will consist of soil nail walls throughout with the exception of the wall on the north side of the north building, which will be of soldier pile construction. The shoring design will be incorporated into the future development plans and are not presented in the CAP.

3.5 EXCAVATION

Four excavation areas have been identified for the cleanup action and their soil will be managed and sampled based on the type and extent of contamination (Excavation Area A, B, C1, C2, and D). Excavation Area A, located on the North Block, encompasses TCE-Contaminated soil. Approximately 3,800 tons of TCE-impacted soil and drill cuttings will be excavated and disposed of at a Subtitle D landfill. These soils do not require disposal as listed dangerous waste as determined by Ecology (Contained-in Determination Letter dated February 4, 2014) and will be disposed of as non-hazardous waste following the guidelines outlined in the aforementioned determination. Additional impacted soils may be identified based on the eight pre-excavation borings advanced after building demolition. Excavation Area B, also located on the North Block, encompasses the area where lead-contaminated soil has been encountered. Excavation areas C1 and C2, located on the North and South Blocks, respectively, encompass the areas where PAH-contaminated soil has been encountered. Excavation Area D, located on the North block, encompasses the area where the GPR survey encountered an anomaly, potentially representing a heating oil UST. The locations of the excavation areas are presented on Figure A-3.

Performance soil samples will be periodically collected and submitted to a laboratory for analysis of COCs for characterization and documentation purposes. TCE-impacted soil above Method A cleanup levels within the redevelopment excavation will be removed and disposed of during site preparation and grading activities.

The remedial excavation will commence once the redevelopment excavation is complete on the North Block. Any sidewalls of the remedial excavation deeper than 4 feet will be sloped at a 1:1 maximum slope. The contractor will make an effort to minimize the cross contamination of clean soil during the excavation of the remedial excavation area by directly loading the contaminated soil, if feasible, and minimizing tracking of soil across the site; by establishing site controls, such as tire and truck wash stations and by limiting the excavation daily to only remove contaminated soil to ensure proper decontamination of equipment before excavating clean soil, if feasible.

3.5.1 Contingency Plan to Address Unknown Contamination

The presence of aesthetic impacts and conditions encountered by site employees and equipment operators during the construction excavation activities at the site may be indicative of conditions associated with contaminated media. Equipment operators will be instructed to use these criteria to alert the site superintendent and construction manager of potential issues of previously unidentified contamination at the Site, in accordance with the communication plan (Figure 13 of the CAP). Any of the following occurrences are considered common sense criteria that may require a mitigation or remediation response. These criteria include, but are not limited to the following:

- Obvious petroleum staining, sheen, or colored hues in soil or standing water.
- The presence of petroleum products or leachate of other chemicals.
- The presence of utility pipe lines with sludge or trapped liquid indicating petroleum or chemical discharge sludge.
- The presence of buried pipes, conduits, tanks, or unexplained metallic objects or debris.
- Materials with a granular texture that suggests industrial origin.
- Vapors causing eye irritation or nose tingling or burning.
- White, chalky compounds or fine particulate soil layers.
- Presence of gasoline- or oil-like vapor or odor.
- Burnt debris or the presence of slag-like material.

Any criteria identified by on-site personnel will be evaluated and, as appropriate, a sampling plan will be developed to properly characterize and manage the material in accordance with state and federal regulations.

Two subsurface anomalies were observed east of Building 1 during the GPR survey conducted at the Property in 2011 (Excavation Area D). In the event that a previously unidentified UST is encountered during the course of the excavation activities, a UST site assessment will be conducted under the oversight of a Washington State certified UST site assessor, and the UST will be removed in accordance with the Guidance for Site Checks and Site Assessment for Underground Storage Tanks (Ecology 2003), Underground Storage Tank Regulations (WAC 173-360), and Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2011). In the event that impacts to soil are observed, performance and confirmational soil samples will be collected and analyzed to ensure that the contaminated soil is removed and properly characterized before disposal.

3.6 PARKING STRUCTURE CONSTRUCTION

Construction of the subgrade parking structure will commence after the excavation is completed. Preliminary plans are to construct two levels of below-grade parking with an associated venting system. The concrete shoring and foundation system will be constructed to act as a barrier to recontamination and vapor intrusion from the groundwater plume within the ROWs. Any vapor intrusion into the subgrade parking structure will be further mitigated by the venting system typically incorporated into such structures to avoid buildup of carbon monoxide and petroleum fumes generated by running vehicle engines. The garage venting system will be designed to adequately increase the air exchange rate if vapor intrusion mitigation measures are required in the future.

3.7 PERMANGANATE INJECTION SYSTEM

Once the final limits of the excavation are reached and prior to the completion of the mat slab foundation floor, the in situ groundwater treatment system will be installed (Figures 12, 14 and 15 of the CAP). The following sections describe the permanganate injection system design, well installation, injection activities, and well decommissioning.

3.7.1 Permanganate Injection System Design

The injection wells will be installed assuming a radius of influence of 10-feet along the perimeter of the TCE plume, throughout the source area, and along each side of the North 34th Street ROW. Approximately 1,000 gallons of 3 to 4 percent potassium permanganate solution will be injected into each well. The layout of the system will serve as a barrier to further migration of contaminated groundwater and address the groundwater plume beneath the North and South Blocks and North 34th Street ROW.

The following equation describes the oxidation of TCE ($CHCl_3$) by potassium permanganate ($KMnO_4$):

$$2KMnO_4 + CHCl_3 \rightarrow 2CO_2 + 2MnO_2 + 2K^+ + 2Cl + HCl$$

A stoichiometric ratio of 2:1 permanganate to TCE is required for the chemical mineralization of TCE. In addition to the chlorinated solvent, organics present in the soil and groundwater consume the permanganate. This natural oxidant demand can be quantified as permanganate water oxidant demand (PWOD) and soil oxidant demand (SOD) and are determined in laboratory studies performed by the Carus Corporation. The average SOD was measured to be 0.5 grams of permanganate per kg of dry soil and the average PWOD was 0.021 grams of permanganate per liter of groundwater.

Based on the estimated total mass of TCE in the groundwater plume, the PWOD, and SOD, The mass of permanganate required was conservatively determined to be approximately 20,000 pounds. Approximately 350 pounds of permanganate would be combined with water in 1,000 gallons of 4 percent solution and injected into each point. Actual injection volumes and solution percentages may vary from well to well and will be determined individually based on field conditions.

3.7.2 Remediation Injection Well Installation

The remedial well design and specifications are presented on Figure 14 of the CAP. There will be 59 injection wells advanced beneath the North and South Blocks and the North 34th Street ROW to a typical depth of 40 feet bgs. All wells will be completed by a licensed well driller and comply with the requirements of WAC 173-160, Minimum Standards for Construction and Maintenance of Wells.

Each remediation well will be constructed of 2-inch-diameter blank PVC casing, flush-threaded to a 0.010-inch slotted well screen. The bottom of each of the wells will be fitted with a threaded PVC bottom cap, and the top of each well will be fitted with a PVC female adapter and threaded plug. A hose from the permanganate injection system will attach to the injection well head.

Each remediation well will be completed with a grout/bentonite seal extending down from the top of casing, which will be the approximate elevation at the base of the excavation. The annulus of the remediation wells will be filled with #10/20 silica sand extending from the bottom of the bentonite seal to total depth. The well completion will be recorded in boring logs, examples of which are provided as Attachment A.

The injection wells will be developed by SoundEarth field staff with the use of an electric submersible pump or bailer and will consist of surging and purging until a minimum of five well volumes are removed and the groundwater no longer appears turbid. Turbidity will be measured visually by field staff conducting development activities. The installation of the injection wells will occur concurrently with construction activities. The estimated remedial time frame for groundwater restoration is 1 year following the final injection event.

SoundEarth will collect soil and groundwater samples from 7 of the new wells during installation. The analytical results will be analyzed to confirm the conceptual site model, which due to existing buildings has not fully defined the source or depth of groundwater contamination. The field program for remedial implementation at the Site would be modified in accordance with that data discussion and its conclusions.

3.7.3 Permanganate Injection System Operation

To mix and inject approximately 59,000 gallons of permanganate solution, a temporary system will be constructed on site. The system will consist of a mixing pump, injection pump, batch tank, injection manifold, and ancillary piping and controls, as shown on Figure 15. The pumps, control panel and manifold will be constructed off-site prior to injection field work. Dry potassium permanganate will be mixed and injected in up to 10 wells at once. The anticipated injection flow rate determined from the pilot test conducted on September 28, 2013, is approximately 5 gallons per minute per well. SoundEarth anticipates injecting the entire volume in 2 weeks, outside of unforeseen hydraulic refusal or equipment failures. Initial injections will occur on the North Block. The system will then be disassembled and moved to the South Block.

3.7.4 Injection and Monitoring Well Decommissioning

Upon completion of the permanganate injection activities, all the injection wells will be retained during the construction process. These wells may be utilized for future contingency permanganate injections, if needed. Once the required confirmational monitoring is complete, the compliance monitoring wells and injection wells will be decommissioned in place with bentonite clay in accordance with the Ecology Water Well Construction Act (1971), Revised Code of Washington 18.104 (WAC 173-160-460).

4.0 COMPLIANCE MONITORING PROGRAM

Compliance monitoring during the cleanup action will include protection, performance, and confirmational monitoring. Specific protocols for protection monitoring are provided in the HASP (Appendix C of the CAP). The specific protocols for performance and confirmational vapor monitoring, discharge confirmational monitoring, and groundwater performance and confirmational monitoring for the cleanup action are provided in detail in Sections 3.0 of the CAP. The containers, preservation procedures, and holding times for all media samples are shown in Table A-1 and follow standard laboratory protocols. Documentation requirements for the performance and confirmational monitoring are presented in Section 11.1. Laboratory reporting limits for the analytes discussed in each subsection are presented in Table A-2. Deviations from the procedures presented below will be approved by the Project Manager prior to implementation and will be discussed in the Closure Report for the Site.

4.1 GROUNDWATER

It is anticipated that the Site groundwater quality will be improved by virtue of removing the source area from the Property. Performance groundwater samples will be collected will be collected and analyzed using an Ecology-accredited laboratory to monitor the effectiveness of implementation of the injection program at the Site. Groundwater confirmational monitoring will be initiated once performance monitoring results indicate that the cleanup objectives described in the CAP have been achieved at the points of compliance for groundwater at the Site. These analytical results will be used to confirm that the cleanup objectives have been met. The groundwater sampling frequency and locations, procedures for sample collection and handling, analytical testing methods, and QA/QC for groundwater performance monitoring are presented below.

4.1.1 Sampling Frequency

Performance groundwater sampling will be conducted on a quarterly basis and will continue until the data indicates that cleanup levels at the point of compliance at the Site have been met. Confirmation groundwater sampling will be performed on a quarterly basis for a minimum of4 consecutive quarters after active remediation via injection program is complete. If the results of 8 consecutive confirmation sampling events confirm that concentrations of the COCs in groundwater are below MTCA Method A cleanup levels, the cleanup action for groundwater will be considered complete, and no additional groundwater sampling will be necessary.

4.1.2 Sample Locations

Performance and confirmational groundwater samples will be collected from the existing well network that remains after the excavation of the Property, including monitoring wells MW03, MW04, MW05 and MW15. Wells MW01, MW02, and MW06 through MW10 will be decommissioned during excavation activities and. Compliance groundwater samples will also be collected from two wells to be installed on Burke Avenue North and from three wells to be installed in the finish parking garage. Compliance wells are shown on Figure 16 of the CAP. As part of the UIC permit, downgradient wells MW07, MW11, and MW15 will also be monitored for color, manganese, and pH.

4.1.3 Sample Collection Procedures

Groundwater samples will be handled in accordance with the 1996 U.S. Environmental Protection Agency (EPA) guidance document, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures* at least 24 hours following well development. SoundEarth field staff with follow the procedures described below when collecting groundwater samples:

- The locking well cap from the monitoring well will be removed and the groundwater level in the well will be allowed to equilibrate to atmospheric pressure for a minimum of 20 minutes.
- The depth to groundwater in the monitoring well will be measured relative to the top of well casing to the nearest 0.01 foot using an electronic water-level meter. The depth to the monitoring well bottom will also be measured to evaluate siltation of the monitoring well and to calculate the estimated purge water volume. All non-disposable equipment will be decontaminated between uses.
- Each monitoring well will be purged at a low-flow rate (100 to 300 milliliters per minute) using a bladder pump and dedicated polyethylene tubing. The pump intake will be placed at the approximate center of the screened interval. Temperature, pH, specific conductivity, dissolved oxygen, and oxidation-reduction potential will be monitored during purging using a water quality meter equipped with a flow-through cell while purging to determine when stabilization of these parameters occurs.
- Groundwater samples will be collected directly from the pump outlet following stabilization of temperature, pH, specific conductance, turbidity, dissolved oxygen, and oxygen-reduction potential. If the monitoring well is completely dewatered during purging, samples will be collected when the groundwater in the well has recovered to at least 80 percent of the pre-purge casing volume.
- If low-flow sampling methods are not practical, the monitoring well will be allowed to recharge for no longer than 2 hours following cessation of purging and will be sampled using a dedicated, disposable, polyethylene double-check valve bailer and sampling cord.
- The sample containers, as described in Table A-3, will be filled directly if collected from a pump, or the water samples will be transferred immediately from the bailer into laboratory-supplied sample containers, taking care to minimize turbulence. Care will be taken not to handle the seal or lid of the container when decanting the sample into the

containers. The containers will be filled completely to eliminate any headspace, and the seals/lid will be secured.

- Each sample container will be labeled and handled following the protocols described in Section 4.3, Sample Container and Handling Procedures.
- The chain-of-custody protocols will be maintained during sample transport and submittal to the laboratory.
- The well cap and monument will be secured following sampling. Any damaged or defective well caps or monuments will be noted and scheduled for replacement, if necessary.

Field personnel will be required to prepare Groundwater Purge and Sample Forms during groundwater monitoring and sampling activities. The forms will include depth to groundwater and total depth measurements, as well as water quality measurements, including pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential, and/or turbidity. In addition, the sample identifier (ID), date of sample collection, and analyses will be recorded on the form. An example of the Groundwater Purge and Sample Form is included in Attachment A-A.

4.1.4 Sample Identification

Each sample collected during the cleanup action will be assigned a unique sample ID and number. Sample ID labels will be filled out and affixed to appropriate containers immediately before sample collection. The label is filled out in indelible ink and will include the following information: media, date, time sampled, sample identification and number, project name, project number, sampler's initials, and analyte preservative(s) if any. An example of the Sample ID Label is included in Attachment A-A of this SAP. Groundwater sample IDs will include a prefix of the well identification and the date. For example, the groundwater sample collected from monitoring well MW06 on October 22, 2014, would be numbered MW06-20141022. The sample identification will be placed on the Sample ID Label, the Field Report form, the Groundwater Purge and Sample Form, and the Sample Chain of Custody form.

4.2 SOIL

Existing sample analytical results will be used for performance and confirmational soil monitoring.Performance soil samples will be collected and analyzed using an Ecology-accredited laboratory to confirm that all of the soil exhibiting concentrations of COCs in excess of the MTCA Method A cleanup up level has been removed. Compliance soil samples will be collected from the bottom of each 25-foot by 25-foot soil grid cell at the bottom of Excavation Area A. The soil samples will be centered in the grid cell and will be located and identified by the grid cell. If the concentrations of COCs exceed the MTCA Method A cleanup level in the bottom samples, supplemental soil samples will be collected at a greater depth to confirm that cleanup levels have been achieved.

A contingency for performance samples will be retained in the event that an unknown condition is encountered during the course of the excavation, such as a UST. In this case, performance monitoring for soil will be conducted, the analytical results will direct the advancement of the excavation and characterize the soil for disposal.

Existing sample results will be used for soil confirmational monitoring. With the exception of the dangerous waste excavation area, no confirmational soil monitoring is proposed for the Remedial Excavation Area because the excavation plan includes removal of all contaminated soil from the Site.

Confirmational monitoring may be required if unforeseen soil conditions are encountered during the course of the excavation. In the event that unanticipated conditions are encountered and confirmational soil samples are required, samples will be collected from the bottom and the sidewalls of the excavation to confirm that cleanup levels have been achieved.

4.2.1 Sampling Frequency

The number of samples anticipated to be collected from the bottom of the main excavation within each 25-foot by 25-foot soil grid is one. Sidewall samples will be collected every 25 feet.

One five-point composite sample is anticipated to be collected and analyzed from the bottom and sidewalls of each of the remaining excavation areas (Excavation Areas B, C1, C2, and D).

If USTs are encountered during excavation activities, SoundEarth will collect soil samples in accordance with Ecology's *Guidance for Site Checks and Site Assessments for Underground Storage Tanks.* The locations and number of soil samples anticipated to be collected in the two potential UST areas is dependent on the condition of the UST(s) and the extent of contamination, if any. At minimum, soil samples will be collected from one to two feet below the bottom of the UST and the number of samples will be in accordance with Table 5-3 of Ecology's guidance document.

4.2.2 Sample Collection Procedures

Soil samples will be collected directly from the sidewalls and/or bottom of the remedial excavation area using either stainless steel or plastic sampling tools. Soil samples collected for analysis of volatile organic compounds will be collected in accordance with EPA Method 5035. Soil samples collected at depths of less than 4 feet bgs or in a shored or sloped area will be collected manually. Samples collected at depths below 4 feet bgs will be collected with the backhoe bucket unless engineering controls are in place that allow for manual sample collection at depths greater than 4 feet bgs. Information logged during soil sampling will include sample depth, Unified Soil Classification System description, soil moisture content, observations of physical indications of contamination (e.g., odors, staining), and field screening data obtained using a photoionization detector (PID). All non-dedicated sampling equipment will be decontaminated between uses. The samples will be submitted for laboratory analysis and the analytical results will be used to assess when the points of compliance for soil have been achieved.

4.2.3 Sample Identification

Each sample collected during the cleanup action will be assigned a unique sample ID and number. Sample ID labels will be filled out and affixed to appropriate containers immediately before sample collection. The label is filled out in indelible ink and will include the following information: media, date, time sampled, sample identification and number, project name, project number, sampler's initials, and analyte preservative(s) if any. An example of the Sample ID Label is included in Attachment A-A of this SAP.

All soil samples collected during the cleanup action will be first identified by the excavation area from which they were collected. Samples collected from Excavation Area A during the cleanup action will be identified by their position relative to a grid measuring approximately 50 feet (northwest-southeast) by 200 feet (southwest-northeast), and segregated into eight discrete grid cells (A1 through B4), each measuring 25 feet by 25 feet.

Samples collected from Excavation Area A will be assigned a unique identifier that will include the components listed below:

- Excavation Area (e.g., EXA)
- The grid cell identification (e.g., A1)
- The compass heading of the sidewall (e.g., N)
- The sample type (e.g., bottom "B", sidewall "Southwest")
- The number of samples collected in that area (e.g., 01, 02, 03)
- The depth in feet bgs (e.g., 12)

For example, a soil sample collected from the bottom of excavation area A in grid cell A1 at a depth of 12 feet bgs would be identified as EXA-A1B01-12. If this bottom location required overexcavation and further sampling within the same grid cell and depth, for example 14 feet below ground surface, a second sample would be collected and would be identified as A1B02-14. The sample identification would be recorded on the Sample ID Label, Field Report form, and Sample Chain of Custody form.

Samples collected from excavation areas B, C1, C2, and D will be composited. Their unique identifiers will include the excavation area (e.g., EXB) and the suffix "composite." For example, a soil sample collected from Excavation Area B would be identified as EXB-Composite.

4.3 SAMPLE CONTAINER AND HANDLING PROCEDURES

SoundEarth personnel will be responsible for following the container handling procedures below:

- Each sample container will be labeled and handled with the date and time sampled, well identification number, project number, and preservative(s), if any.
- All sample collection information will be documented on a Sample Chain of Custody form; the sample will be placed in a cooler chilled to near 4 degrees Celsius and transported to the laboratory.

The FC will check all container labels, chain of custody for entries, and field notes for completeness and accuracy at the end of each day.

4.4 FIELD QUALITY ASSURANCE SAMPLING

Field and laboratory activities will be conducted in such a manner that the results be valid and meet the data quality objectives for this project. QA/QC groundwater samples will be collected during the course of the groundwater monitoring to provide for data validation, as detailed in Section 4.4. QA/QC samples will consist of field duplicates. QA/QC samples will be collected and sent to the laboratory along with the primary field samples. It is estimated that one groundwater field duplicate sample will be collected for every 10 groundwater samples collected per sampling event. The QA/QC samples will be assigned a unique sample identifier and number. The number will include a prefix of FD for field duplicates. For example, the field duplicate collected during a sampling event on October 22, 2014, would be labeled FD01-20141022. SoundEarth will note the locations of the field duplicates in the field notes.

4.5 SAMPLE CHAIN-OF-CUSTODY PROCEDURES

The written procedures that will be followed whenever samples are collected, transferred, stored, analyzed, or destroyed are designed to create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and reporting of analytical values. This written record, the Sample Chain of Custody form, will be filled out by the field sampling team at the time the sample is obtained. An example of the Sample Chain of Custody form is included in Attachment A-A.

All samples submitted to the laboratory are accompanied by the Sample Chain of Custody form. This form is checked for accuracy and completeness and then signed and dated by the laboratory sample custodian accepting the sample. At the laboratory, each sample is assigned a unique, sequential laboratory identification number that is stamped or written on the Sample Chain of Custody form.

All samples are held under internal chain of custody in the sample control room using the appropriate storage technique (i.e., ambient, refrigeration, frozen). The laboratory project manager assigned will be responsible for tracking the status of the samples throughout the laboratory. Samples will be signed out of the sample control room in a sample control logbook by the analyst who will prepare the samples for analysis.

The Sample Chain of Custody form will include the following information: client, project name and number, date and time sampled, sample identification, sampler's initials, analysis, and analyte preservative(s), if any.

4.6 DECONTAMINATION PROCEDURES

Decontamination of all nondisposable tools and equipment will be conducted before each sampling event and between each sampling location, including stainless steel bowls/containers, stainless steel spoons/spatulas, stainless steel core catcher, hack saw blades, and drill bits. A sufficient supply of pre-decontaminated small equipment will be mobilized to the sampling locations to minimize the need for performing field decontamination. Field personnel will change disposable latex or nitrile gloves before collecting each sample and before decontamination procedures and will take precautions to prevent contaminating themselves with water used in the decontamination process. The following steps will be followed to decontaminate reusable soil and groundwater sampling equipment:

- The equipment will be washed with a solution of Alconox (or an equivalent detergent) and water.
- The equipment will be rinsed with tap water.
- A final rinse will be conducted with distilled or deionized water.

Residual sample media from the equipment, used decontamination solutions and associated materials, and disposable contaminated media will be disposed of according to the procedures described in Section 6.0, Management of Investigation-Derived Waste.

5.0 ANALYTICAL TESTING

All compliance samples will be submitted to Friedman and Bruya, Inc., an Ecology-accredited analytical laboratory, on a standard 7- to 10-day turnaround time. All chemical and physical testing will adhere to EPA's Southwest-846 (EPA 2007) QA/QC procedures and analysis protocols or follow the appropriate Ecology methods. In completing chemical analyses for this project, the laboratory will meet the following minimum requirements:

- Adhere to the methods outlined in this SAP, including methods referenced for each analytical procedure.
- Provide a detailed discussion of any modifications made to previously-approved analytical methods.
- Deliver PDF and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in Section 7.0, including data quality objectives (DQOs), laboratory quality control requirements, and performance evaluation testing requirements.
- Notify the project QA/QC manager of any QA/QC problems when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

Copies of the *Laboratory Quality Assurance Manual* from Friedman and Bruya, Inc. are on file at SoundEarth's offices for review and reference and will be followed throughout the cleanup action. Access to laboratory personnel, equipment, and records pertaining to samples, collection, transportation, and analysis can be provided. Container requirements, holding times, and preservation methods for soil and water are summarized in Table A-3.

Sample laboratory analytical results for each analyte will be compared to regulatory limits applicable to the cleanup action. A detailed description of the analytical methods, laboratory practical quantitation limits (PQLs), and applicable regulatory limits for each analyte is provided in Table A-4. Analytical testing is summarized in the sections below for each medium to be sampled during the cleanup action.

5.1 GROUNDWATER

Groundwater performance and confirmational samples collected during and after the cleanup action will be analyzed for chlorinated volatile organic compounds, including tetrachloroethene (PCE), trichloroethene (TCE), cis- and trans-1,2-dichloroethene (DCE), and vinyl chloride by EPA Method 8260C. Resultant concentrations will be compared to MTCA Method A cleanup levels for groundwater (Table A-4) to evaluate the effectiveness of the cleanup action on groundwater beneath the Site. Additionally, MW05 and MW15 will be sampled for manganese (a by-product of potassium permanganate), pH, and color.

5.2 SOIL

Select soil samples will be collected from submitted for laboratory analysis of chlorinated volatile organic compounds, including tetrachloroethene (PCE), trichloroethene (TCE), cis- and trans-1,2-dichloroethene (DCE), and vinyl chloride by EPA Method 8260C.

Areas where lead and PAHs have been previously encountered above MTCA Method A cleanup levels (Excavation Areas B, C1, and C2) will be submitted for laboratory analysis of PAHs, including carcinogenic PAHs by EPA Method 8270D and lead by EPA Method 200.8.

If field indications of petroleum impacts are encountered during the excavation activities, associated with the potential heating oil USTs (for example Excavation Area D), soil samples will be collected and submitted for laboratory analysis of DRPH and ORPH by Northwest Total Petroleum Hydrocarbon method NWTPH-Dx.

6.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Contaminated soil, groundwater, decontamination water, and disposable equipment generated during the cleanup action will be handled in accordance with Ecology's February 4, 2014, Contained-In determination for the Property and/or in accordance with state and federal regulations. The procedures for managing investigation-derived waste for the expected waste streams are discussed in the sections below.

6.1 WASTEWATER

Wastewater will be generated during the cleanup action in the course of equipment decontamination activities and purging water from the wells during compliance groundwater sampling events. Water will be stored on site, labeled, and disposed of at an appropriate waste TSDF or discharged to the sanitary system if levels are below King County Metro limits.

6.2 SOIL

Soil not exhibiting any detectable concentrations of COCs will be disposed of as clean fill or reused on the Site.

Soil contaminated with TCE, a listed dangerous Waste (F001) under the Resource Conservation and Recovery Act, will be managed in accordance with Ecology's Contained-In determination. TCE-contaminated soil will transported directly to a permitted RCRA Subtitle D landfill or a Washington State solid waste landfill permitted under Chapter 173-351 WAC.

If Soil containing petroleum hydrocarbons is excavated during the cleanup action at the Sit and contains no detectable concentrations of TCE, it will be segregated into Class 1 Soil, Class 2 Soil, and Class 3 Soil in accordance with Table V in *Guidance for Remediation of Petroleum Contaminated Soils* when feasible (Attachment A-B). Based on SoundEarth's current understanding of the nature and extent of petroleum-contaminated soil at the Avtech Property, there are large areas anticipated to be Class 1 Soil. Class 1 Soil will be stockpiled at the Avtech Property, sampled in accordance with Table I of the *Guidance for Remediation of Petroleum Contaminated Soils* (Attachment A-B) and analyzed for COCs. Samples of stockpiled excavated soil will be collected from locations where field instrumentation (i.e., PID) or field observations indicate that contamination is likely to be present and will be collected from a depth of 6 to 12 inches beneath the surface of the stockpile. Class 1 Soil will be transported off the Property for disposal or used as backfill.

Class 2 Soil and Class 3 Soil at the Property are anticipated to be present within the designated remedial excavation areas. Class 2 Soil and Class 3 Soil will be excavated and loaded directly on to trucks for disposal off the Site. SoundEarth field personnel will provide each truck driver with a Soil Class Ticket designating the class of soil carried in the truck and document the class of each truck load of soil on the Material Import and Export Summary form. The truck driver will provide the treatment, storage, and disposal facility (TSDF) with the ticket identifying the class of the soil. The TSDF will dispose of the soil based on the class of soil identified on the soil class ticket or confirm the class of the soil by collecting and analyzing soil samples for petroleum hydrocarbon constituents. If the TSDF identifies the class of soil as being different than identified on the soil class ticket, the TSDF will inform SoundEarth of the change in the class of soil.

6.3 DISPOSABLES

Disposable personal protective clothing (e.g., TYVEK suits, rubber gloves, and boot covers) and disposable sampling devices (e.g., plastic tubing, plastic scoops, and bailers) will be placed in plastic garbage bags and disposed of as nonhazardous waste.

7.0 DATA QUALITY OBJECTIVES

Field and laboratory activities will be conducted in such a manner that the results be valid and meet the data quality objectives for this project. Guidance for QA/QC will be derived from the protocols developed for the cited methods within EPA's documents *Test Methods for the Evaluation of Solid Wastes Laboratory Manual Physical/Chemical Methods Southwest-846* (EPA 2007) and the *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review* (EPA 2008). The data quality objectives are designed to:

- Assist the project manager and project team to focus on the factors affecting data quality during the planning stage of the project.
- Facilitate communication among field, laboratory, and project staff as the project progresses.
- Document the planning, implementation, and assessment procedures for QA/QC activities for the cleanup action.
- Verify that the DQOs are achieved.
- Provide a record of the project to facilitate final report preparation.

The DQOs for the project include both qualitative and quantitative objectives, which define the appropriate type of data and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the cleanup action. To verify that the DQOs are achieved, this SAP details aspects of sample collection and analysis including analytical methods, QA/QC procedures, and data quality reviews. This SAP describes both qualitative and quantitative measures of data quality to verify that the DQOs are achieved.

Detailed QA/QC procedures in the field and at the laboratory are provided in the following sections. The DQOs for the cleanup action will be used to develop and implement procedures to verify that data collected is of sufficient quality to adequately address the objectives of the cleanup action as defined in the CAP. All observations and measurements will be made and recorded in such a manner as to yield results representative of the media and conditions observed and/or measured. Goals for representativeness will be met by verifying that sampling locations are selected properly, that a sufficient number of samples are collected, and that field screening and laboratory analyses are conducted properly.

The quality of the laboratory data will be assessed by precision, accuracy, representativeness, completeness, comparability, and sensitivity. Definitions of these parameters and the applicable QC procedures are described in Sections 7.1 through 7.6. Quantitative DQOs are provided following each definition. Laboratory DQOs have been established by the analytical laboratory. Applicable quantitative goals for these DQOs are listed in Table A-5.

7.1 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of two or more measurements compared to their average values. Precision is calculated from results of duplicate sample analyses. Precision is quantitatively expressed as the relative percent difference (RPD) and is calculated as follows:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \; x\, 100$$

Where:

RPD = relative percent difference

C_1 = larger of the two duplicate results (i.e., the highest detected concentration)

C_2 = smaller of the two duplicate results (i.e., the lowest detected concentration)

There are no specific RPD criteria for organic chemical analyses. Quantitative RPD criteria for organic analyses will be based on laboratory-derived control limits.

7.2 ACCURACY

Accuracy is a measure of the closeness (bias) of the measured value to the true value. The accuracy of chemical analytical results is assessed by “spiking” samples in the laboratory with known standards (a surrogate or matrix spike of known concentration) and determining the percent recovery. The accuracy is measured as the percent recovery (%R) and is calculated as follows:

$$\%R = \frac{(M_{sa} - M_{ua})}{C_{sa}} \; x\, 100$$

Where:

%R = percent recovery

M_{sa} = measured concentration in spiked aliquot

M_{ua} = measured concentration in unspiked aliquot

C_{sa} = actual concentration of spike added

Laboratory matrix spikes and surrogates will be carried out at the analytical laboratory in accordance with EPA Southwest-846 (EPA 2007) and Ecology methods and procedures for inorganic and organic chemical analyses. The frequency of matrix spikes and matrix spike duplicates will each be one per batch of 20 samples or less for soil and groundwater samples. Quantitative percent recovery criteria for organic analyses will be based on laboratory-derived control limits for surrogate recovery and matrix spike results.

The accuracy of sample results can also be affected by the introduction of contaminants to the sample during collection, handling, or analysis. Contamination of the sample can occur because of improperly cleaned sampling equipment, exposing samples to chemical concentrations in the field or during transport to the laboratory, or because of chemical concentrations in the laboratory. To demonstrate that the samples collected are not contaminated, laboratory method blank samples will be analyzed. The laboratory will run method blanks at a minimum frequency of 5 percent, or one per batch, to assess potential contamination of the sample within the laboratory.

7.3 REPRESENTATIVENESS

Representativeness is a qualitative assessment of how closely the measured results reflect the actual concentration or distribution of the constituent concentrations in the matrix sampled. The sampling plan design, sample collection techniques, sample handling protocols, sample analysis methods, and data review procedures have been developed to verify that the results obtained are representative of the site conditions. These issues are addressed in detail in Section 5.0, Analytical Testing, and Section 9.0, Quality Control Procedures.

7.4 COMPLETENESS

Completeness is defined as the percentage of measurements judged to be valid. Results will be considered valid if they are not rejected during data validation (Section 9.0, Quality Control Procedures). Completeness is calculated as follows:

$$C = \frac{(Number\ of\ Valid\ Measurements)}{(Total\ Number\ of\ Measurements)}\ x\ 100$$

Objectives for completeness are based, in part, on the subsequent uses of the data (i.e., the more critical the use, the greater the completeness objective). The objectives for completeness of samples are expressed as percentages, which refer to the minimum acceptable percentages of samples received at the laboratory in good condition and acceptable for analysis. The objectives of completeness for other samples are 95 percent for soil and water samples. These objectives will be met through the use of proper sample containers, proper sample packaging procedures to prevent breakage during shipment, proper sample preservation, and proper labeling and chain-of-custody procedures. A loss of 5 to 10 percent of intended samples is common, and the goals set are sufficient for intended data uses.

The objectives for completeness of chemical analyses are also expressed as percentages and refer to the percentages of analytical requests for which usable analytical data are produced. The initial objective for completeness of chemical analyses in the laboratory is 95 percent.

7.5 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The use of standard Ecology and EPA methods and procedures for both sample collection and laboratory analysis will make the data collected comparable to both internal and other data generated.

7.6 SENSITIVITY

Analytical sensitivities are measured by PQLs, which are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. PQLs are determined by the laboratory. The specific analytes and their corresponding PQLs that will be required for the cleanup action are presented in Table A-4. The detection or reporting limits for actual samples may be higher depending on the sample matrix and laboratory dilution factors.

8.0 DATA COLLECTION

This section outlines the procedures to be followed for the inventory, control, storage, and retrieval of data collected during performance of the cleanup action. The procedures contained in this SAP are designed to verify that the integrity of the collected data is maintained for subsequent use. Moreover, project-tracking data (e.g., schedules and progress reports) will be maintained to monitor, manage, and document the progress of the cleanup action.

8.1 DATA COLLECTION APPROACH

Procedures that will be used to collect, preserve, transport, and store samples are described in Section 4.3, Sample Container and Handling Procedures. All sampling protocols will be performed in accordance with generally accepted environmental practices and will meet or exceed current regulatory standards and guidelines. Sampling procedures may be modified, if necessary, to satisfy amendments to current regulations, methods, or guidelines. The data collection approach for key elements of the cleanup action field program will verify the project DQOs are met or exceeded. The key elements include soil samples collected and analytical results used to demonstrate that the concentrations of COCs at the limits of the remedial excavation are below applicable cleanup levels as defined in the SAP. The total number of samples collected and specific analyses to be performed will be based on field screening results, field observations, and analytical results for performance and confirmational monitoring.

8.2 DATA TYPES

A variety of data will be generated during the cleanup action, including sampling and analytical data. The laboratory analytical data will be transmitted to SoundEarth as an electronic file, in addition to a hardcopy laboratory data report. This method will facilitate the subsequent validation and analysis of these data while avoiding transcription errors that may occur with computer data entry. Examples of data types include manually recorded field data, such as boring logs, and electronically reported laboratory data.

8.3 DATA TRANSFER

Procedures controlling the receipt and distribution of incoming data packages to SoundEarth and outgoing data reports from SoundEarth include the following:

- Incoming documents will be date-stamped and filed. Correspondence and transmittal letters for all reports, maps, and data will be filed chronologically. Data packages, such as those from field personnel, laboratories (such as soil data) and surveyors (elevation data), will be filed by project task, subject heading, and date. If distribution is required, the appropriate number of copies will be made and distributed to the appropriate persons or agencies.
- A transmittal sheet will be attached to all project data and reports sent out. A copy of each transmittal sheet will be kept in the administrative file and the project file. The project manager and project QA/QC officer will review all outgoing reports and maps.

8.4 DATA INVENTORY

Procedures for filing, storage, and retrieval of project data and reports are discussed below.

8.4.1 Document Filing and Storage

As previously discussed, project files and raw data files will be maintained at SoundEarth's office. Files will be organized by project tasks or subject heading and maintained by the document control clerk. Hard copy project files will be archived for a minimum of 3 years after completion of the project. Electronic copies of files will be maintained in a project directory and backed up daily, weekly, and monthly.

8.4.2 Access to Project Files

Access to project files will be controlled and limited to AMLI Residential Partners and its authorized representatives, Ecology, and SoundEarth personnel. When a hard copy file is removed for use, a sign-out procedure will be used to track custody. If a document is to be used for a long period, a copy will be used, and the original will be returned to the project file. Electronic access to final reports, figures, and tables will be write-protected in the project directory.

8.5 DATA VALIDATION

Data quality review will be performed, where applicable, in accordance with the current EPA guidance as set forth in *Guidance on Environmental Data Verification and Data Validation* (EPA QA/G-8). The following types of QC information will be reviewed, as appropriate:

- Method deviations
- Sample extraction and holding times
- Method reporting limits
- Blank samples (equipment rinsate and laboratory method)
- Duplicate samples
- Matrix spike/matrix spike duplicate samples (accuracy)
- Surrogate recoveries
- Percent completeness and RPD (precision)
- A QA review of the final analytical data packages for samples collected during the cleanup action.

8.6 DATA REDUCTION AND ANALYSIS

The project manager and project QA/QC officer are responsible for data review and validation. Data validation parameters are outlined as quantitative DQOs in Section 7.0, Data Quality Objectives. The particular type of analyses and presentation method selected for any given data set will depend on the type, quantity, quality, and prospective use of the data in question. The analysis of the project data will require data reduction for the preparation of tables, charts, and maps. To verify that data are accurately transferred during the reduction process, two data reviews will be performed, one by the project QA/QC officer or project manager and another by the project principal, before issuing the documents. Any incorrect transfers of data will be highlighted and changed.

9.0 QUALITY CONTROL PROCEDURES

This section provides a description of the QC procedures for both field activities and laboratory analysis. The field QC procedures include standard operating procedures for sample collection and handling, equipment calibration, and field QC samples.

9.1 FIELD QUALITY CONTROL

Field QC samples (e.g., duplicate samples) will be collected during this project and will follow the standard operating procedures during field screening activities. The procedural basis for these field data collection activities will be documented on the field report forms, as described in Section 11.1, Field Documentation, of this SAP. Any deviations from the established protocols will be documented on the field report forms.

QA/QC groundwater samples will be collected during the cleanup action to provide for data validation, as described in Section 9.0, Data Quality Objectives. QA/QC samples will consist of field duplicates. QA/QC samples will be collected and shipped to the laboratory along with the primary field samples. It is estimated that one groundwater field duplicate sample will be collected for every 10 groundwater samples collected per sampling event. The QA/QC samples will be assigned a unique sample identifier and number. The number will include a prefix of FD for field duplicates. For example, the field duplicate collected during a sampling event on October 22, 2014, would be labeled FD01-20141022. SoundEarth SoundEarth will note the locations of the field duplicates in the field notes.

9.2 LABORATORY QUALITY CONTROL

Analytical laboratory QA/QC procedures are provided in the *Laboratory Quality Assurance Manual* that is on file at SoundEarth's office for Friedman & Bruya, Inc. and are summarized below:

- **Laboratory Quality Control Criteria.** Results of the QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits were exceeded. If control limits are exceeded in the sample group, corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated before processing a subsequent group of samples. All primary chemical standards and standard solutions used in this project will be traceable to documented and reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities identified in the standard will be documented.

The following paragraphs summarize the procedures that will be used to assess data quality throughout sample analysis:

- **Laboratory Duplicates.** Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of 1 duplicate will be analyzed per sample group or for every 20 samples, whichever is more frequent.
- **Matrix Spikes and Matrix Spike Duplicates.** Analysis of matrix spike (MS) samples provides information on the extraction efficiency of the method on the sample matrix. By performing matrix spike duplicate (MSD) analyses, information on the precision of the method is also provided for organic analyses. A minimum of 1 MS/MSD will be analyzed for every sample group or for every 20 samples, whichever is more frequent.
- **Laboratory Control Samples.** A laboratory control sample is a method blank sample carried throughout the same process as the samples to be analyzed, with a known amount of standard added. The blank spike compound recovery assesses analytical accuracy in the absence of any sample heterogeneity or matrix effects.
- **Surrogate Spikes.** All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds, as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample result will be corrected for recovery using these values.
- **Method Blanks.** Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for every extraction batch or for every 20 samples, whichever is more frequent.

9.3 DATA QUALITY CONTROL

All data generated by Friedman & Bruya, Inc. will undergo two levels of QA/QC evaluation: one by the laboratory and one by SoundEarth. As specified in Friedman & Bruya, Inc.'s *Laboratory Quality Assurance Manual*, the laboratory will perform initial data reduction, evaluation, and reporting. The analytical data will then be validated at SoundEarth under the supervision of the project QA/QC officer. The following types of QC information will be reviewed, as appropriate:

- Method deviations
- Sample transport conditions (temperature and integrity)
- Sample extraction and holding times
- Method reporting limits
- Blank samples
- Duplicate samples
- Surrogate recoveries
- Percent completeness
- RPD (precision)

SoundEarth will review field records and results of field observations and measurements to verify procedures were properly performed and documented. The review of field procedures will include the following:

- Completeness and legibility of field logs
- Preparation and frequency of field QC samples
- Equipment calibration and maintenance
- Sample Chain of Custody forms

Corrective actions are described in Section 10.0, Corrective Actions.

9.4 DATA ASSESSMENT PROCEDURES

The project manager and project QA/QC officer are responsible for data review and validation. Upon receipt of each data package from the laboratory, calculations using the equations presented for precision, accuracy, and completeness will be performed. Results will be compared to quantitative DQOs, where established, or qualitative DQOs. Data validation parameters are outlined in Section 7.0, Data Quality Objectives, of this SAP.

9.5 PERFORMANCE AUDITS

Performance audits will be completed for both sampling and analysis work. Field performance will be monitored through regular review of Sample Chain of Custody forms, field forms, and field measurements. The project manager and/or the project QA/QC Officer may also perform periodic review of work in progress at the Site.

Accreditations received from Ecology for each analysis by Friedman & Bruya, Inc. demonstrate the laboratory's ability to properly perform the requested methods. Therefore, a system audit of the analytical laboratory during the course of this project will not be conducted.

The project manager and/or project QA/QC officer will oversee communication with the analytical laboratory on a frequent basis while samples are being processed and analyzed at the laboratory. This will allow SoundEarth to assess progress toward meeting the DQOs and to take corrective measures if problems arise.

The analytical laboratory will be responsible for identifying and correcting, as appropriate, any deviations from performance standards as discussed in Friedman & Bruya, Inc.'s *Laboratory Quality Assurance Manual.* The laboratory will communicate to the project manager or the project QA/QC officer all deviations to the performance standards and the appropriate corrective measures made during sample analysis. Corrective actions are discussed in Section 10.0 of this SAP.

10.0 CORRECTIVE ACTIONS

Corrective actions will be the joint responsibility of the project manager and the project QA/QC officer. Corrective procedures can include:

- Identifying the source of the violation.
- Reanalyzing samples, if holding time criteria permit.

- Resampling and analyzing.
- Re-measuring parameter.
- Evaluating and amending sampling and analytical procedures.
- Qualifying data to indicate the level of uncertainty.

During field sampling operations, the project manager and field staff will be responsible for identifying and correcting protocols that may compromise the quality of the data. All corrective actions taken will be documented in the field notes.

11.0 DOCUMENTATION AND RECORDS

Project files and raw data files will be maintained at SoundEarth's office. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all necessary project information or providing the information to the person responsible for the filing system. Individual team members may maintain files for individual tasks, but team members must provide such files to the central project files upon completion of each task. A project-specific index of file contents will be kept with the project files. Hard copy documents will be kept on file at SoundEarth or at a document storage facility throughout the duration of the project, and all electronic data will be maintained in the database at SoundEarth. All sampling data will be submitted to Ecology in both printed and electronic formats pursuant to WAC 173-340-840(5) and Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements).

11.1 FIELD DOCUMENTATION

Documentation of field activities will be included on Field Report forms, Boring Log forms, Groundwater Purge and Sample Forms, Sample ID Labels, Waste Material Labels, Drum Inventory forms, Material Import and Export Summary forms, and Sample Chain of Custody forms, examples of which are provided in Attachment A-A. Field forms will be scanned and saved to an electronic project folder. Original and copied forms will be filed in a binder that will be maintained by the project manager.

Field personnel will be required to keep a daily field log on a Field Report form. Field notes will be as descriptive and as inclusive as possible, allowing independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate terminology. A summary of each day's events will be completed on a Field Report form. At a minimum, field documentation will include the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and activities performed in a manner other than specified in the SAP. In addition, if other forms are completed or used (e.g., Sample Chain of Custody form), they will be referred to in and attached to the Field Report form. Field personnel will sign the Field Report form. An example of the Field Report form is included in Attachment A-A.

11.2 ANALYTICAL RECORDS

Analytical data records will be retained by the laboratory and stored electronically in the SoundEarth project file and project database. For all analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of all raw data. The analytical laboratory will be required to report the following, as applicable: project narrative, chain-of-custody records, sample results, QA/QC summaries, calibration data summary, method blank analysis, surrogate spike recovery, matrix spike recovery, matrix duplicate, and laboratory control sample(s).

12.0 HEALTH AND SAFETY PROCEDURES

Field personnel will adhere to health and safety procedures that will be detailed under a separate cover as the project-specific Health and Safety Plan (HASP). The health and safety and emergency response protocols outlined in the HASP are designed to ensure compliance with state and federal regulations governing worker safety on hazardous waste sites. The U.S. Department of Labor has published final rules (Part 1910.120 of Title 29 of the Code of Federal Regulations, March 6, 1990) that amend the existing Occupational Safety and Health Administration standards for hazardous waste operations and emergency response. Within Washington State, these requirements are addressed in WAC 296-843, Hazardous Waste Operations. These regulations apply to the activities to be performed at this Site as a site remediation, or cleanup, under Resource Conservation and Recovery Act 1976 and/or MTCA.

Subcontractors to SoundEarth are required to prepare and effectively implement their own HASP based on their unique scope of work and professional expertise. Each subcontractor's HASP must comply with all applicable federal, state, and local regulations. The subcontractor's HASP should employ appropriate best practices to protect all personnel working on the Site, as well as the public, and to prevent negative impacts to the project or Site.

The responsibilities of SoundEarth for safety on this Site are limited to the following:

- Implementation of the provisions of this HASP for the protection of its employees and visitors on the Site to the extent that the Site and its hazards are under the control of SoundEarth for the Site remediation exclusively.
- Protection of the Site, other personnel, and the public from damage, injury, or illness as a result of the activities of SoundEarth and its employees while on the Site.
- Provision of additional safety-related advice and/or management as contractually determined between the parties.

It is anticipated that the majority of the field work will be performed during the cleanup action in Level D personal protective equipment (PPE), with exception of the injection activities, which will be performed in modified level C PPE. Potential hazards that may be encountered during the cleanup action field activities include exposure to contaminants; dust, electrical hazards, ergonomic hazards, excavation collapse, hazardous processes, heavy equipment/moving machinery, mechanical failures, noise exposure, overhead utilities and features, potentially flammable or explosive environment, pressurized liquid, slips, trips, falls, spills, struck by, struck against, temperature extremes, traffic and moving equipment, underground utilities and features, unsecure/uncontrolled site, unstable ground, and visibility. A copy of the Site-Specific HASP is included at Appendix B of the CAP.

13.0 BIBLIOGRAPHY

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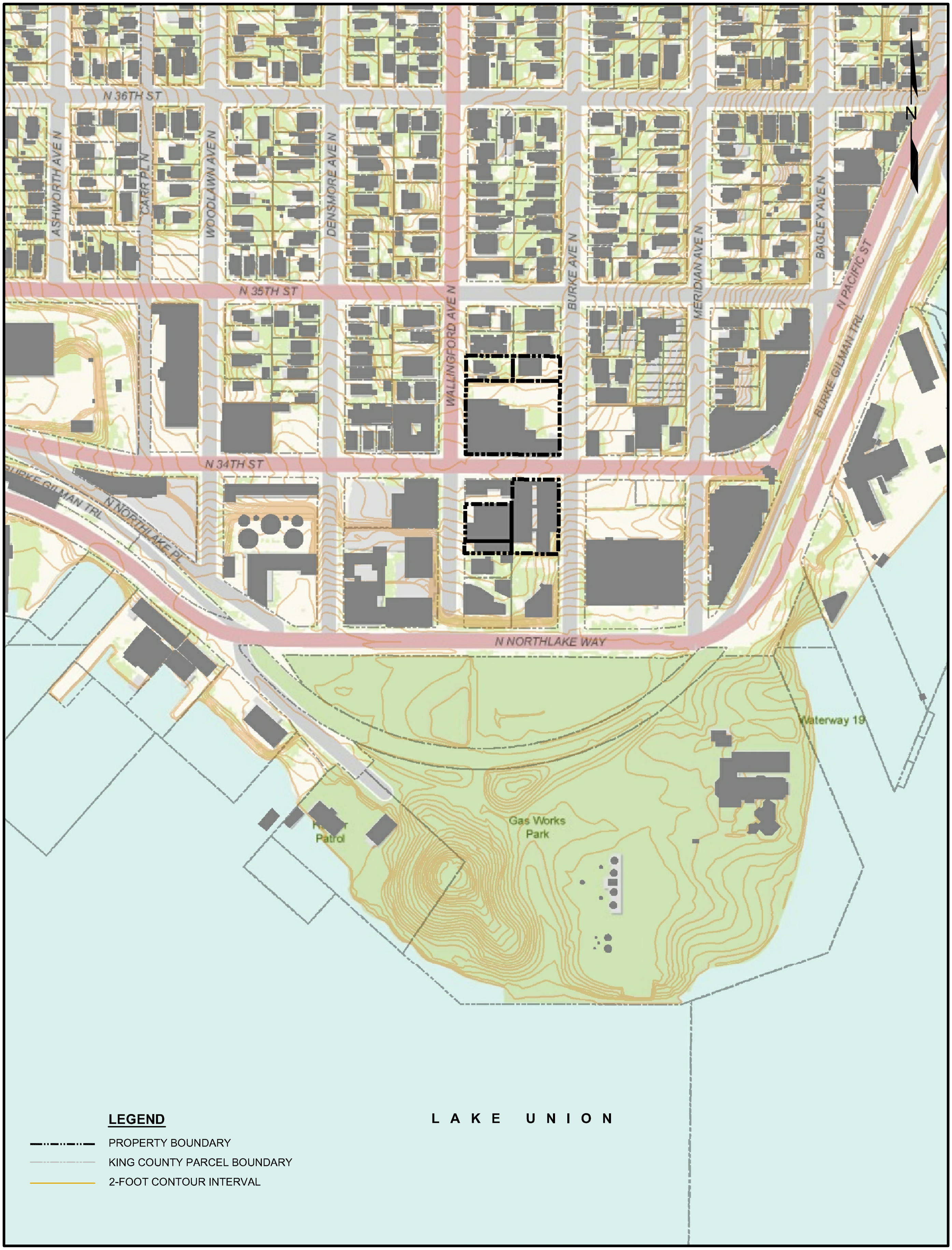
FIGURES



SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

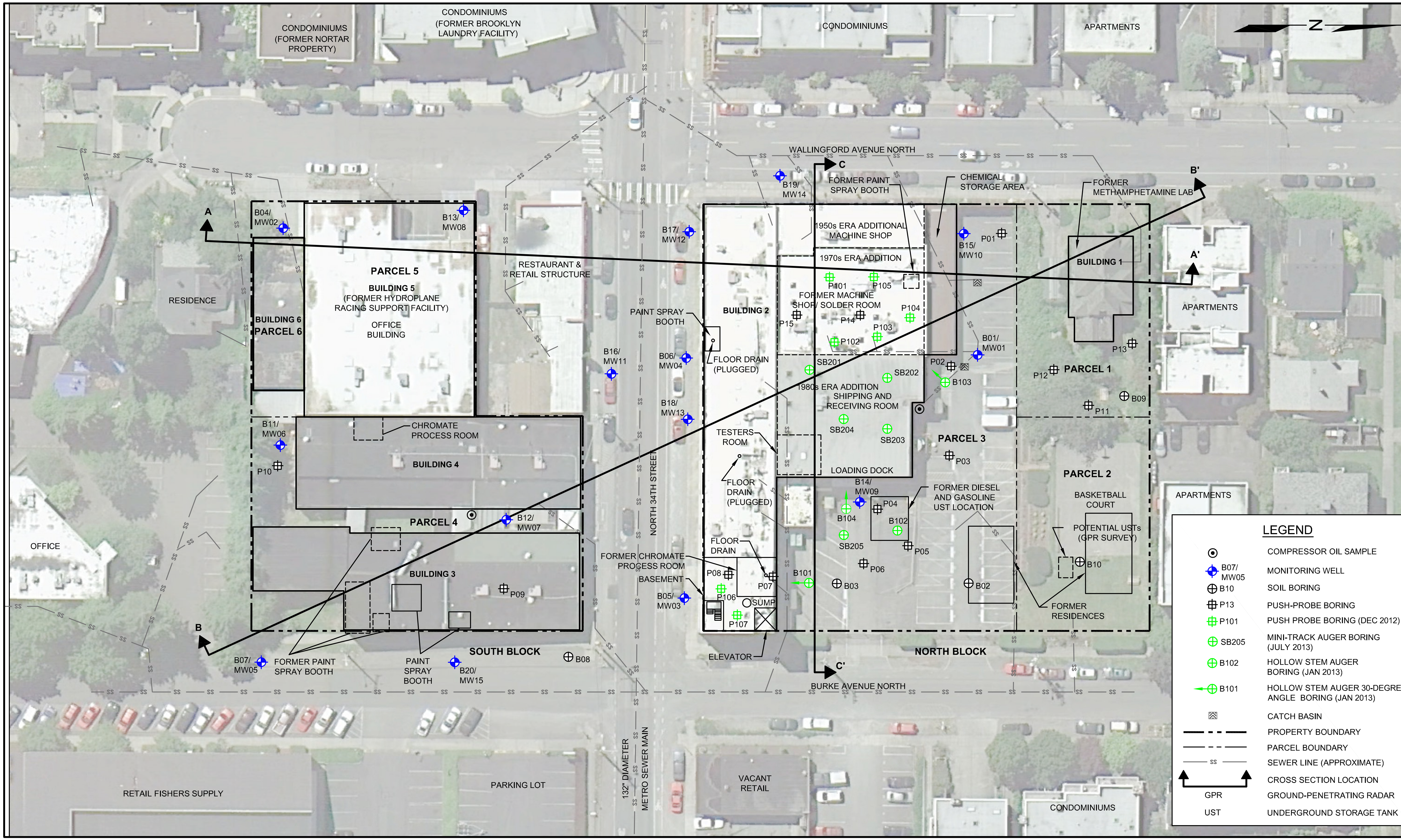
DATE: 08/30/13
DRAWN BY: BLR
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_FIG1

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

FIGURE A-1
PROPERTY LOCATION MAP

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\SAP\0789-004 2014SAP FIG1 F.DWG 3/14/2014

WWW.SOUNDEARTHINC.COM



3/14/2014

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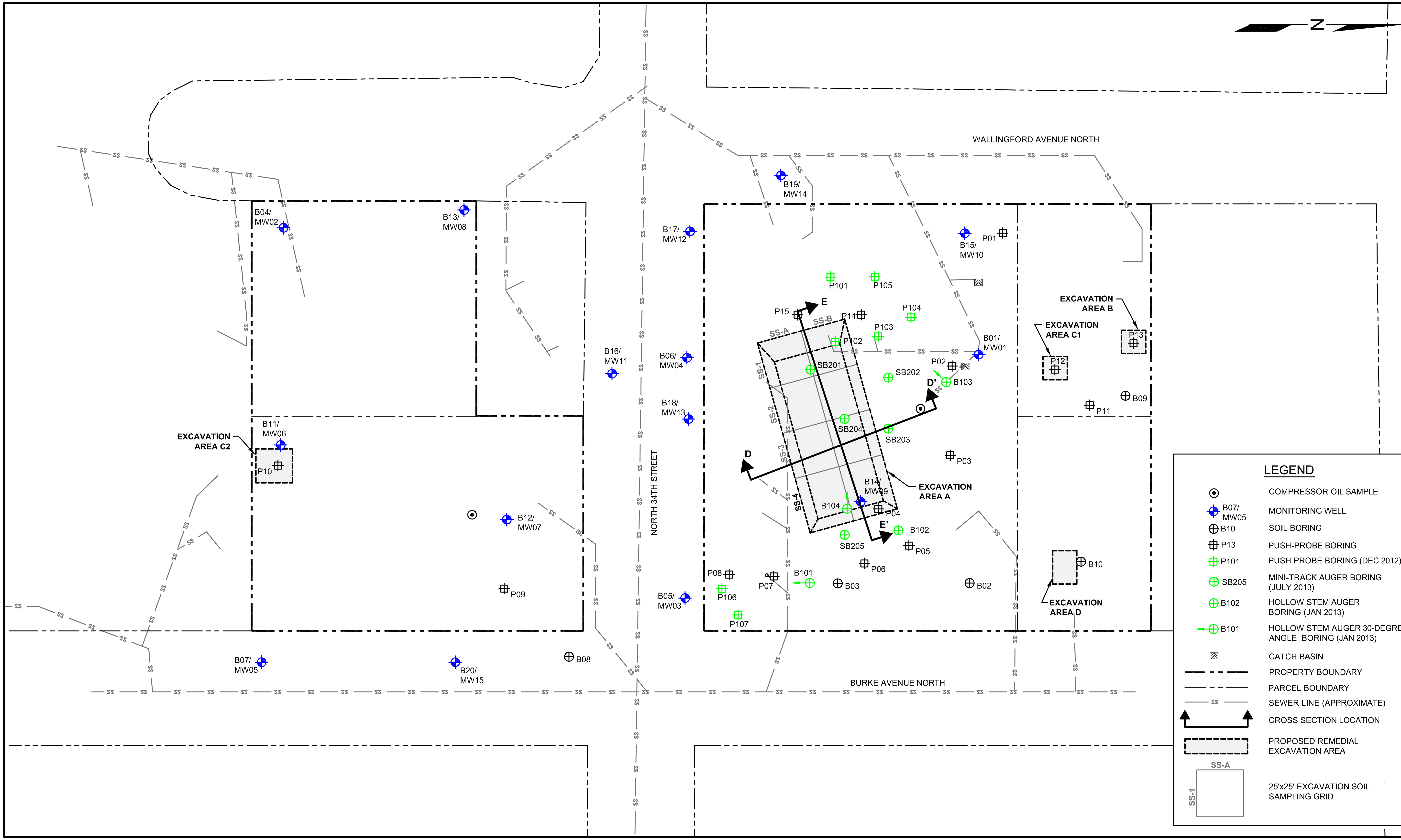
DATE: 03/11/14
DRAWN BY: NAC/BLR/JQC
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_EL

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE A-2
PROPERTY AND EXPLORATION LOCATION PLAN



3/14/2014

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DATE:	03/11/14
DRAWN BY:	BLR
CHECKED BY:	CER
CAD FILE:	0789-004_2014CAP_EXCA

PROJECT NAME:	AVTECH PROPERTY
PROJECT NUMBER:	0789-004
STREET ADDRESS:	3400 WALLINGFORD AVENUE NORTH
CITY, STATE:	SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE A-3
PROPOSED REMEDIAL EXCAVATION AREAS

TABLES

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Table A-1
Key Personnel and Responsibilities
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Project Title	Name	Project Role	Organization	Mailing Address	Email Address	Phone
Regulatory Agency	John Guenther	Regulatory project management. Reviews and approves all submittals to Washington State Department of Ecology.	Washington State Department of Ecology	3190 160th Avenue Southeast Bellevue, Washington	jgue461@ecy.wa.gov	425-649-7038
Project Contact	Scott Koppelman	Property owner and project contact.	AMLI Residential Partners	425 Pontius Avenue North, Suite 400 Seattle, Washington	skoppelman@amli.com	206-621-5610
Project Principal	John Funderburk, MSPH	Reviews and oversees all project activities. Reviews all data and deliverables prior to submittal to project contact or Washington State Department of Ecology.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington	jfunderburk@soundearthinc.com	206-306-1900
Project Manager	Rob Roberts	Overall project management, including SAP development, field oversight, document preparation and submittal, and project coordination.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington	rroberts@soundearthinc.com	206-306-1900
Project QA/QC Officer	Audrey Hackett	Coordinates with laboratory to ensure that SAP requirements are followed and that laboratory QA objectives are met.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington	ahackett@soundearthinc.com	206-306-1900
Field Coordinator	Tyler Oester	Reports to the project manager. Ensures all project health and safety requirements are followed; coordinates and participates in the field sampling activities; coordinates sample deliveries to laboratory; coordinates sampling activities with site owner subcontractors; reports any deviations from project plans.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington	toester@soundearthinc.com	206-306-1900
Field Staff	Various licensed geologists and environmental professionals	Reports to field coordinator. Conducts sampling activities.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington		206-306-1900
Data Manager	Jenny Cheng	Ensures that analytical data is incorporated into site database with appropriate qualifiers following validation.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington	jcheng@soundearthinc.com	206-306-1900
Data Validation	Audrey Hackett	Coordinates with laboratory to ensure that the SAP requirements and laboratory QA/QC objectives are met.	SoundEarth	2811 Fairview Avenue South, Suite 2000 Seattle, Washington	ahackett@soundearthinc.com	206-306-1900
Laboratory Project Manager	Michael Erdahl	Provides analytical support and will be responsible for providing certified, precleaned sample containers and sample preservatives (as appropriate) and for ensuring that all chemical analyses meet the project quality specifications detailed in the SAP.	Friedman & Bruya, Inc.	3012 16th Avenue West Seattle, Washington	merdahl@friedmanandbruya.com	206-285-8282
Private Utility Locator (Subcontractor)	Kemp Garcia	Under the oversight of SoundEarth, clears all boring locations for utilities prior to drilling.	Bravo Environmental	2316 SW 115th Street Seattle, Washington	kgarcia@bravonw.com	206-255-6550
Driller (Subcontractor)	Nick DeLeon	Conducts drilling activities, including well installation and decommissioning, under SoundEarth oversight.	Cascade Drilling, L.P.	19404 Woodinville-Snohomish Road Woodinville, Washington	--	425-485-8908
Surveyor (Subcontractor)	Brad Freeman	Conducts site survey of monitoring wells and key site features following the completion of well installation activities.	Triad Associates	12112 115th Avenue Northeast Kirkland, Washington	bfreeman@triadassoc.com	425-216-2140
General Contractor	Mr. Joe Nascimento	Coordinated demolition, construction excavation, and construction activities for the site.	RAFN Company	RAFN Company 1721 132nd Avenue Northeast Bellevue, Washington	jnascimento@rafn.com	425-702-6686

NOTES:
QA/QC = quality control/quality assurance
SAP = Sampling Analysis Plan
SoundEarth = SoundEarth Strategies, Inc.

SoundEarth Strategies

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Table A-2
Current Project Schedule
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Task/Scope of Work		Schedule
Task 1	Site Preparation and Mobilization	May 1, 2014 (for 7 bounding borings and preliminary injection wells Sept 1, 2014 (for remedial excavations and ISCO injections)
Task 2	Demolition	August 5 through August 29, 2014
Task 3	Well Decommissioning (existing on-property wells)	August 25 through 30, 2014
Task 4	Shoring Installation	September through November 2014
Task 5	Excavation and soil disposal	September 15 through 30, 2014
Task 6	Parking Structure Construction	December 1, 2014 through February 1, 2015
Task 7	Injection System Design	June 2014
Task 8	Injection System Installation	September through October 2014
Task 9	Injection Program	41913
Task 10	Groundwater Compliance Monitoring	January 2015 through 2018
Task 11	Well Decommissioning	2019

SoundEarth Strategies

Table A-3
Analytical Methods, Container, Preservation, and Holding Time Requirements
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

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Analyte and Analytical Method	Analytical Method	Size and Type of Container	Container Quantity	Preservation Requirements	Holding Time To Extract/After Extraction
Groundwater Samples					
TCE, PCE, 1,1,-DCE, and cis- and trans-1,2-DCE	EPA 8260C	40-mL VOA vial	2	4°C at the laboratory, HCl, no headspace	7 days
Vinyl Chloride	EPA 8260C	40-mL VOA vial	2	4°C at the laboratory	7 days
Manganese	EPA 200.8	500 mL Poly	1	4°C at the laboratory, HNO_3	7 days
pH	EPA 9045/150.1	500 mL Poly	1	4°C at the laboratory	24 hours
Color	EPA 110.2	500 mL Poly	1	4°C at the laboratory	24 hours
Soil Samples					
TCE, PCE, 1,1,-DCE, vinyl chloride, and cis- and trans-1,2-DCE	EPA 8260C	40-mL VOA	3	4°C at the laboratory	48 hours/2 weeks
DRPH and ORPH	NWTPH-Dx	4-oz glass jar	1	4°C at the laboratory	7 days/40 days
PAHs	EPA 8270D				
Lead	EPA 200.8	4-oz glass jar	1	4°C at the laboratory	6 months

NOTES:
°C = degrees Celsius
DCE = dichloroethene
DRPH = diesel-range petroleum hydrocarbons
EPA = U.S. Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbons
HCl = hydrochloric acid
HNO_3 = nitric acid
mL = milliliter
NWTPH = Northwest Total Petroleum Hydrocarbon
ORPH = oil-range petroleum hydrocarbons
oz = ounce
PCE = tetrachloroethene
TCE = trichloroethene
VOA = volatile organic analysis

Table A-4
Analytes, Analytical Methods, Laboratory Practical Quantitation Limits, and Applicable Regulatory Limits
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

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Analyte	Analytical Method	Laboratory PQL[1]	Applicable Cleanup Level[2]
Groundwater (micrograms per liter)			
TCE	EPA 8260C	<1	5
PCE	EPA 8260C	<1	5
1,1-DCE	EPA 8260C	<1	400
cis-1,2-DCE	EPA 8260C	<1	16
trans-1,2-DCE	EPA 8260C	<1	160
Vinyl Chloride	EPA 8260C	<0.2	0.2
Manganese	EPA 200.8	<1	50[3]
pH	EPA 9045/150.1	1 to 14	6.5 to 8.5[3]
Color	EPA Method 110.2	<1	15[3]
Soil (milligrams per kilogram)			
TCE	EPA 8260C	<0.020	0.03
PCE	EPA 8260C	<0.020	0.05
cis-1,2-DCE	EPA 8260C	<0.05	160
trans-1,2-DCE	EPA 8260C	<0.05	1,600
Vinyl Chloride	EPA 8260C	<0.05	0.67
DRPH	NWTPH-Dx	<50	2,000
ORPH	NWTPH-Dx	<250	2,000
Lead	EPA 200.8	<1	250
Acenaphthene	EPA 8270D	<0.01	320
Acenaphthylene	EPA 8270D	<0.01	4,800
Anthracene	EPA 8270D	<0.01	24,000
Benzo[a]anthracene	EPA 8270D	<0.01	1.4
Benzo[a]pyrene	EPA 8270D	<0.01	0.01[4]
Benzo[b]fluoranthene	EPA 8270D	<0.01	1.4
Benzo[g,h,i]perylene	EPA 8270D	<0.01	NE
Benzo[k]fluoranthene	EPA 8270D	<0.01	14
Chrysene	EPA 8270D	<0.01	137
Dibenzo[a,h]anthracene	EPA 8270D	<0.01	0.14
Fluoranthene	EPA 8270D	<0.01	3,200
Fluorene	EPA 8270D	<0.01	3,200
Indeno[1,2,3-cd]pyrene	EPA 8270D	<0.01	1.4
Methylnaphthalene, 1-	EPA 8270D	<0.01	5
Methylnaphthalene, 2-	EPA 8270D	<0.01	5
Phenanthrene	EPA 8270D	<0.01	NE
Pyrene	EPA 8270D	<0.01	2,400

NOTES:

[1]Standard laboratory PQLs for Friedman & Bruya, Inc.

[2]MTCA Method A or B Cleanup Levels, Tables 720-1 and 740-1 of Section 900 of Chapter 173-340 of the WAC, revised November 2007, or MTCA Cleanup Regulation, CLARC, Soil, MTCA Method B, Standard Formula Value, Unrestricted Land Use, CLARC Website <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

[3]Secondary Maximum Contaminant level, Table 1, Groundwater Quality Criteria, of Section 040 of Chapter 173-200 of the WAC.

[4]Cleanup level is based on using equation toxicity equivalency methodology for carcinogenic polycyclic aromatic hydrocarbons of Section 173-340-708(8) of the WAC.

CLARC = cleanup levels and risk calculations
DCE = dichloroethene
DRPH = diesel-range petroleum hydrocarbons
EPA = U.S. Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbons
MTCA = Washington State Model Toxics Control Act
NE = not established
NWTPH = Northwest Total Petroleum Hydrocarbon
ORPH = oil-range petroleum hydrocarbons
PCE = tetrachloroethene
PQL = practical quantitation limit
TCE = trichloroethene
WAC = Washington State Administrative Code

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Table A-5
Quantitative Goals of Data Quality Objectives
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

			Precision(1)	Accuracy(2)						Completeness(3)	Sensitivity(4)
				Surrogate Recovery (%)		LCS Recovery (%)		MS Recovery (%)			
Analyte	Analytical Method	CAS Number	RPD	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	% of Samples	PQL(5)
Groundwater (micrograms per liter)											
TCE	EPA 8260C	79-01-6	20	--	--	77	108	75	109	95	<1
PCE	EPA 8260C	127-18-4	20	--	--	78	109	72	113	95	<1
1,1-DCE	EPA 8260C	75-35-4	20	--	--	75	119	71	123	95	<1
cis-1,2-DCE	EPA 8260C	156-59-2	20	--	--	81	111	73	119	95	<1
trans-1,2-DCE	EPA 8260C	156-60-5	20	--	--	76	118	72	122	95	<1
Vinyl Chloride	EPA 8260C	75-01-4	20	--	--	73	132	61	139	95	<0.2
1,2-dichloroethane-d4(6)	EPA 8260C	17060-07-0	--	50	150	--	--	--	--	--	--
toluene-d8(6)	EPA 8260C	2037-26-5	--	50	150	--	--	--	--	--	--
4-bromofluorobenzene(6)	EPA 8260C	460-00-4	--	50	150	--	--	--	--	--	--
Manganese	EPA 200.8	7439-96-5	20	--	--	76	120	47	155	95	<1
Germanium(7)	EPA 200.8	7440-60-0	--	60	125	--	--	--	--	--	--
pH	EPA 9045/150.1	12408-02-5	20	--	--	--	--	--	--	95	1 to 14
Color	EPA Method 110.2	--	20	--	--	--	--	--	--	95	<1
Soil (milligrams per kilogram)											
TCE	EPA 8260C/5035A	79-01-6	20	--	--	64	117	21	139	95	<0.03
PCE	EPA 8260C/5035A	127-18-4	20	--	--	72	114	20	133	95	<0.025
1,1-DCE	EPA 8260C/5035A	75-35-4	20	--	--	47	128	19	140	95	<0.05
cis-1,2-DCE	EPA 8260C/5035A	156-59-2	20	--	--	72	113	25	135	95	<0.05
trans-1,2-DCE	EPA 8260C/5035A	156-60-5	20	--	--	67	127	14	137	95	<0.05
Vinyl Chloride	EPA 8260C/5035A	75-01-4	20	--	--	22	139	10	138	95	<0.05
1,2-dichloroethane-d4(6)	EPA 8260C	17060-07-0	--	50	150	--	--	--	--	--	--
toluene-d8(6)	EPA 8260C	2037-26-5	--	50	150	--	--	--	--	--	--
4-bromofluorobenzene(6)	EPA 8260C	460-00-4	--	50	150	--	--	--	--	--	--
DRPH	8015M/NWTPH-Dx	--	20	--	--	70	127	69	125	95	<50
ORPH	8015M/NWTPH-Dx	--	20	--	--	70	127	69	125	95	<250
o-Terphenyl(6)	8015M/NWTPH-Dx	84-15-1	--	67	127	--	--	--	--	--	--
Lead	EPA 200.8	7439-92-1	20	--	--	70	130	50	150	95	<1
Holmium(7)	EPA 200.8	7440-60-0	--	60	125	--	--	--	--	--	--
Acenaphthene	EPA 8270D	83-32-9	20	--	--	65	96	50	150	95	<0.01
Acenaphthylene	EPA 8270D	208-96-8	20	--	--	67	97	50	150	95	<0.01
Anthracene	EPA 8270D	120-12-7	20	--	--	66	96	50	150	95	<0.01
Benzo[a]anthracene	EPA 8270D	56-55-3	20	--	--	60	93	50	150	95	<0.01
Benzo[a]pyrene	EPA 8270D	50-32-8	20	--	--	57	104	50	150	95	<0.01
Benzo[b]fluoranthene	EPA 8270D	205-99-2	20	--	--	67	110	50	150	95	<0.01
Benzo[g,h,i]perylene	EPA 8270D	191-24-2	20	--	--	61	110	50	150	95	<0.01
Benzo[k]fluoranthene	EPA 8270D	207-08-9	20	--	--	62	105	50	150	95	<0.01
Chrysene	EPA 8270D	218-01-9	20	--	--	62	95	50	150	95	<0.01
Dibenzo[a,h]anthracene	EPA 8270D	53-70-3	20	--	--	67	113	50	150	95	<0.01
Fluoranthene	EPA 8270D	206-44-0	20	--	--	66	106	50	150	95	<0.01
Fluorene	EPA 8270D	86-73-7	20	--	--	63	99	50	150	95	<0.01
Indeno[1,2,3-cd]pyrene	EPA 8270D	193-39-5	20	--	--	64	111	50	150	95	<0.01
Methylnaphthalene, 1-	EPA 8270D	90-12-0	20	--	--	70	130	50	150	95	<0.01
Methylnaphthalene, 2-	EPA 8270D	91-57-6	20	--	--	70	130	50	150	95	<0.01
Phenanthrene	EPA 8270D	85-01-8	20	--	--	63	97	50	150	95	<0.01
Pyrene	EPA 8270D	129-00-0	20	--	--	66	105	50	150	95	<0.01
Anthracene-d10(6)	EPA 8270D	1719-06-8	--	50	150	--	--	--	--	--	--
Benzo(a)anthracene-d12(6)	EPA 8270D	1718-53-2	--	50	150	--	--	--	--	--	--

NOTES:

(1)Precision measured in RPD between sample and lab duplicate, LCS and LCS duplicate, and/or MS and MS duplicate.

(2)Laboratory to follow in accordance with the EPA SW-846 and Ecology methods and procedures for inorganic and organic chemical analyses. Method Blanks will be analyzed for each analyte in addition to the quantitative data quality objectives listed in this table.

(3)Refers to the minimum acceptable percentages of samples received at the laboratory in good condition that are acceptable for analysis.

(4)Sensitivity is measured by the laboratory PQL for each analyte.

(5)Standard PQLs for Friedman & Bruya, Inc., standard PQLs.

(6)Surrogate compound.

(7)Internal standard compound.

CAS = Chemical Abstracts Service
DCE = dichloroethelene
DRPH = diesel-range petroleum hydrocarbons
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
GRPH = gasoline-range petroleum hydrocarbons
LCS = laboratory control sample
MS = matrix spike
NWTPH = Northwest Total Petroleum Hydrocarbon
ORPH = oil-range petroleum hydrocarbons
PCE = tetrachloroethene
PQLs = practical quantitation limits
RPD = relative percent difference
TCE = trichloroethene

ATTACHMENT A-A
FIELD FORMS

FIELD REPORT

Client & Site Name/Number:		SoundEarth Project Number:		Date:
Site Address:		Purpose of Visit/Task #:		Field Report Prepared by:
Temp/Weather:	Permit Required to Work:	Time of Arrival/Departure (2400): ________ onsite to ________ offsite	Personnel Onsite:	

Attachments:

SoundEarth Strategies

Project:
Project Number:
Logged by:
Date Started:
Surface Conditions:
Well Location N/S:
Well Location E/W:
Reviewed by:
Date Completed:

BORING LOG

Site Address:

Water Depth At Time of Drilling: feet bgs
Water Depth After Completion: feet bgs

Depth (feet bgs)	Interval	Blow Count	% Recovery	PID (ppm)	Sample ID	USCS Class	Graphic	Lithologic Description	Well Construction Detail
0									
5									
10									
15									

Drilling Co./Driller:
Drilling Equipment:
Sampler Type:
Hammer Type/Weight: lbs
Total Boring Depth: feet bgs
Total Well Depth: feet bgs
State Well ID No.:

Well/Auger Diameter: inches
Well Screened Interval: feet bgs
Screen Slot Size: inches
Filter Pack Used:
Surface Seal:
Annular Seal:
Monument Type:

Notes/Comments:

Page:

SoundEarth Strategies

GROUNDWATER PURGE AND SAMPLE FORM
LOW FLOW PUMP

Sample Date:___________

General Info

Client: ____________ Project #: ____________

Site Name/ #: ____________ Field/Sampling Personnel: ____________ **Well ID Number:** ____________

Well Details

Total Depth (TD)	Depth to Water (DTW) (Immediately Prior to Purging)	Water Column (WC) (=TD-DTW)	Casing Diameter / Volume Conversion Factor (VC)					Casing Volume (=WC x VC)
			0.75"	1"	2"	4"	6"	
Feet BTOC	Feet BTOC	Feet BTOC	0.023	0.041	0.16	0.65	1.44	gallons

Screened Interval: ________ to ________ Feet bgs

Screen Submerged? ☐ **NO** ⟹ Place tubing intake 2 to 3 feet below depth to water
☐ **YES** ⟹ Place tubing intake at approximate center of screen

Equipment

Pump Method: ☐ Peristaltic ☐ Other: ________ Owner/ID #: ________ **Water Quality Meter** Brand/Model: ________ Owner/ID #: ________

Water Level Instrument: ☐ WL Meter ☐ Bubbler ☐ Interface ☐ Other: ________ Owner/ID #: ________

Sampling

Depth of Tubing Intake: ______ Feet BTOC Time Start Purge: ________

Time (3-5 min intervals)	Water Level (feet) drawdown <0.33 feet	**Purge Rate** (L/min) 0.1 – 0.5	**pH**[1] *± 0.1*	**Specific Conductivity**[1] **UNITS:** ______ *± 3%*	**Turbidity**[1] (NTU) *If ≥10, ±10%* *if <10, stabilized*	**Dissolved Oxygen**[1] (mg/L) *If ≥1.00, ± 10%* *if ≤1.00, ± 0.2*	Temperature (ºC)	ORP (mV)
Minimum # of Readings								

Sample Time: ________ **Field Duplicate Sample Time:** ________ **Time Sampling Ended:** ________

Sampling Comments: ________________

Analytical

Sample Number/ID	Number of Containers and Type	Preservative	Field Filtered?	Analysis Request
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	

Purge Water

Sheen? ☐ NO ☐ YES **Odor?** ☐ NO ☐ YES ⟹ Describe: ____________ Color (describe): ____________

Total Discharged (1Gal = 3.88 liter): ________ gallons Disposal Method: ☐ Drummed ☐ Remediation System ☐ Other: ________

Well Condition

Well/Security Devices in good condition (i.e.: Monument, Bolts, Seals, J-cap, Lock)? ☐ YES ☐ NO ⟹ Describe: ________

Water in Monument? ☐ NO ☐YES ⟹ Describe: ________

Additional Well Condition Comments or Explanation of any Access Issues: ________

[1]At minimum, pH, specific conductivity, and dissolved oxygen and/or turbidity must stabilize within the limits (indicated in *italics*) for three successive readings prior to sampling.

FRIEDMAN & BRUYA, INC.	
Client:	
Sample ID:	
Date Sampled:	Time:
Project:	
Analysis Request:	
Preservative:	

SAMPLE CHAIN OF CUSTODY

Send Report to ________________________

Company SoundEarth Strategies, Inc.

Address 2811 Fairview Avenue E, Suite 2000

City, State, ZIP Seattle, Washington 98102

Phone # 206-306-1900 Fax # 206-306-1907

SAMPLERS (*signature*)	
PROJECT NAME/NO.	PO #
REMARKS	

Page # ________ of ________

TURNAROUND TIME
☐ Standard (2 Weeks)
☐ RUSH________________
Rush charges authorized by: ________________
SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

Sample ID	Sample Location	Sample Depth	Lab ID	Date Sampled	Time Sampled	Matrix	# of Jars	ANALYSES REQUESTED								
								NWTPH-Dx	NWTPH-Gx	BTEX by 8021B	VOCs by 8260	SVOCs by 8270				Notes

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

SoundEarth Strategies

DRUM INVENTORY SHEET

Site Name/Project #:	
Site Address:	
Reason for Visit:	
Date of Inventory:	
Field Personnel:	

Drum #[1] (eg 001)	Content Information (eg Soil, B05, 5'-15')	Drum Size (gal)	Date(s) Accumulated	Fullness (%)	Sample Analysis Performed? (eg EPA 200.8)	Composite Soil Sample[2] (RCRA 8 metals) Y/N	Saturated Soil[3] Y/N	Drum Labeled Y/N	Drum Location Photo Y/N	Drum Access[4] (eg Lock Comb. #XXX)

NOTES:

(1)Drum # — Write the Drum # on the drum lid, as well as on the non-hazardous or hazardous waste label.

(2)Composite Soil Sample— For all sites, collect a composite soil sample from each drum onsite. Place sample on hold at the laboratory, for future RCRA 8 metals analysis. Collect sample in a 4-ounce jar.

(3)Saturated soil—Add bentonite chips or kitty litter to the water that has accumulated or may accumulate inside the drum. Bentonite chips available in the garage.

(4)Drum access for pickup—(eg. fenced, owner notification, lock combination?)

NON
HAZARDOUS
WASTE

GENERATOR INFORMATION (Optional)

SHIPPER ____________________________

ADDRESS ____________________________

CITY, STATE, ZIP ____________________________

CONTENTS ____________________________

____

HAZARDOUS WASTE

ACCUMULATION
START DATE ______________________________

CONTENTS ______________________________

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

SoundEarth Strategies

Material Import and Export Summary

Truck Company	Truck Number	Date	Time	Volume (note: tons or yards)	Type of Material	Destination of Material

ATTACHMENT A-B

TABLE I AND TABLE V OF GUIDANCE FOR REMEDIATION OF PETROLEUM-CONTAMINATED SOILS

TABLE I. NUMBER OF SAMPLES FOR EXCAVATED SOIL	
Cubic Yards of Soil	Minimum Number of Samples
0-100	3
101-500	5
501-1000	7
1001-200	10
>2000	10 + 1 for each additional 500 cubic yards

TABLE V. END USE CRITERIA FOR PETROLEUM-CONTAMINATED SOILS

Analyte	Analytical Method	Soil Class (ppm) 1	2	3	4
Heavy fuel hydrocarbons (C24-C30)	WTPH-418.1 mod.	<60	60-200	200-2000	>2000
Diesel (C12-C24)	WTPH-D	<25	25-200	200-500	>500
Gasoline (C6-C12)	WTPH-G	<5	5-100	100-250	>250
Benzene	8020	<0.005	0.005-0.5	≤0.5	>0.5
Ethylbenzene	8020	<0.005	0.005-20	≤20	>20
Toluene	8020	<0.005	0.005-40	≤40	>40
Xylenes (total)	8020	<0.005	0.005-20	≤20	>20

Treatment is strongly recommended prior to disposal for all Class 3 and 4 soils.

NOTES:

Class 1 Soil Uses:

Any use which will not cause threat to human health or the environment.

Class 2 Soil Uses:

Backfill at the original site
Fill in commercial or industrial areas
Cover or fill in permitted landfills
Road or parking lot construction material
Fill in or near: wetlands, surface water, groundwater, drinking water wells or utility trenches is NOT recommended. Use as residential topsoil is also NOT recommended.

Class 3 Soil Uses:

Treatment
Disposal at the original site (no solid waste disposal permit needed) **note:** If you use this option, there will still be hazardous substances above the cleanup levels on site.
Road or parking lot construction (subgrade material only)
Offsite disposal or use in an existing permitted municipal landfill
Offsite disposal at a new permitted PCS landfill
(An evaluation should be made to ensure that disposal will not cause a threat to human health or the environment, e.g., use near water bodies)

Class 4 Soil Uses:

Treatment
Offsite disposal in an existing permitted municipal landfill
Offsite disposal at a new permitted PCS landfill

APPENDIX B
HEALTH AND SAFETY PLAN

SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington 98102

SITE-SPECIFIC HEALTH AND SAFETY PLAN

APPENDIX B OF THE DRAFT CLEANUP ACTION PLAN

Property:
Avtech Property
3400 Wallingford Avenue North
Seattle, Washington

Initiation Date: March 14, 2014

Prepared for:
AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington

DRAFT – ISSUED FOR REGULATORY REVIEW

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Prepared for:

AMLI Residential Partners
425 Pontius Avenue North, Suite 400
Seattle, Washington 98109

Avtech Property
3400 Wallingford Avenue North
Seattle, Washington 98103
Project No.: 0789-004

Project No.: 0789-004

Prepared by:

DRAFT

____
Audrey Hackett
Project Scientist

Reviewed by:

DRAFT

____
Rob Roberts
Associate Scientist

Initiation Date: March 14, 2014

SoundEarth Strategies

HAZARD SUMMARY

SoundEarth Strategies, Inc. (SoundEarth) has prepared this Site-Specific Health and Safety Plan (HASP) for Avtech Corporation property, located at 3400 Wallingford Avenue North in Seattle, Washington (the Property). The Site-Specific HASP was written in general accordance with the Washington State Model Toxics Control Act (MTCA) as promulgated in Chapter 173-340-350 of the Washington Administrative Code.

SITE DESCRIPTION

The site is currently unoccupied. The Property is a 2.04-acre commercial property spanning six parcels on the north and south sides of North 34th Street (the North and South Blocks). The Property was initially developed by the early 1900s with four single-family residences. A two-story factory building (Building 2) was constructed on the north side of North 34th Street (North Block) in 1909 (Figure 2). Building 2 contained a shoe manufacturer from 1909 to the 1940s and Grandmas Cookies in the 1950s and 1960s. Avtech Corporation, a manufacturer of aviation electronics, occupied Building 2 from 1974 to 2011. Two furniture workshop buildings (Buildings 3 and 4, Figure 2) were constructed on the south side of North 34th Street (South Block) in the 1930s, with an additional single-story warehouse constructed in 1965. Avtech occupied the South Block buildings from the 1980s to 2011. Based on the results of the investigations conducted at the Property, trichloroethene (TCE) is present in soil and groundwater beneath the Property at concentrations exceeding the Washington State Model Toxics Control Act Method A cleanup levels. Groundwater containing TCE is present on the southern half of the North Block and has migrated to the south, across North 34th Street to the South Block. Groundwater contamination may also extend to the east, beneath Burke Avenue North. Soil impacted by TCE generally in the loading dock area of Building 2 at depths ranging from 9 to 20 feet below grade. Trace levels of 1,2-dichlorethene and tetrachloroethylene (PCE) have also been detected in this area. TCE is likely present in vapor form near source areas. Localized areas of surface soil containing lead near the Building 1 house (likely from lead paint) and polycyclic aromatic hydrocarbons at the south end of the Property (likely from the former gasworks to the south) exceeding Method A cleanup levels are also present.

FIELD ACTIVITIES

The following field activities are covered under this Site-Specific HASP:

- Well Decommissioning;
- Oversight of Excavation of contaminated soil;
- Underground Storage Tank (UST) decommissioning;
- Soil confirmational sampling;
- Injection well installation oversight;
- Injection of potassium permanganate solution; and
- Groundwater sampling and monitoring.

SITE HAZARDS

Hazards present at the site include the following:

HAZARD SUMMARY (CONTINUED)

Chemical

- Trichloroethene in soil, groundwater, and vapor.
- Tetrachloroethylene in soil.
- Diesel-range petroleum hydrocarbons in heating oil USTs and potentially soil.
- cis,1,2-dichloroethylene in soil.
- Lead in soil.
- CPAHs in soil.
- Potassium Permangante, as an in situ chemical oxidation solution. SoundEarth proposes to inject potassium permanganate beneath the site to remediate groundwater.

Physical

- Dust
- Electrical hazards
- Ergonomic hazards
- Excavation collapse
- Hazardous processes
- Heavy equipment/moving machinery
- Mechanical failures
- Noise Exposure
- Overhead utilities and features
- Potentially flammable or explosive environment
- Pressurized liquid
- Slips, trips, and falls
- Spills
- Struck by
- Struck against
- Temperature extremes
- Traffic and moving equipment
- Underground utilities and features
- Unsecure/uncontrolled site
- Unstable ground
- Visibility

HAZARD SUMMARY (CONTINUED)

HAZARD CONTROLS

The following additional hazard controls, based on the tasks identified in the Field Activities above, are required for employees of SoundEarth while performing work on the site:

- For well decommissioning, oversight of excavation of contaminated soil, UST decommissioning, soil and groundwater sampling, injection well installation oversight activities, Level D PPE, which includes hard hats, steel-toed boots, safety glasses, and a reflective safety vest, with hearing protection when near operating heavy equipment.
- For excavation of contaminated soil, UST decommissioning, and soil sampling activities SoundEarth will additionally operate a photoionization detector to measure concentrations of volatile organic compounds in the soil and air.
- For UST decommissioning activities, SoundEarth will additionally use a certified marine chemist to inert any USTs encountered at the site with carbon dioxide, reducing the potential for a flammable or explosive environment.
- For injection activities:
  - When mixing dry chemicals, Modified Level C PPE, which includes hard hats, steel-toed boots, safety glasses, nitril gloves, impermeable synthetic apron over chemical resistant coveralls, reflective safety vest a combination dust-particle mask with vapor cartridge
  - When injecting material, Modified Level C PPE, which includes hard hats, steel-toed boots, nitrile gloves, a full face shield, impermeable synthetic apron over chemical resistant coveralls, reflective safety vest, and a full face shield when injecting liquid material.
- Clothing appropriate to cold/wet weather conditions, layered under chemical-protective PPE, when working in inclement weather.
- Traffic control and/or fencing to secure the site.

This hazard 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, investigation methods, and investigation results can be found in previous reports referenced in Section 4.1.4, Reports that Provide Chemical Analytical Results

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

This Site-Specific Health and Safety Plan (HASP) was written for the use of SoundEarth Strategies, Inc. (SoundEarth) and its employees. The health and safety and emergency response protocols outlined in this plan are designed to ensure compliance with state and federal regulations governing worker safety on hazardous waste sites. The Department of Labor has published final rules (Part 1910.120 of Title 29 of the Code of Federal Regulations, March 6, 1990) that amend the existing Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations and emergency response. Within Washington State, these requirements are addressed in Chapter 296-843 of the Washington Administrative Code, Hazardous Waste Operations. These regulations apply to the activities to be performed at this site as a site environmental investigation, remediation, or cleanup, under the Federal Resource Conservation and Recovery Act of 1976; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980; and/or the Washington State Model Toxics Control Act (MTCA).

Subcontractors to SoundEarth are required to prepare and effectively implement their own HASP based on their unique scope of work and professional expertise. Each subcontractor's HASP must comply with all applicable federal, state, and local regulations. The subcontractor's HASP should employ appropriate best practices to protect all personnel working on the site, as well as the public, and to prevent negative impacts to the project or site.

The responsibilities of SoundEarth for safety on this site are limited to the following:

- **Implementation** of the provisions of this HASP for the protection of its employees and visitors on the site to the extent that the site and its hazards are under the control of SoundEarth.
- **Protection of the site**, other personnel, and the public from damage, injury, or illness as a result of the activities of SoundEarth and its employees while on the site.
- **Provision** of additional safety-related advice and/or management as contractually determined between the parties.

This plan is active for this site until 1 year from the date of the HASP or until SoundEarth implements a scope of work change not covered by this HASP, whichever comes first, after which time it must be reviewed and extended.

NOTE: Reference identifications (01, Project Safety Responsibilities, through 25, Demolition) incorporated into this Site-Specific HASP refer to the *HASP Reference Manual*, prepared by SoundEarth and dated December 2013, which is a stand-alone document that compiles detailed information and instructions for protecting SoundEarth employees from chemical and physical hazards applicable to this Site-Specific HASP. The *HASP Reference Manual* and this Site-Specific HASP **MUST** be present at the site during field activities.

2.0 SITE INFORMATION

Site Name: Avtech Corporation Property
Site Address: 3400 Wallingford Avenue North
Site Owner: AMLI Residential Partners
Site Tenant: None - vacant
Nature of Activities at this Site: Current: Vacant Past: glove, shoe, and cookie factories; hydroplane support facility, plywood warehouse and cabinet manufacturer, Avionics equipment manufacturing facility
Figures 1 and 2 show the site location and features.

3.0 PROJECT ROLES AND EMERGENCY INFORMATION

On-site personnel shall acknowledge that they have reviewed a copy of the HASP for this project, that they understand it, and that they agree to comply with all of its provisions by signing and dating the Acknowledgement and Agreement Form in Attachment A.

A daily health and safety tailgate meeting shall take place at the start of every day in the field. All on-site personnel are to attend this meeting and print and sign their name on the attached Daily Health and Safety Briefing Log in Attachment B. Reference 01, Project Safety Responsibilities, provides more information.

Project Roles and Phone Numbers

Title	**Name**	**Phone Number**
Project Manager	Rob Roberts	O: (206) 245-1184 C: (425) 985-6253
Site Health and Safety Officer	Tyler Oester	O: (206) 436-5956 C: (509) 432 3943
Principal-in-Charge	John Funderburk	O: (206) 436-5901 C: (206) 794-4673
Corporate Health and Safety Administrator	John Funderburk	O: (206) 436-5901 C: (206) 794-4673
Certified Industrial Hygienist working for SoundEarth	Michelle Copeland	O: (206) 612-6355
Client/Owner/Operator Representative	Scott Koppelman	O: (206) 621-5610

On-site personnel are responsible for initiating emergency response actions, as necessary, and reporting any potentially hazardous conditions they encounter to the Corporate Health and Safety Administrator and initiating site evacuation procedures. **For a critical emergency, any SoundEarth employee should call 911.** Reference 02, Emergency Response Plan, provides more information.

Note: A SoundEarth employee MAY NOT transport a non-SoundEarth employee off of the site for medical attention.

The following list of emergency phone numbers and the location and driving directions to the nearby hospitals must be posted at the site (Attachment C, Hospital Routes).

Local Emergency Services and Phone Numbers		
Institution/Department	**Name/Address**	**Phone Number**
Hospital	University of Washington Medical Center 1959 NE Pacific St Seattle, Washington	911 or (206) 598-3300
Alternative Hospital	Swedish Medical Center 5300 Tallman Avenue Northwest Seattle, Washington	911 or (206) 782-2700
Ambulance		911
Police/Sheriff	Seattle Police North Precinct 10049 College Way N. Seattle, Washington	911
Fire	Fire Station 9 3829 Linden Avenue North Seattle, Washington	911

4.0 SITE HAZARD ANALYSIS

This section is used to determine the project's potential health and safety hazards specifically as they relate to the site where the work will occur. Task-related hazards are analyzed in Section ⍰, Overhead electrical/power lines that run along the Burke Avenue North right-of-way.

Task-Related Site Hazard Analysis.

4.1 SITE HAZARD ANALYSIS—CHEMICAL

This section describes and identifies potential and known chemical hazards that may be encountered while working at the site (summarized in Table 1: Chemical Hazards). Reference 03, Chemical Hazards Analysis, provides information on the process for identifying chemical hazards at a site.

4.1.1 Past Opportunities for Chemical Contamination

The primary source area of TCE contamination beneath the Property is has been identified proximate to the loading dock area of Building 2 (Figure 2). Trace levels of 1,2-dichlorethylene and tetrachloroethylene (PCE) have also been detected in this area. The TCE impacts to soil are likely attributable to surface spills during the Property's operation as an aviation electronics manufacturer. TCE was likely used in a degreasing product for the electronics. Localized areas of surface soil containing lead near the Building 1 house (likely from lead paint) and polycyclic aromatic hydrocarbons (CPAHs) at the south end of the Property (likely from the former gasworks to the south) exceeding Method A cleanup levels are also present.

4.1.2 Opportunities for Unknown or Unidentified Chemical Contamination

A GPR survey conducted in 2012 identified two magnetic anomalies indicating potential heating oil USTs were identified near the former residence on Parcel 2. The anomalies were approximately 4-feet square and identified at depths of approximately 4 feet (typical for heating oil tanks).

4.1.3 Summary of Potential Chemical Hazards

The following known or suspected chemical hazards have been identified at the site:

- Trichloroethene (TCE) in soil, groundwater, and vapor.
- Tetrachloroethylene (PCE) in soil.
- Diesel-range petroleum hydrocarbons in heating oil USTs and potentially soil.
- cis,1,2-dichloroethylene in soil.
- Lead in soil.
- CPAHs in soil.
- Potassium permangante, as an in situ chemical oxidation solution. SoundEarth proposes to inject potassium permanganate beneath the site to remediate groundwater. The MSDS for is attached to this HASP (Attachment D).

The chemicals identified above are included in Table 1: Chemical Hazards.

4.1.4 Reports that Provide Chemical Analytical Results

The following report and associated tables containing chemical analytical data have been prepared for the site:

- *Draft Remedial Investigation and Feasibility Study Report*, Avtech Property, 3400 Wallingford Avenue North, Seattle, Washington by SoundEarth, January 10, 2014.
  - Table 1 Summary of Soil Analytical Results for VOCs
  - Table 2 Summary of Soil Analytical Results for Petroleum Hydrocarbons
  - Table 3 Summary of Soil Analytical Results for RCRA Metals and Cyanide
  - Table 4 Summary of Soil Analytical Results for PCBs
  - Table 5 Summary of Soil Analytical Results for PAHs

- Table 6 Summary of Groundwater Data

TABLE 1: CHEMICAL HAZARDS

Chemical or Class (Synonyms or Isomers)	DOSH PEL/AL (OSHA PEL if different)	Other Pertinent Limits / Special Characteristics	Routes of Exposure / Warning Properties	Exposure Symptoms	Target Organs / First Aid	Recommended PPE / Respiratory Protection	Recommended Monitoring
1,2-DCE (1,2-Dichloroethylene; includes cis- or trans-isomers)	DOSH PEL: 200 ppm TWA 250 ppm STEL	NIOSH REL: 200 ppm TWA IDLH: 1,000 ppm FP: 36–39°F LEL: 5.6% — None	Inhalation, ingestion, skin or eye contact — Slightly acidic, chloroform-like odor	Eye and respiratory system irritation, central nervous system depression	Eyes, respiratory system, central nervous system — Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Respiratory support Ingestion: Medical attention immediately	▪ Impermeable, chemical-resistant, disposable clothing ▪ Silver Shield/composite glove — If PEL is exceeded: min SA continuous flow or PAPR OV cartridge	If potential for exposure exists: ▪ Initiate personal air monitoring; additional monitoring if necessary based on initial results ▪ Verify method with laboratory prior to ordering media and equipment Real Time Monitoring Equipment: ▪ Detector Tubes ▪ 10.2 or 10.6 eV PID
DRPH (As Diesel Fuel #2 and petroleum distillates)	DOSH PEL: 100 ppm TWA 150 ppm STEL OSHA PEL: 500 ppm TWA	NIOSH REL: 86 ppm TWA 444 ppm STEL ACGIH TLV: 100 mg/m3 TWA IDLH: 1,100 ppm FP: -40 to -86°F LEL: 1.1% — Carcinogen Combustible liquid	Inhalation, ingestion, skin or eye contact — Gasoline or kerosene-like odor Floats on water Clear, yellow-brown liquid	Irritation of eyes, nose, throat; dizziness; drowsiness; headache; nausea; dry cracked skin; inflammation of lungs; dermatitis; skin reddening	Eyes, skin, respiratory system, central nervous system, kidneys — Breathing: Respiratory support	▪ Impermeable, chemical-resistant, disposable clothing ▪ Nitrile or neoprene gloves — If PEL is exceeded: any SA respirator	If potential for exposure exists: ▪ Initiate personal air monitoring; additional monitoring if necessary based on initial results ▪ Verify method with laboratory prior to ordering media and equipment Real Time Monitoring Equipment: ▪ 10.2 or 10.6 eV PID

Chemical or Class (Synonyms or Isomers)	DOSH PEL/AL (OSHA PEL if different)	Other Pertinent Limits / Special Characteristics	Routes of Exposure / Warning Properties	Exposure Symptoms	Target Organs / First Aid	Recommended PPE / Respiratory Protection	Recommended Monitoring
Lead, Inorganic	DOSH PEL: 0.05 mg/m^3 TWA DOSH AL: 0.03 mg/m^3 TWA	NIOSH REL: 0.05 mg/m^3 TWA IDLH: 100 mg/m^3 ——— None	Inhalation, ingestion, skin and eye contact ——— Odorless dust – poor warning properties	Eye irritation, weakness, exhaustion, insomnia, facial paleness; weight loss, constipation, abdominal pain, colic, anemia, gingival lead line; tremor; paralysis of wrist and ankles, brain damage, kidney disease; hypotension (Carcinogen)	Eyes, gastro-intestinal tract, central nervous system, kidneys, blood, gingival tissue ——— Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Respiratory support Ingestion: Medical attention immediately	■ Impermeable, disposable clothing ■ Nitrile or Neoprene gloves ——— Min ½ Mask AP/HEPA; Higher APF if personal air monitoring	If potential for exposure exists: ■ Initiate personal air monitoring; additional monitoring if necessary based on initial results ■ Verify method with laboratory prior to ordering media and equipment
PAHs (Polycyclic Aromatic Hydrocarbons; coal tar pitch volatiles, e.g., creosote, pyrene, phenanthrene, acridine, chrysene, anthracene, and benzo[a]pyrene)	DOSH PEL: 0.2 mg/m^3 TWA 0.6 mg/m^3 STEL	NIOSH REL: 0.1 mg/m^3 TWA IDLH: 80 mg/m^3 ——— Carcinogen	Inhalation, ingestion, skin or eye contact ——— Black or dark-brown amorphous residue	Dermatitis, bronchitis (carcinogen)	Respiratory system, skin, bladder, kidneys ——— Eye: Irrigate immediately Skin: Soap wash immediately Inhalation: Respiratory support Ingestion: Medical attention immediately	■ Impermeable, chemical resistant disposable clothing ■ Nitrile or neoprene gloves ——— If PEL is exceeded: min full-face SA respirator in PP/PD mode	If potential for exposure exists: ■ Initiate personal air monitoring; additional monitoring if necessary based on initial results ■ Verify method with laboratory prior to ordering media and equipment

Chemical or Class (Synonyms or Isomers)	DOSH PEL/AL (OSHA PEL if different)	Other Pertinent Limits / Special Characteristics	Routes of Exposure / Warning Properties	Exposure Symptoms	Target Organs / First Aid	Recommended PPE / Respiratory Protection	Recommended Monitoring
Potassium Permanganate	DOSH PEL: None	None ——— Corrosive solid. Contact with combustible material may cause fire.	Inhalation, ingestion, skin or eye contact skin adsorption ——— Dark Purple, sweet odor	Irritation of eyes, skin, nose, throat, respiratory system, gastrointestinal tract; skin burns; ulcerations; kidneys, lungs, and liver damage; CNS damage; and blindness	Respiratory system, eyes skin, bladder, kidneys, liver, CNS ——— Eye: Irrigate immediately Skin: water flush immediately Inhalation: Respiratory support Ingestion: Medical attention immediately	▪ Synthetic apron ▪ Nitrile or neoprene gloves ▪ Splash goggles ——— Min ½ Mask AP/HEPA with OV cartridge	If potential for exposure exists: ▪ Initiate personal air monitoring; additional monitoring if necessary based on initial results ▪ Verify method with laboratory prior to ordering media and equipment
PCE (Tetrachloroethylene, tetrachloroethene, perchloroethylene)	DOSH PEL: 25 ppm TWA 38 ppm STEL Skin OSHA PEL: 100 ppm TWA 200 ppm C (5-minutes in 3-hour period) 300 ppm (5-min maximum peak)	ACGIH TLV: 25 ppm TWA 100 ppm STEL IDLH: 150 ppm ——— Carcinogen	Inhalation, ingestion, skin absorption, skin or eye contact ——— Mild, chloroform-like odor	Irritation of eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; (potential occupational carcinogen)	Eyes, skin, respiratory system, liver, kidneys, central nervous system ——— Eye: Irrigate immediately Skin: Soap wash promptly Inhalation: Respiratory Support Ingestion: Medical attention immediately	▪ Impermeable, chemical resistant disposable clothing ▪ Nitrile or neoprene gloves ——— If PEL is exceeded: any full-face SA respirator in PP/PD mode	If potential for exposure exists: ▪ Initiate personal air monitoring; additional monitoring if necessary based on initial results ▪ Verify method with laboratory prior to ordering media and equipment Real Time Monitoring Equipment: 10.2 or 10.6 eV PID

Chemical or Class (Synonyms or Isomers)	DOSH PEL/AL (OSHA PEL if different)	Other Pertinent Limits / Special Characteristics	Routes of Exposure / Warning Properties	Exposure Symptoms	Target Organs / First Aid	Recommended PPE / Respiratory Protection	Recommended Monitoring
TCE (Trichloroethylene, trichloroethene, ethylene trichloride)	DOSH PEL: 50 ppm TWA 200 ppm STEL OSHA PEL: 100 ppm TWA 200 ppm C 300 ppm peak (5 minutes)	IDLH: 1,000 ppm LEL: 8% ――― None	Inhalation, skin absorption, ingestion, skin or eye contact ――― Chloroform-like odor	Irritation of eyes and skin; headache; visual disturbance; weakness; exhaustion; dizziness; tremor; drowsiness; nausea; vomiting; tingling, pricking, and inflammation of skin; cardiac arrhythmias; liver injury (potential occupational carcinogen)	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system ――― Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately	Impermeable, chemical resistant disposable clothing Nitrile gloves ――― If PEL is exceeded: min full-face SA respirator in PP/PD mode	If potential for exposure exists: ▪ Initiate personal air monitoring; additional monitoring if necessary based on initial results ▪ Verify method with laboratory prior to ordering media and equipment Real Time Monitoring Equipment: ▪ 10.2 or 10.6 eV PID

NOTES:
The NIOSH Pocket Guide provides more information for the chemical in question or for a chemical not listed.

µg/m^3 = micrograms per cubic meter
ACGIH = American Conference of Governmental Industrial Hygienists
AL = action limit
AP = air purifying respirator
APF = assigned protection factor
ATSDR = Agency for Toxic Substances and Disease Registry
C = ceiling exposure limit
cm^3 = cubic centimeter(s)
DOSH = Washington State Department of Labor and Industries, Division of Occupational Safety and Health
DRPH = diesel-range petroleum hydrocarbons
eV = electron volt
^{o}F = degrees Fahrenheit
FP = flash point
GRPH = gasoline-range petroleum hydrocarbons
HEPA = high efficiency particulate air cartridge
IDLH = immediately dangerous to life and health
IP = ionization potential
kg = kilogram
LEL = lower explosive limit
mg/m^3 = milligrams per cubic meter
min = minimum
ng/day = nanograms per day
NIOSH = National Institute of Safety and Health
OSHA = Occupational Safety and Health Administration
OV = organic vapor cartridge
PAPR = powered air purifying respirator
PEL = permissible exposure limit
PID = photoionization detector
pg/kg/day = picogram per kilogram per day
PP/PD = positive pressure/pressure demand mode
PPE = personal protective equipment
ppm = parts per million
REL = recommended exposure limit
SA = supplied air respirator
STEL = short-term exposure limit, 15 minutes, unless otherwise noted
TLV = threshold limit value
TPH = total petroleum hydrocarbon
TWA = time-weighted average
UV = ultraviolet
WHO = World Health Organization

4.2 SITE HAZARD ANALYSIS—PHYSICAL

This section addresses known and potential physical hazards specific to the site. Reference 04, Physical Hazards Analysis, provides more information regarding the process for identifying physical hazards.

4.2.1 Site-Specific Physical Hazards

The following physical hazards may be encountered while working on the site:

- Dust
- Electrical hazards
- Ergonomic hazards
- Excavation collapse
- Hazardous processes
- Heavy equipment/moving machinery
- Mechanical failures
- Noise Exposure
- Overhead utilities and features
- Potentially flammable or explosive environment
- Pressurized liquid
- Slips, trips, and falls
- Spills
- Struck by
- Struck against
- Temperature extremes
- Traffic and moving equipment
- Underground utilities and features
- Unsecure/uncontrolled site
- Unstable ground
- Visibility

4.2.2 Utility Hazards

Described below are utility hazards that may be present at the site. In order to locate utilities, the Utilities Underground Location Center should be called at (800) 424-5555, a private locate should be scheduled (as appropriate), side sewer cards should be reviewed, owner/tenant documents should be reviewed, and the site should be visually inspected. References 10, Electrical Safety; 16, Overhead Hazards; and 19, Underground Services Location and Protection, provide additional information.

4.2.2.1 Underground Utilities

The following utilities and subsurface features have been identified beneath the site:

- Sanitary sewer Lines beneath the Wallingford Avenue North right-of-way that run east beneath the western portion of the Property.
- Sanitary sewer lines beneath the Burke Avenue North right-of-way that run west beneath the Property.
- Ground-penetrating radar survey anomalies beneath the northern portion of the Property, which are potentially heating USTs and their associated piping.

4.2.2.2 Overhead Utilities

The following overhead utilities have been identified around the site:

- Overhead electrical/power lines that run along the Wallingford Avenue North right-of-way.
- Overhead electrical/power lines that run along the Burke Avenue North right-of-way.

5.0 TASK-RELATED SITE HAZARD ANALYSIS

This section outlines the health and safety hazards that may be present on the site as a result of the tasks to be performed by SoundEarth or subcontractors as they relate to the chemical and physical hazards identified in Sections 4.1 and 4.2, above. References noted in Table 2: Site-Specific Task-Related Hazards, should be reviewed for the controls and any personal protective equipment (PPE) required. References 01, Project Safety Responsibilities, through 25, Demolition, as cited in Table 2, provide detailed information and instructions for protecting SoundEarth employees from chemical and physical hazards applicable to this Site-Specific HASP. A summary of the controls specific to the site is presented in Section 6.0, Task-Related Site Hazard Controls Summary.

TABLE 2: SITE-SPECIFIC TASK-RELATED HAZARDS

Tasks	Role	Hazard	References
Sampling – Environmental	Task performed by SoundEarth	Chemicals	Table 1, Chemical Hazards 06, Chemical Hazard Controls 17, Sample Collection
		Confined spaces	09, Confined Space Awareness
		Dust	06, Chemical Hazard Controls 07, General Site Safety Requirements 17, Sample Collection

Tasks	Role	Hazard	References
		Emergencies	02, Emergency Response Plan
		Ergonomics	11, Ergonomics
		General site hazards	07, General Site Safety Requirements
		Ladders or heights	22, Work at Heights
		Processes	21, Work Around Hazardous Processes
		Spills	06, Chemical Hazard Controls 24, Safe Handling of Flammable Liquids
		Temperature extremes	13, Temperature Extremes
		Traffic/mobile equipment	18, Traffic and Moving Equipment Hazards
		Unstable ground	20, Unstable Ground
		Visibility	07, General Site Safety Requirements 18, Traffic and Moving Equipment Hazards
		Working near water	23, Work Near Water
Drilling and Subsurface Investigation	Subcontractor Observation	Chemicals	Table 1, Chemical Hazards 06, Chemical Hazard Controls 17, Sample Collection
		Emergencies	02, Emergency Response Plan
		Ergonomics	11, Ergonomics
		General site hazards	07, General Site Safety Requirements
		Noise	15, Noise and Hearing Protection
		Overhead electric utilities	10, Electrical Safety
		Powered tools and equipment	10, Electrical Safety;

Tasks	Role	Hazard	References
Drilling and Subsurface Investigation *(continued)*	Subcontractor Observation	Temperature extremes	13, Temperature Extremes
		Traffic/mobile equipment	18, Traffic and Moving Equipment Hazards
		Unsecure/uncontrolled site	08, Site Security and Overall Site Control
		Underground utilities and features	19, Underground Services Location and Protection 10, Electrical Safety
		Unstable ground	20, Unstable Ground
		Visibility	07, General Site Safety Requirements 18, Traffic and Moving Equipment Hazards
In Situ Chemical Oxidation	Task performed by SoundEarth	Chemicals	06, Chemical Hazard Controls Table 1, Chemical Hazards
		General site hazards	07, General Site Safety Requirements
		Emergencies	02, Emergency Response Plan
		Ergonomics	11, Ergonomics
		Noise	015, Noise and Hearing Protection
		Overhead utilities and features	10, Electrical Safety
		Potentially flammable or explosive environment	06, Chemical Hazard Controls 24, Safe Handling of Flammable Liquids
		Powered tools and equipment	10, Electrical Safety
		PPE, meetings, inspections	07, General Site Safety Requirements

Tasks	Role	Hazard	References
		Pressurized liquids	Table 1, Chemical Hazards 06, Chemical Hazard Controls 24; Safe Handling of Flammable Liquids
		Temperature extremes	13, Temperature Extremes
		Traffic/mobile equipment	18, Traffic and Moving Equipment Hazards
		Unsecure/uncontrolled site	08, Site Security and Overall Site Control
		Unstable ground	20, Unstable Ground
		Visibility	07, General Site Safety Requirements 18, Traffic and Moving Equipment Hazards
UST Decommissioning	Subcontractor Observation	Chemicals	Table 1, Chemical Hazards 06, Chemical Hazard Controls 17, Sample Collection
		Confined spaces	09, Confined Space Awareness
		Cutting/welding	10, Electrical Safety 14, Hot Work Awareness 25, Demolition
		Demolition	25, Demolition
		Emergencies	02, Emergency Response Plan
		Ergonomics	11, Ergonomics
		General site hazards	07, General Site Safety Requirements
UST Decommissioning *(continued)*	Subcontractor Observation	Noise	15, Noise and Hearing Protection
		Overhead utilities and features	10, Electrical Safety 16, Overhead Hazards

Tasks	Role	Hazard	References
		Potentially flammable or explosive environment	06, Chemical Hazard Controls 24, Safe Handling of Flammable Liquids
		Powered tools and equipment	10, Electrical Safety;
		Unsecure/uncontrolled site	08, Site Security and Overall Site Control
		Temperature extremes	13, Temperature Extremes
		Traffic/mobile equipment	18, Traffic and Moving Equipment Hazards
		Underground utilities and features	10, Electrical Safety 19, Underground Services Location and Protection
		Unstable ground	20, Unstable Ground
		Visibility	07, General Site Safety Requirements 18, Traffic and Moving Equipment Hazards
Excavation and Trenching	Subcontractor Observation	Chemicals	Table 1, Chemical Hazards 06, Chemical Hazard Controls 17, Sample Collection
		Confined spaces	09, Confined Space Awareness
		Cutting/welding	10, Electrical Safety 14, Hot Work Awareness
		Demolition	25, Demolition
		Dust	06, Chemical Hazard Controls 07, General Site Safety Requirements 17, Sample Collection
		Emergencies	02, Emergency Response Plan
		Ergonomics	11, Ergonomics

Tasks	Role	Hazard	References
Excavation and Trenching *(continued)*	Subcontractor Observation	General site hazards	07, General Site Safety Requirements
		Noise	15, Noise and Hearing Protection
		Overhead utilities and features	10, Electrical Safety 16, Overhead Hazards
		Powered tools and equipment	10, Electrical Safety
		Temperature extremes	13, Temperature Extremes
		Traffic/mobile equipment	18, Traffic and Moving Equipment Hazards
		Unsecure/uncontrolled site	08, Site Security and Overall Site Control
		Underground utilities and features	10, Electrical Safety; 19, Underground Services Location and Protection
		Unstable ground	20, Unstable Ground
		Visibility	07, General Site Safety Requirements 18, Traffic and Moving Equipment Hazards

6.0 TASK-RELATED SITE HAZARD CONTROLS

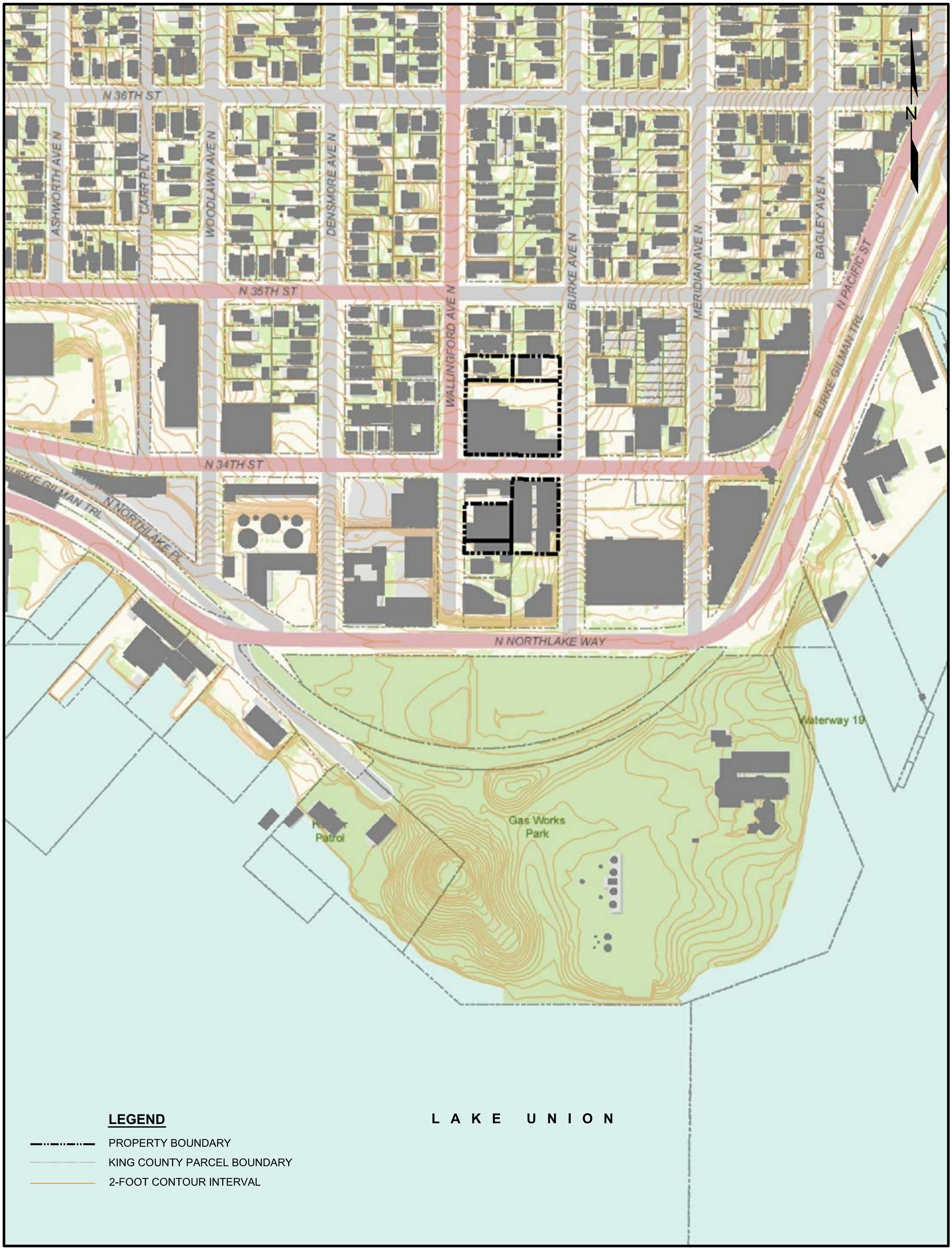
The following additional hazard controls, based on the tasks identified in the Field Activities above, are required for employees of SoundEarth while performing work on the site:

- For well decommissioning, oversight of excavation of contaminated soil, UST decommissioning, soil and groundwater sampling, injection well installation oversight activities:
  - level D PPE, which includes hard hats, steel-toed boots, safety glasses, and a reflective safety vest, with hearing protection when near operating heavy equipment.
- For excavation of contaminated soil, UST decommissioning, and soil sampling activities SoundEarth will operate a photoionization detector to measure concentrations of volatile organic compounds in the soil and air.
- For UST decommissioning activities, SoundEarth will additionally use a certified marine chemist to inert any USTs encountered at the site with carbon dioxide, reducing the potential for a flammable or explosive environment.
- For injection activities:

- When mixing dry chemicals, Modified Level C PPE, which includes hard hats, steel-toed boots, safety glasses, nitril gloves, impermeable synthetic apron over chemical resistant coveralls, reflective safety vest a combination dust-particle mask with vapor cartridge
- When injecting material, Modified Level C PPE, which includes hard hats, steel-toed boots, nitrile gloves, a full face shield, impermeable synthetic apron over chemical resistant coveralls, reflective safety vest, and a full face shield when injecting liquid material.

- Clothing appropriate to cold/wet weather conditions, layered under chemical-protective PPE, when working in inclement weather.
- Traffic control and/or fencing to secure the site.

FIGURES



3/12/2014

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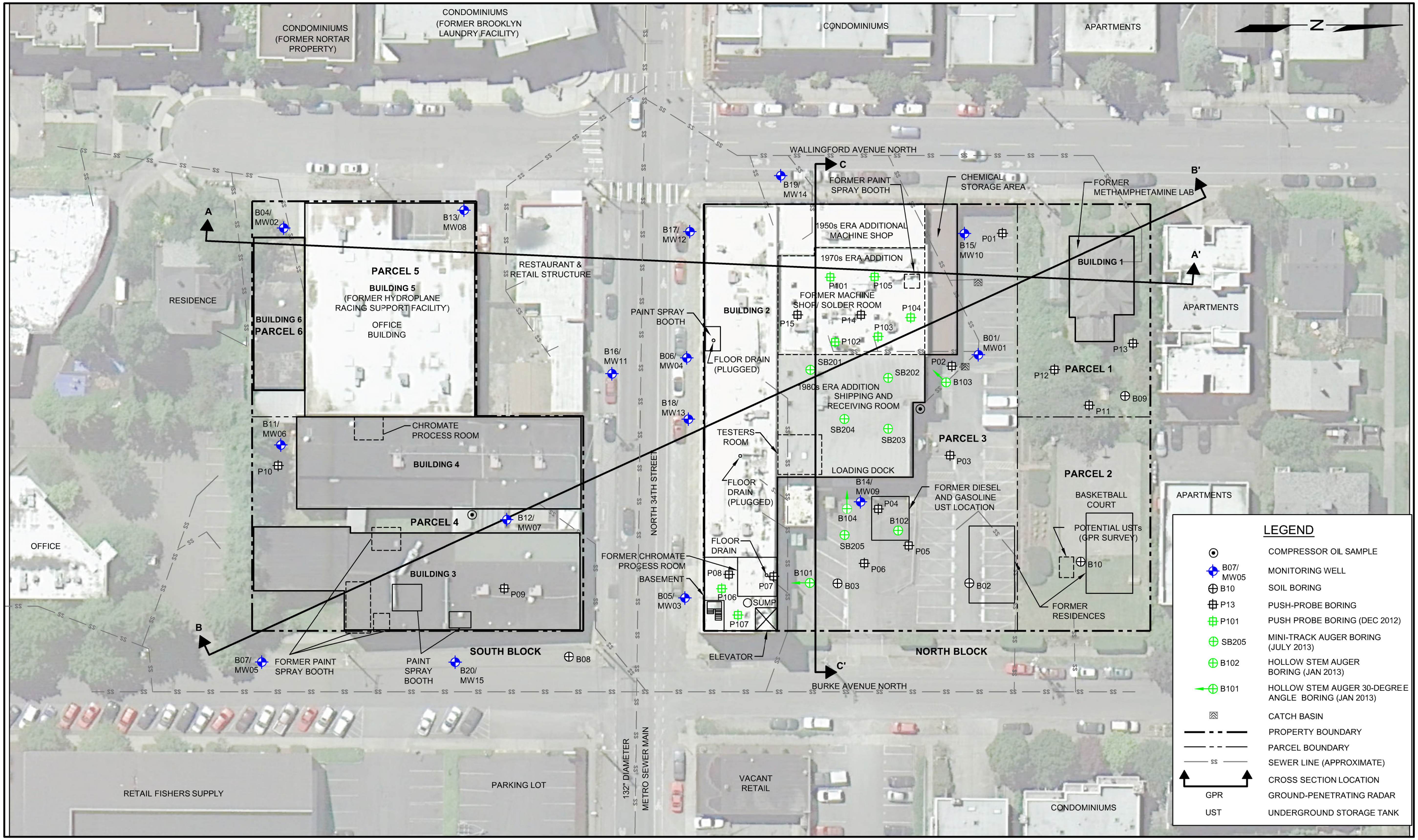
SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

DATE: 08/30/13
DRAWN BY: BLR
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_FIG1

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

FIGURE B-1
PROPERTY LOCATION MAP

WWW.SOUNDEARTHINC.COM



3/14/2014

P:\0789 AMLI RESIDENTIAL\0789-004 AMLI AVTEC\TECHNICAL\CAD\2014CAP\HASP\0789-004-2014HASP_EL.DWG

SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

DATE: 03/11/14
DRAWN BY: NAC/BLR/JQC
CHECKED BY: CER
CAD FILE: 0789-004_2014CAP_EL

PROJECT NAME: AVTECH PROPERTY
PROJECT NUMBER: 0789-004-10
STREET ADDRESS: 3400 WALLINGFORD AVENUE NORTH
CITY, STATE: SEATTLE, WASHINGTON

REGION:

0 25 50 100
APPROXIMATE SCALE IN FEET

FIGURE B-2
PROPERTY AND EXPLORATION LOCATION PLAN

ATTACHMENT B-A
ACKNOWLEDGEMENT AND AGREEMENT FORM

ACKNOWLEDGMENT AND AGREEMENT FORM

Project Name/Facility Name: ____

Project Number/Facility Number: ____

I acknowledge that I have reviewed a copy of the Health and Safety Plan for this project, that I understand it, and that I agree to comply with all of its provisions. I also understand that I could be prohibited by the Site Manager/Health and Safety Officer or other SoundEarth personnel from working on this project if I fail to comply with any aspect of this Health and Safety Plan:

Name	*Signature*	*Company*	*Date*

ATTACHMENT B-B
DAILY HEALTH AND SAFETY BRIEFING LOG

SoundEarth Strategies

DAILY HEALTH AND SAFETY BRIEFING LOG

Date: ______________________________ **Start Time:** ______________

Site Discussed: ____

Subjects Discussed: ____

____

____

____

____

____

____

____

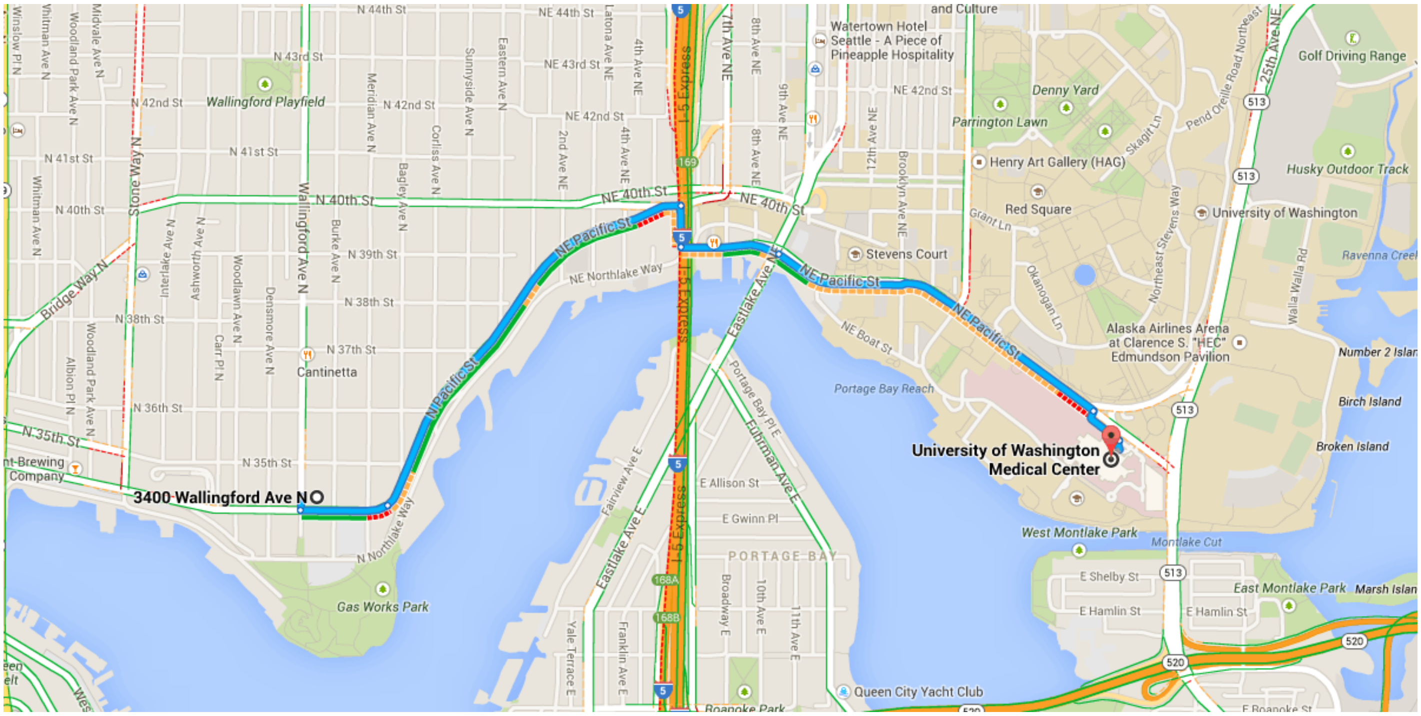
ATTENDEES

Print Name	Signature

Meeting Conducted by ______________________ **Date Signed**______________

ATTACHMENT B-C
HOSPITAL ROUTE

Directions from **3400 Wallingford Ave N** to **University of Washington Medical Center** **Drive 1.9 mi, 5 min**



○ 3400 Wallingford Ave N
Seattle, WA 98103

Drive along **N Pacific St**

1.8 mi / 5 min

1. Head **south** on **Wallingford Ave N** toward **N 34th St**

   121 ft

2. Take the 1st **left** onto **N 34th St**

   0.1 mi

3. Continue onto **N Pacific St**

   0.7 mi

4. Turn **right** onto **6th Ave NE**

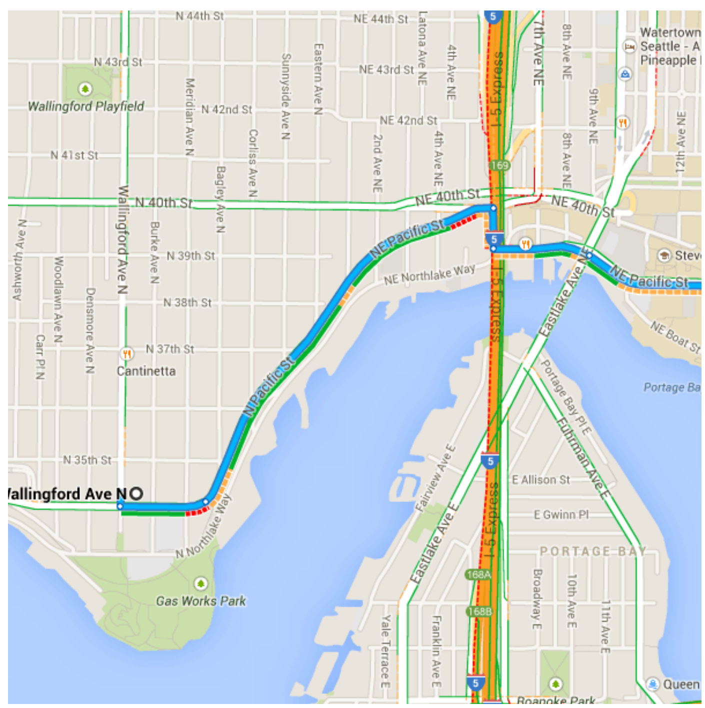
   374 ft

5. Take the 1st **left** onto **NE Northlake Way**

   0.2 mi

6. Continue onto **NE Pacific St**

   0.6 mi



Drive to your destination

486 ft / 18 s

7. Turn **right**

394 ft

8. Turn **right**

Destination will be on the right

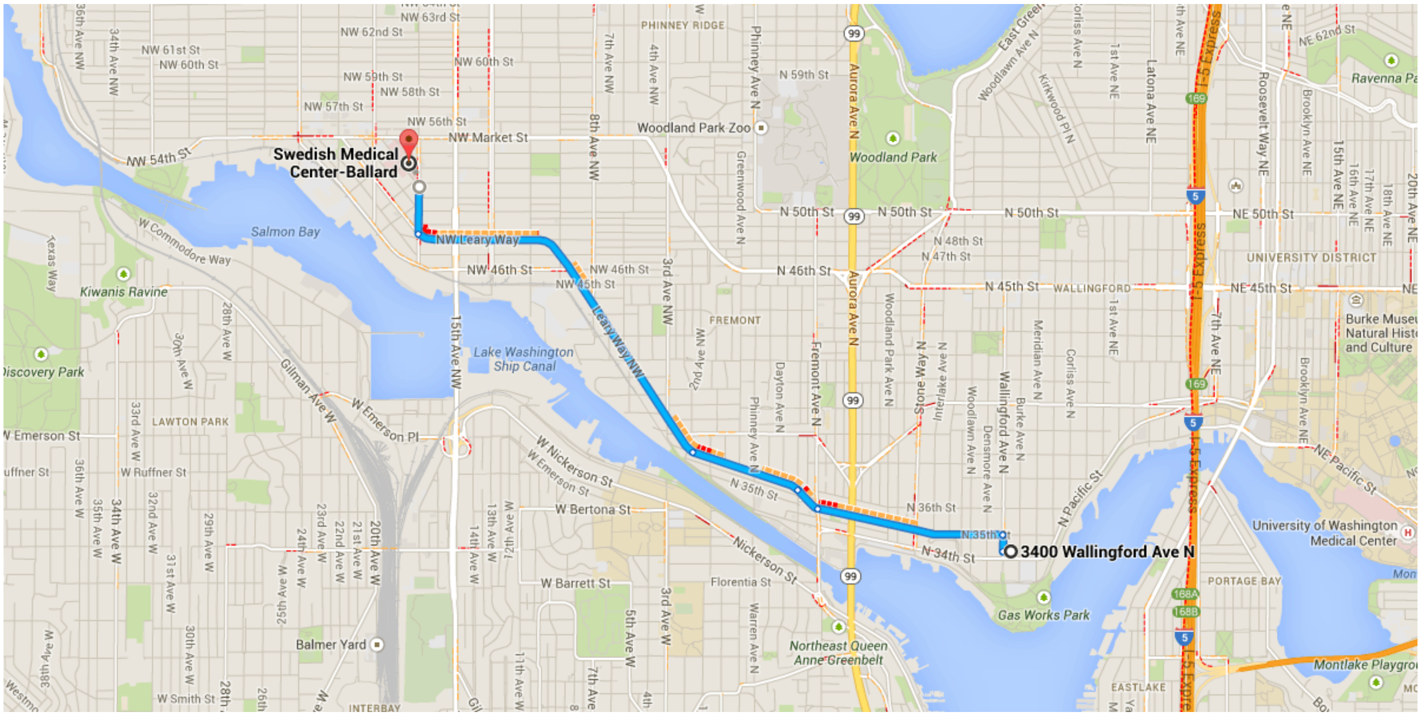
92 ft

University of Washington Medical Center

1959 NE Pacific St, Seattle, WA 98195

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Directions from **3400 Wallingford Ave N** to **Swedish Medical Center-Ballard** **Drive 2.6 mi, 7 min**



3400 Wallingford Ave N

Seattle, WA 98103

1. Head **north** on **Wallingford Ave N** toward **N 35th St**

   305 ft

2. Take the 1st **left** onto **N 35th St**

   0.6 mi

3. Slight **right** onto **Fremont Pl N**

   492 ft

4. Continue onto **N 36th St**

   0.4 mi

5. Continue onto **Leary Way NW**

   1.3 mi

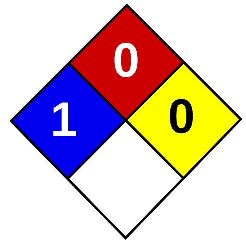
6. Turn **right** onto **17th Ave NW**

   0.2 mi

Swedish Medical Center-Ballard

5300 Tallman Ave NW, Seattle, WA 98107

ATTACHMENT B-D
SITE-SPECIFIC CHEMICAL MATERIAL SAFETY DATA SHEETS – POTASSIUM PERMANGANATE



Health	2
Fire	0
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
Potassium permanganate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Potassium permanganate

Catalog Codes: SLP4912, SLP3892, SLP1075

CAS#: 7722-64-7

RTECS: SD6475000

TSCA: TSCA 8(b) inventory: Potassium permanganate

CI#: Not available.

Synonym: Potassium Permanganate, Biotech Grade

Chemical Name: Potassium Permanganate

Chemical Formula: $KMnO_4$

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Potassium permanganate	7722-64-7	100

Toxicological Data on Ingredients: Potassium permanganate, Biotech: ORAL (LD50): Acute: 1090 mg/kg [Rat]. 2157 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator). Possibly corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: organic materials, metals, combustible materials

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of organic materials, of metals.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Spontaneously flammable on contact with ethylene glycol. Potassium Permanganate being conveyed through propylene tube ignited the tube. When solid hydroxylamine is brought into contact with solid potassium permanganate, there is produced immediately a with flame. Potassium permanganate decomposes hydrogen trisulfide so rapidly that sufficient heat is liberated to ignite the trisulfide. When Antimony or arsenic and solid potassium permanganate are ground together, the metals ignite.

Special Remarks on Explosion Hazards:
Take care in handling as explosions may occur if it is brought in contact with organic or other readily oxidizable substances, either in solution or in dry state. Explosive in contact with sulfuric acid or hydrogen peroxide. Potassium permanganate + acetic acid or acetic anhydride can explode if permanganate is not kept cold. Explosions can occur when permanganates come on contact with benzene, carbon disulfide, diethyl ether, ethyl alcohol, petroleum, or oganic matter. Contact with glycerol

may produce explosion. Crystals of potassium permanganate explode vigorously when ground with phosphorous. A mixture of .5% potassium permanganate + ammonium nitrate explosive caused an explosion 7 hrs. later. Addition of Potassium permanganate + dimethylformamide to give a 20% solution led to an explosion after 5 min. During a preparation of chlorine by addition of the concentrated acid (Hydrochloric acid) to solid potassium permanganate, a sharp explosion occurred on one occasion.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Oxidizing material. Corrosive solid. Stop leak if without risk. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Keep away from combustible material. Do not ingest. Do not breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as organic materials, metals, acids.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 5 Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Sweetish, astringent.

Molecular Weight: 158.03 g/mole

Color: Purple. (Dark.)

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 2.7 @ 15 C (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, acetone.

Solubility:
Easily soluble in methanol, acetone. Partially soluble in cold water, hot water. Soluble in Sulfuric Acid

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances:
Highly reactive with organic materials, metals, acids. Reactive with reducing agents, combustible materials.

Corrosivity: Not available.

Special Remarks on Reactivity:
It is a powerful oxidizing agent. Incompatible with reducing agents, acids, formaldehyde, ammonium nitrate, dimethylformamide, glycerol, combustible materials, alcohols, arsenites, bromides, iodides, charcoal, organic substances, ferrous or mercurous salts, hypophosphites, hyposulfites, sulfites, peroxides, oxalates, ethylene glycol, Manganese salts in air oxidize the toxic sulfur dioxide to more toxic sulfur trioxide. Can react violently with most metal powders, ammonia, ammonium salts, phosphorous, many finely divided organic compounds (materials), flammable liquids, acids, sulfur.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 1090 mg/kg [Rat]. Lowest Published Lethal Dose: LDL[Woman] - Route: Oral; Dose: 100 mg/kg LDL[Human] - Route: Oral; Dose: 143 mg/kg.

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of eye contact (corrosive), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (Male and Female fertility) based on animal data. May affect genetic material (mutagenetic) based on animal data.

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 5.1: Oxidizing material.

Identification: : Potassium permanganate UNNA: 1490 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut carcinogen reporting list.: Potassium permanganate Illinois toxic substances disclosure to employee act: Potassium permanganate Illinois chemical safety act: Potassium permanganate New York release reporting list: Potassium permanganate Rhode Island RTK hazardous substances: Potassium permanganate Pennsylvania RTK: Potassium permanganate Massachusetts RTK: Potassium permanganate Massachusetts spill list: Potassium permanganate New Jersey: Potassium permanganate New Jersey spill list: Potassium permanganate Louisiana spill reporting: Potassium permanganate California Director's list of Hazardous Substances: Potassium permanganate

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS C: Oxidizing material. CLASS E: Corrosive solid.

DSCL (EEC):
R8- Contact with combustible material may cause fire. R22- Harmful if swallowed. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S60- This material and its container must be disposed of as hazardous waste. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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