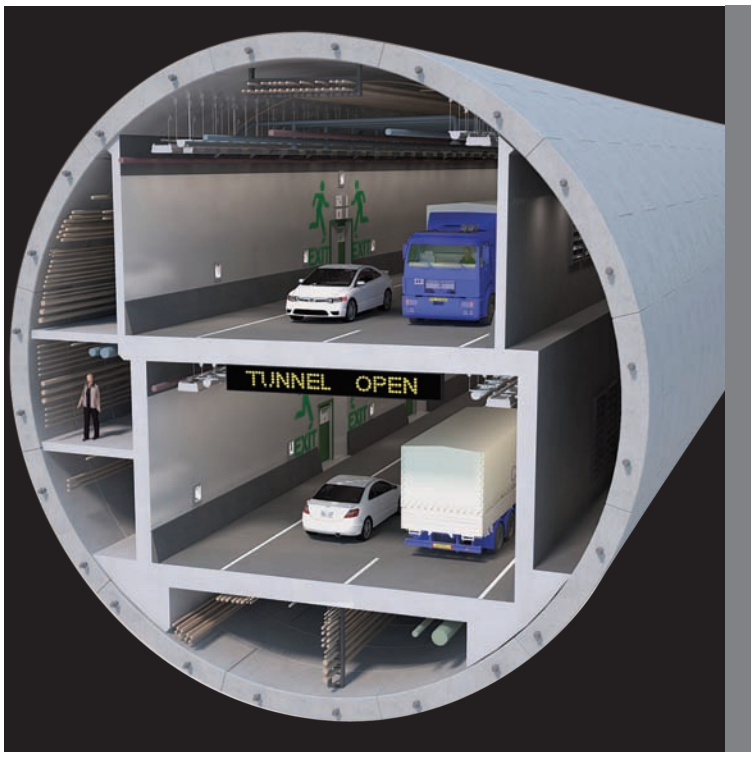
ALASKAN WAY VIADUCT REPLACEMENT PROJECT

2010 Supplemental Draft Environmental Impact Statement

APPENDIX Q Hazardous Materials Discipline Report



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Washington State Department of Transportation

City of Seattle

OCTOBER 2010

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Alaskan Way Viaduct Replacement Project
Supplemental Draft EIS
Hazardous Materials Discipline Report

The Alaskan Way Viaduct Replacement Project is a joint effort between the Federal Highway Administration (FHWA), the Washington State Department of Transportation (WSDOT), and the City of Seattle. To conduct this project, WSDOT contracted with:

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ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing materials
AHERA	Asbestos Hazard Emergency Response Act
ASTM	ASTM International (formerly, the American Society for Testing Materials)
bgs	below ground surface
BMP	best management practice
BNSF	BNSF Railway Company
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDF	controlled-density fill
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (of 1980)
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
City	City of Seattle
CMMP	contaminated media management plan
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSCSL	Confirmed and Suspected Contaminated Sites List
cy	cubic yards
DPD	Department of Planning and Development
Ecology	Washington State Department of Ecology
EDR	Environmental Data Resources, Inc.
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPB	earth pressure balance
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
FHWA	Federal Highway Administration
GAC	granular activated carbon
GPR	ground-penetrating radar
H_2S	hydrogen sulfide
HSL	Hazard Site List (Ecology)
ICR	Washington Site Register of Independent Cleanup Reports
LBP	lead-based paint
LUST	leaking underground storage tank
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^2	milligrams per square meter
MTCA	Model Toxics Control Act

NEPA	National Environmental Policy Act
NFA	No Further Action
NFRAP	No Further Remedial Action Planned
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PGIS	pollutant-generating impervious surface
POTW	publicly owned treatment works
ppm	parts per million
Program	Alaskan Way Viaduct and Seawall Replacement Program
project	Alaskan Way Viaduct Replacement Project
PSCAA	Puget Sound Clean Air Agency
RCRA	Resource Conservation and Recovery Act
RCRAINFO	Resource Conservation and Recovery Act Information
REC	recognized environmental condition
RP	reasonably predictable
SC	substantially contaminated
SEPA	State Environmental Policy Act
SODO	South of Downtown
SPB	slurry pressure balance
SPU	Seattle Public Utilities
SR	State Route
SVOC	semivolatile organic compound
TBM	tunnel boring machine
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
TS&L	type, size, and location
TSD	treatment, storage, and disposal
UST	underground storage tank
VCP	Voluntary Cleanup Program (Washington State Department of Ecology)
VOC	volatile organic compound
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act
WOSCA	Washington-Oregon Shippers Cooperative Association
WSDOT	Washington State Department of Transportation

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Chapter 1 INTRODUCTION AND SUMMARY

1.1 Introduction

This discipline report evaluates the Bored Tunnel Alternative, the new alternative under consideration for replacing the Alaskan Way Viaduct. This report and the Alaskan Way Viaduct Replacement Project Supplemental Draft Environmental Impact Statement (EIS) that it supports are intended to provide new information and updated analyses to those presented in the March 2004 Alaskan Way Viaduct and Seawall Replacement Project Draft EIS and the July 2006 Alaskan Way Viaduct and Seawall Replacement Project Supplemental Draft EIS. The discipline reports present the detailed technical analyses of existing conditions and predicted effects of the Bored Tunnel Alternative. The results of these analyses are presented in the main volume of the Supplemental Draft EIS.

The Federal Highway Administration (FHWA) is the lead federal agency for this project, primarily responsible for compliance with the National Environmental Policy Act (NEPA) and other federal regulations, as well as distributing federal funding. As part of the NEPA process, FHWA is also responsible for selecting the preferred alternative. FHWA will base their decision on the information evaluated during the environmental review process, including information contained within the Supplemental Draft EIS and the subsequent Final EIS. FHWA can then issue their NEPA decision, called the Record of Decision (ROD).

The 2004 Draft EIS (WSDOT et al. 2004) evaluated five Build Alternatives and a No Build Alternative. In December 2004, the project proponents identified the cut-and-cover Tunnel Alternative as the preferred alternative and carried the Rebuild Alternative forward for analysis as well. The 2006 Supplemental Draft EIS (WSDOT et al. 2006) analyzed two alternatives—a refined cut-and-cover Tunnel Alternative and a modified rebuild alternative called the Elevated Structure Alternative. After continued public and agency debate, Governor Gregoire called for an advisory vote to be held in the city of Seattle. The March 2007 ballot included an elevated alternative and a surface-tunnel hybrid alternative. The citizens voted down both alternatives.

Following this election, the lead agencies committed to a collaborative process to find a solution to replace the viaduct along Seattle's central waterfront. This Partnership Process is described in Appendix S, the Project History Report. In January 2009, Governor Gregoire, King County Executive Sims, and Seattle Mayor Nickels announced that the agencies had reached a consensus and recommended replacing the aging viaduct with a bored tunnel.

The environmental review process for the Alaskan Way Viaduct Replacement Project (the project) builds on the five Build Alternatives evaluated in the 2004 Draft EIS and the two Build Alternatives evaluated in the 2006 Supplemental Draft EIS. It also incorporates the work done during the Partnership Process. The bored tunnel was not studied as part of the previous environmental review process, and so it becomes the eighth alternative to be evaluated in detail.

The Bored Tunnel Alternative analyzed in this discipline report and in the Supplemental Draft EIS has been evaluated both quantitatively and qualitatively. The Bored Tunnel Alternative includes replacing State Route (SR) 99 with a bored tunnel and associated improvements, such as relocating utilities located on or under the viaduct, removing the viaduct, decommissioning the Battery Street Tunnel, and making improvements to the surface streets in the tunnel's south and north portal areas.

Improvements at the south portal area include full northbound and southbound access to and from SR 99 between S. Royal Brougham Way and S. King Street. Alaskan Way S. would be reconfigured with three lanes in each direction. Two options are being considered for new cross streets that would intersect with Alaskan Way S.:

- New Dearborn Intersection – Alaskan Way S. would have one new intersection and cross street at S. Dearborn Street.
- New Dearborn and Charles Intersections – Alaskan Way S. would have two new intersections and cross streets at S. Charles Street and S. Dearborn Street.

Improvements at the north portal area would include restoring Aurora Avenue and providing full northbound and southbound access to and from SR 99 near Harrison and Republican Streets. Aurora Avenue would be restored to grade level between Denny Way and John Street, and John, Thomas, and Harrison Streets would be connected as cross streets. This rebuilt section of Aurora Avenue would connect to the new SR 99 alignment via the ramps at Harrison Street. Mercer Street would be widened for two-way operation from Fifth Avenue N. to Dexter Avenue N. Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N. Two options are being considered for Sixth Avenue N. and the southbound on-ramp:

- The Curved Sixth Avenue option proposes to build a new roadway that would extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets. The new roadway would have a signalized intersection at Republican Street.
- The Straight Sixth Avenue option proposes to build a new roadway that would extend Sixth Avenue N. from Harrison Street to Mercer Street in a

typical grid formation. The new roadway would have signalized intersections at Republican and Mercer Streets.

For these project elements, the analyses of effects and benefits have been quantified with supporting studies, and the resulting data are found in the discipline reports (Appendices A through R). These analyses focus on assessing the Bored Tunnel Alternative's potential effects for both construction and operation, and consider appropriate mitigation measures that could be employed. The Viaduct Closed (No Build Alternative) is also analyzed.

The Alaskan Way Viaduct Replacement Project is one of several independent projects that improve safety and mobility along SR 99 and the Seattle waterfront from the South of Downtown (SODO) area to Seattle Center. Collectively, these individual projects are often referred to as the Alaskan Way Viaduct and Seawall Replacement Program (the Program). This Supplemental Draft EIS evaluates the cumulative effects of all projects in the Program; however, direct and indirect environmental effects of these independent projects will be considered separately in independent environmental documents. This collection of independent projects is categorized into four groups: roadway elements, non-roadway elements, projects under construction, and completed projects.

Roadway Elements

- Alaskan Way Surface Street Improvements
- Elliott/Western Connector
- Mercer West Project (Mercer Street improvements from Fifth Avenue N. to Elliott Avenue)

Non-Roadway Elements

- First Avenue Streetcar Evaluation
- Transit Enhancements
- Elliott Bay Seawall Project
- Alaskan Way Promenade/Public Space

Projects Under Construction

- S. Holgate Street to S. King Street Viaduct Replacement
- Transportation Improvements to Minimize Traffic Effects During Construction

Completed Projects

- SR 99 Yesler Way Vicinity Foundation Stabilization (Column Safety Repairs)
- S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project (Electrical Line Relocation Along the Viaduct's South End)

1.2 Summary

1.2.1 Discipline Study Overview

This discipline report presents the results of a study to identify properties that have the potential to contain hazardous materials that could affect replacement of the existing Alaskan Way Viaduct from south of Railroad Way S. to approximately Mercer Street with a bored tunnel. There are no sites that could present a significant unavoidable adverse impact that could not be mitigated.

The study area includes the alignment of SR 99 from S. Atlantic Street to Mercer Street and the area within two city blocks (approximately 400 feet) of the proposed bored tunnel alignment. This report discusses design and construction issues as they relate to hazardous materials and associated effects and mitigation. It also analyzes, as appropriate, these issues and effects in comparison with existing conditions in the study area and with conditions under the Viaduct Closed (No Build Alternative).

1.2.2 Regulatory Considerations

Numerous federal, state, and local regulations and policies govern decisions concerning the potential and liability for hazardous materials and hazardous waste. Federal and state regulations that apply to the project are listed in Attachment H. Applicable local regulations are discussed in this report.

1.2.3 Methodology

The property identification process focused on properties where it is likely that contamination would be encountered during excavation or dewatering and properties that would be acquired or where temporary or permanent easements would be obtained as part of the Bored Tunnel Alternative.

Information on current and historical land uses and records of environmental enforcement were reviewed to identify potentially contaminated properties and properties with documented releases within the study area. These properties have a potential to adversely affect the environment and are identified as "sites." These sites were then screened to assess their potential to adversely affect the project. Sites with a potential to adversely affect the project, referred to as "validated sites," were then categorized as high, moderate, or low potential impact, as defined by the Washington State Department of Transportation (WSDOT) (WSDOT 2009a). Sites that pose a risk to the environment but are located sufficiently far enough from the project area as to have no impact on the project were eliminated from further consideration.

1.2.4 Affected Environment

The study area is characterized by industrial, commercial, and residential activity. The south portal area is primarily industrial in nature, including railroad operations past and present. Container short term storage and transfer operations have replaced other industrial activities on Port of Seattle property adjacent to the alignment. Former industries in the south portal area include metal works, foundries and plating operations, machine shops, warehouses, and fueling facilities, as discussed in Section 4.3, Historical Land Use. The most likely contaminants from such historic operations include metals, solvents, and petroleum products. The area is underlain by fill that was placed in the early 1900s, which covered and incorporated timber and debris that previously had been used in the construction of piers, wharves, and trestles. Common contaminants in this old fill include petroleum constituents and metals. In addition, some of the buried piles and timbers were probably treated with creosote, which likely has leached into the adjoining soil and groundwater. Cinders, possibly from the Seattle Fire of 1889, and coal have been identified, and lubricating oil associated with railroad operations may also be encountered in the fill soils.

The bored tunnel section of the alignment is characterized by commercial activity that includes dry cleaners, printers, lithographers, auto repair shops, gas stations, and commercial residential properties such as hotels and apartments. In the last 20 years, condominiums have been constructed at the north end of the bored tunnel section, mostly displacing commercial use.

The north portal area is also a commercial area; primary businesses in this area are dry cleaners, auto repair shops, gas stations, and motels. The most likely contaminants at both the south and north ends of the bored tunnel alignment are petroleum products, lead that may be present in gasoline, other heavy metals, and solvents. As the tunnel deepens, solvents typically associated with printers and dry cleaners are the contaminants most likely to migrate to the depth of the tunnel.

Historical land uses potentially resulted in releases of a variety of hazardous materials into the surrounding environment, causing soil and groundwater contamination that could adversely affect the project.

Because there has been only limited redevelopment along the bored tunnel alignment, most of the buildings were constructed before the enactment of recent laws restricting the use of hazardous building materials. Therefore, the presence of asbestos-containing materials (ACM) and lead-based paint (LBP) should be expected in many of the buildings in the area. ACM, LBP, and lead-containing soot have been identified in the existing Battery Street Tunnel, which would be decommissioned as part of the Bored Tunnel Alternative.

1.2.5 Operational Effects, Mitigation, and Benefits

The Viaduct Closed (No Build Alternative) includes two scenarios: (1) sudden closure of SR 99 due to an event that renders the structure unsafe, and (2) collapse of the viaduct during an earthquake. Compared with conditions under these scenarios, the Bored Tunnel Alternative would reduce pollutant loading and improve the quality of stormwater runoff discharged from the study area to surface water. Under the Bored Tunnel Alternative, improvements to surface streets would include stormwater flow control and water quality treatment measures in compliance with Seattle's drainage code, and the Department of Planning and Development (DPD) and Seattle Public Utilities (SPU) Director's Rules for stormwater, grading, and drainage control. Stormwater quality would be maintained or potentially improved compared to existing conditions. Seepage in the tunnel would be discharged to the combined sewer system and would need to comply with the DPD and SPU Director's Rules addressing discharges to the side sewer.

Because of the coarse backfill that surrounds utilities, the utility corridors in the study area could act as preferential pathways for contaminant migration. To prevent the migration of contaminants in shallow groundwater, controlled-density fill (CDF) or trench dams could be installed at intervals along utility runs where contamination is suspected.

As with any roadway, spills of hazardous materials could occur. The fire department is equipped to respond to spills and fires.

If groundwater backup occurs upgradient of the cut-and-cover tunnels, retaining walls, and ground improvements, the water level on the east and west sides of the affected areas could be equalized by the installation of pipes and drainage trenches. The backup is expected to be within the normal range of fluctuations. The placement of the pipes and trenches could be adjusted if groundwater contaminants are encountered so as not to make the existing conditions worse.

1.2.6 Construction Effects and Mitigation

The Bored Tunnel Alternative has been designed to avoid contamination where possible. Where contamination cannot be avoided, planning and design, as well as construction techniques and practices, would be implemented with the intent of avoiding and minimizing the release of contaminated media to the environment. Construction effects from contaminated media would be mitigated by developing and implementing construction plans that describe contaminated media management. Construction effects would also be mitigated by establishing a budget that reflects the costs associated with disposing of contaminated spoils and dewatering water. Early identification of contaminated soil and groundwater, and waste characterization, although increasing up-front costs, may minimize the

volume of contaminated spoils. Areas of contamination could be avoided, construction methods could be modified to address contaminated media, and contaminated spoils could be segregated for appropriate disposal. Adequate laydown areas have been identified to allow for sufficient stockpiling of soil and characterization sampling, without adversely affecting the construction schedule.

Construction effects could result if contaminated soil or groundwater is encountered during various construction activities (e.g., drilling of shafts, deep soil mixing, jet grouting, compensation grouting, excavation for retaining walls, and relocation of utilities). In addition to the sites that have been identified as potentially contaminated, the SR 99 alignment is underlain by fill that consists of soil and debris from unknown sources. Construction throughout the project area could encounter contaminants such as petroleum, metals, and polycyclic aromatic hydrocarbons (PAHs) in the fill soils, as well as creosote-treated timbers and wood debris. These contaminants have been identified in the Alaskan Way S. right-of-way. Solvent- and petroleum-contaminated soil is present in the north portal area between Denny Way and Mercer Street.

To the extent that soil and groundwater removed during construction are contaminated, special handling and disposal would be required, along with provisions for the health and safety of workers and the public, and the protection of the environment from releases of contaminants, spreading of contamination, and cross-contamination.

The Bored Tunnel Alternative would require the acquisition of all or portions of 11 parcels, including 1 parcel that would be acquired if the Curved Sixth Avenue option is implemented in the north end. Easements would also be acquired for 4 parcels for the installation of temporary or permanent tiebacks. On these 15 parcels (including the optional parcel), 17 sites with the potential to adversely affect the environment have been identified. A few large parcels encompass more than one site, and some large parcels have no sites, or the portion of the parcel that is being acquired has not been identified as a site. A majority of the sites are associated with former railroad operations, metal works, a junkyard, gas stations, and dry cleaners. Seven buildings would be acquired, including one that would be acquired if the Curved Sixth Avenue option is implemented in the north end. Two of these buildings may be acquired for construction easements, potentially associated with compensation grouting. Building and parcel acquisitions and easements are discussed in the *SR-99 Bored Tunnel Right-of-Way Needs and Boundaries Summary Report* (PB 2009a).

Four sites (three parcels) would present a potentially high impact on the project because of potential solvent contamination. Potential liability could be mitigated through an indemnification agreement with the property owner. The property could be valued as clean, and funds could be placed in escrow until cleanup is

completed. Depending on whether contaminants are encountered and where the contamination is discovered, a surface easement or lease option may be possible for Site 40.1-4, located near Mercer Street and Sixth Avenue N.

If site investigations are conducted in advance of construction, these sites would not substantially affect the proposed schedule. In addition, an understanding of the distribution and concentration of contaminants could be used to develop potential remediation costs and approaches. Remediation could occur in advance of construction or as part of the project construction. The construction approach and techniques could be modified to address potentially contaminated media.

WSDOT has already acquired five parcels with three potentially contaminated sites. Phase I Environmental Site Assessments (ESAs) were conducted for these parcels, and a Phase II ESA was conducted for two of the parcels to address recognized environmental conditions (RECs). Phase II ESAs and other environmental sampling activities are conducted sometime as part of property transfer proceedings to identify potential contaminants that could be encountered during construction. Explorations conducted for the engineering design could provide sufficient data on hazardous materials sites in other portions of the project area.

In addition, properties adjacent to the alignment that may have underground storage tanks (USTs) have been identified. Historically tanks were abandoned when no longer needed, rather than removed; residual fuel was left in the tank. Over time these tanks may have released the fuel, resulting in contaminated soil and groundwater. Abandoned USTs represent multiple localized potential sources of contamination along the entire alignment. Some of these tanks could be located directly over the tunnel or within a distance where a contaminant release could adversely affect subsurface soil that would be removed for the project.

These tanks could still contain petroleum products that may be flammable or combustible and could pose a fire hazard to the bored tunnel. Identified USTs include tanks registered with the Washington State Department of Ecology (Ecology), USTs at former gas stations, and tanks that stored oil for heating buildings. Geophysical investigation methods, including ground-penetrating radar (GPR), electromagnetic methods, metal detection, or magnetometry surveys are recommended for properties that would be acquired and may still have USTs. In general, USTs containing flammable or combustible liquids are not permitted within 25 feet of a subsurface structure; where the distance is less than 50 feet, an engineering analysis should be performed to determine whether tank removal is necessary. A proposal to apply the standard to vehicle transit systems is being considered.

Construction activities on these and other sites could result in the following types of effects related to hazardous materials:

- Large volumes of spoils containing contaminated soil and debris could be generated.
- Grout and slurry waste due to an elevated pH.
- Contaminated groundwater could be encountered and drawn into areas that were previously uncontaminated, and discharge from dewatering operations could contain hazardous materials.
- Groundwater pathways could be modified by subsurface construction or dewatering, resulting in the mobilization and spread of existing contaminants.
- Air quality could be affected by releases of contaminants and dust during construction and handling of contaminated media.

Construction activities that would involve direct soil removal include excavation for tunnels, foundations, retaining walls, utility installation and relocation, and soil improvement. Similarly, the use of drilled shafts for construction of piles and diaphragm walls would generate large volumes of spoils that would have to be handled and properly disposed of. A contaminated media management plan (CMMP) that addresses handling, storage, and disposal of contaminated materials, including pH-affected spoils would be required by Public Health of Seattle and King County. Other construction management plans address measures that could be implemented to protect stormwater and surface water, as described in Appendix O, Surface Water Discipline Report. Handling and disposal options are also discussed in the *Draft Spoils Handling and Disposal Planning Report* (PB 2009b) and the *Environmental Considerations Report* (Shannon & Wilson 2010c). The ground improvement techniques that would be used would also generate large volumes of spoils and groundwater from dewatering. Jet grouting operations, which inject cement grout to strengthen the subsurface soils, typically produce spoil volumes equal to about 50 to 70 percent of the volume of soil treated. An estimated 20 percent of these spoils would be solids. This spoil material would consist of a blend of eroded soil and cement grout flushed to the ground surface during grouting.

Deep soil mixing, which involves in situ mechanical mixing of soil and cement, is estimated to produce spoil volumes equal to about 30 to 50 percent of the volume of soil treated. An estimated 20 percent of these spoils would be solids. The spoils from deep soil mixing would consist of blended soil and cement with the consistency of a thick mud; this material would have to be allowed to settle before it could be handled or disposed of. Soil improvement methods that use cement result in spoils with a high pH because of the comingled cement and soil. Spoils with a high pH require special handling and disposal. These spoils are considered a problem waste because of the disposal restrictions imposed on the spoils.

Compensation grouting may also be performed along the tunnel alignment to stabilize soil and mitigate ground loss during tunneling. Grouting may be performed through the tunnel liner, beneath structures where settlement is expected (e.g., buildings). Spoils would be generated during the advancement of the grout hole and may be pH affected because of comingling with cement.

The specific areas requiring ground improvement have not been identified. Although a relatively large volume of high pH spoils from ground improvement could be generated, the volume of spoils with a high pH has not been estimated. Ground improvement may be performed between S. King Street and S. Jackson Street and near Yesler Way, where the tunnel passes under the existing viaduct. Where ground improvement is necessary, care would be taken to not adversely affect existing underground utility trenches.

In the south portal area, fill soils consist of soil comingled with substantial quantities of wood debris and sawdust, in addition to other debris such as coal. The distribution and quantity of the wood debris prevent the excavated fill soils from being reused as fill unless the wood debris is removed. The fill soils are also contaminated with low concentrations of petroleum, metals, volatile organic compounds (VOCs), and PAHs (associated with oil and coal). Soil with contaminant concentrations, although not always greater than the cleanup levels established by the Model Toxics Control Act (MTCA), would likely require disposal at a either a land reclamation facility permitted to accept low-level contaminated soil with a pH of less than 8.5 or a Resource Conservation and Recovery Act (RCRA) Subtitle D landfill that has no restrictions on the levels and types of contaminants, as long as the spoils are not considered "dangerous" waste. If there is sufficient space to stockpile soil and it is financially beneficial, the contractor may segregate excavated soil with low levels of contamination from soil with contaminant levels exceeding MTCA. Based on engineering estimates, laydown areas should have a capacity to stockpile 25,000 cy, approximately 2 weeks of excavation spoils. Adequate space for stockpiling is necessary so that the excavation schedule is not affected.

Conditions along the southern part of the bored tunnel along the waterfront are similar to those in the south portal area. Once the tunnel moves away from the waterfront, it is reasonable to assume that a high percentage of the spoils would be less contaminated than those from the south and north portal areas. Elevated metals concentrations may be encountered, generally less than MTCA Method A levels, with possible isolated occurrences of organic contaminants. Glacially deposited soil may have elevated levels of pH (above 8.5). In addition, additives mixed with soil may increase the pH of the spoils.

At the north portal area, petroleum contamination is expected because of the numerous former gas stations in that area. Spent solvents from former dry-cleaning

operations may also be present in soil that will be excavated. Soils containing the spent solvent tetrachloroethylene, commonly associated with dry cleaning, are typically considered a dangerous waste according to Washington Administrative Code, Chapter 173-303 (WAC 173-303). As such, they require disposal at a RCRA, Subtitle C, disposal facility. However, in the north portal area, tetrachloroethylene concentrations originating from a dry cleaner (Site 60.3-1) are expected to be less than the 0.7 milligram per liter (mg/L) threshold measured by the Toxicity Characteristic Leaching Procedure (TCLP) test. These soils can be disposed of as "contained-in" waste at a RCRA Subtitle D landfill, provided that prior approval has been obtained from Ecology and special handling and disposal requirements are observed as described in Section 6.5.5, Contaminated Media Handling and Disposal Options. Washington State determines whether a waste is contained-in through MTCA and Ecology's Toxics Cleanup Program using the federal hazardous remediation waste management requirements[1](Code of Federal Regulations, Title 40, Part 260 [40 CFR Part 260] and Washington State's similar regulation as a basis for waste determination.

The Bored Tunnel Alternative would generate an estimated 1,588,000 cubic yards (cy) of spoils from excavations, and approximately 27 percent of that (322,450 cy) could require special handling and disposal for contamination or an elevated pH (problem waste). Included in this estimate is soil or spoils that contain compounds or elements that restrict where the waste can be reused or disposed of, waste with pH values greater than 8.5, and waste containing high concentrations of organics, such as woody debris, sawdust, or timbers. Fill soil to be excavated from the south area contains wood debris (including creosote-treated pilings). Spoils from glacial soils in the central portion of the bored tunnel were considered separately because they may only have elevated levels of pH occurring naturally or introduced by the additives to the spoils that could be neutralized.

The maximum daily volume of soil that could be excavated in portal areas is estimated to be approximately 2,800 cy. This is the equivalent of approximately 4,000 to 5,000 tons of soil, assuming a multiplier of 1.8 cy per ton. The volume of spoils from the bored tunnel would likely range between 3,900 and 6,600 tons per day, assuming the tunnel boring machine (TBM) advances between 30 and 50 feet per day. Waste handlers for problem waste estimate that they can accept approximately 5,000 tons of soil per day for disposal at a RCRA Subtitle D landfill that has no restrictions on levels of contamination, organic content, and pH level, as long as it is not considered dangerous waste. Although the estimates indicate

[1] U.S. Environmental Protection Agency (EPA), 1998, 40 CFR Part 260, et al., hazardous remediation waste management requirements (HWIR-Media); final rule: 63 FR 65873-65947, November 30.

substantial spoils disposal volumes, advanced coordination and budgeting for disposal would help mitigate the spoils disposal issue. For temporary storage, soil could be stockpiled at proposed staging areas in the south end of the project area. Also, more than one waste disposal company may be used to address the volume of soil requiring disposal.

Although ground improvement would likely be necessary to stabilize soils, these areas have not been delineated. Spoils from ground improvement (deep soil mixing and jet grouting) generally would require special handling because they would consist of commingled soil and cement. Glacially deposited soil may have elevated levels of pH (above 8.5). In addition, additives mixed with soil may elevate the pH of the spoils. These additives may need to be recovered from the spoils before solids are transported off site.

The volume of spoils waste, particularly from deep soil mixing and jet grouting, could be reduced in some areas by using alternative technologies that would generate less spoils. The use of vibro-replacement (stone columns), is thought to be an unlikely method given the particular conditions; however, it could still be considered. Nevertheless, the installation of stone columns could possibly result in the displacement of perched groundwater or other types of groundwater if the groundwater is forced upward through the soils by the high-pressure air used with this method. It could also potentially affect building foundations in the area, depending on the soil conditions. For drilled shafts, casing the shafts should be considered in areas where caving and sloughing are likely. This would reduce both the volume of soil generated and the potential for contamination of the slurry used to complete the shafts.

Dewatering activities would also be required for the cut-and-cover tunnels, retained cuts, and deep excavations for the tunnel operations buildings. Water from dewatering will be discharged to the combined sewer or it will be reinjected to mitigate the potential effects of dewatering. No dewatering water will be discharged directly to Elliott Bay. Water that is discharged to the combined sewer would need to be treated and disposed of in accordance with the King County Wastewater Discharge Permit or Authorization and in accordance with SPU and DPD requirements. Water that does not comply would be treated off site. Off-site disposal may also be necessary if the volume of water exceeds the sewer capacity. Groundwater that is reinjected would comply with Washington's Water Quality Standards for Ground Water.

The water table in the south portal area is about 6 to 10 feet below the ground surface (bgs). Groundwater flow could be altered by the presence of the walls supporting the retained cuts, cut-and-cover tunnel, and ground improvement areas. The walls would essentially block the flow of groundwater and could cause groundwater to backup up against the wall. Groundwater backup may

occur along the east sides of the walls because groundwater flow is generally toward Elliott Bay. Pipes and drainage trenches could be installed to reduce the effect of groundwater backup and minimize changes in groundwater gradients, if necessary. Groundwater backup is expected to be within the normal range of groundwater level fluctuation.

To the extent feasible, the dewatering systems required for construction would be designed to minimize drawdown of the water table. This would reduce the volume of groundwater that requires treatment and disposal. It would also reduce the potential for mobilization and spreading of groundwater contaminants in the project area. Diaphragm walls would be installed on either side of the large excavation at the south portal, where the excavation is expected to extend to a depth of approximately 80 feet. These walls would create an impermeable barrier to groundwater flow. Shallow groundwater from within the excavation would be discharged to the combined sewer. Large-scale dewatering from the deeper water-bearing zone would be performed to keep the water level below the bottom of the excavation. In addition to mitigating potential settlement of structures, the reinjected groundwater would act as a hydraulic barrier and reduce drawdown effects and potential changes in groundwater pathways.

Potential effects on air quality due to contaminants, dust, and nuisance odors could be mitigated, where required, by avoidance measures, best management practices (BMPs) or engineering controls. Depending on the size of the excavation, work areas could be covered to reduce the effect of dust and odors, or the amount of active work surface that is open could be reduced. Engineering controls could also be implemented, such as wetting of surfaces with water or polyacrylamide blends that bind soil to prevent it from becoming airborne, ventilation with fans, and air filtration methods. Work associated with the project would be planned to control fugitive dust during construction according to an existing agreement between WSDOT and the Puget Sound Clean Air Agency (PSCAA).

As part of the Bored Tunnel Alternative, the viaduct would be demolished and the Battery Street Tunnel would be decommissioned. Construction debris, including concrete from the existing viaduct, would be used to fill the Battery Street Tunnel. Before placement, the concrete (which likely would be pulverized) would need to have a best-use determination (WAC 173-350). Public Heath of Seattle and King County oversees compliance of solid waste disposal within the county. The objective is to evaluate the solid waste and determine the most appropriate disposal location, given the materials characteristics.

ACM and LBP may be present in the buildings that would be acquired. ACM and LBP have been identified at various locations in the Battery Street Tunnel. Soot within the tunnel contains high metals concentrations (greater than the dangerous waste threshold) and other contaminants. Before demolishing any

building or structure, hazardous materials building surveys would be conducted to identify the presence of hazardous materials and determine quantities for removal.

1.2.7 Cumulative Effects

Hazardous materials are not in and of themselves a resource that would be evaluated for cumulative effects. Hazardous materials, however, could affect resources including air and water. Hazardous materials could be associated with contaminated soils and groundwater, building materials encountered during demolition, hazardous materials used at construction sites and released into the environment due to accidental spills, and USTs. Depending on the contamination, there could be risks to worker safety and public health in addition to the environmental damage. However, the risk of encountering hazardous materials for this project is low, and there are several safeguards in place to minimize temporary effects, including the WSDOT spill prevention control and countermeasures plan for construction projects.

Although not a cumulative effect related to a specific resource, Program-related removal of hazardous materials or minimization of hazardous materials transport would generally be beneficial to the environment. All planned construction projects include stormwater flow control and water quality treatment in compliance with Seattle's drainage code, which would result in an overall improvement in water quality. Material requiring special handling and disposal, including soil and groundwater contaminated with petroleum hydrocarbons, metals, VOCs, and/or PAHs, may be encountered during the construction associated with many of the urban transportation improvement projects. To the extent that contaminated material is removed from the environment and treated and/or disposed of, soil and groundwater quality would improve as a result of construction. Adverse effects would be related to a decrease in the capacity of temporary holding areas and landfills available to receive hazardous materials, requiring material to be transported greater distances or stockpiled/staged for future disposal.

Chapter 2 METHODOLOGY

The objective of this Hazardous Materials Discipline Report is to identify current and historical land uses near the project area that have the potential to result in environmental contamination and to assess the possible environmental effects of such hazardous material sites on the project. The downtown area has a long history of commercial and industrial use, with a large number of known and suspected contaminated sites near the alignment.

The study to identify known and suspected contaminated sites included two parts: a regulatory database search of sites identified by federal and state agencies (April 2009) and sites identified based on current or historical land use. Distances for the regulatory database search conformed to ASTM 1527, Phase I ESA standards. Sites identified on the state lists that are located more than two blocks (approximately 400 feet) from the project alignment were not evaluated because they have a much lower potential to affect the project than the large number of similar types of sites identified in the study area, based on a review historical records. Focused research of current and historical land use was conducted for a study area that was defined to include the alignment of SR 99 from S. Atlantic Street to Mercer Street and the area within two city blocks of the alignment. The study area also included blocks adjacent to on- and off-ramps or surface streets that would be modified as part of the Bored Tunnel Alternative and any parcels that may be used as temporary laydown areas. The distance of 400 feet on either side of the alignment was selected because it was judged to encompass the areas from which contamination could reasonably be expected to migrate to the project footprint. Contamination on sites that would have been identified within the study area has the potential to migrate outside the project footprint.

A number of factors were considered in selecting two blocks on either side of the alignment as the study area boundary. Most of the bored tunnel section and the north portal area are underlain by interlayered fine-grained and coarse-grained soils to a depth of to 40 feet. These soils are underlain by very dense sand and gravel (till) that limit the vertical and lateral migration of contaminants. Groundwater is present in occasional perched water-bearing zones, with the depth to regional water greater than 70 feet bgs. The isolated perched water zones further reduce the potential for contaminants to migrate as a soluble contaminant within the groundwater.

Although the southern area has a shallow water table and consists of fill in the upper 20 to 30 feet, this commercial and industrial part of the city has a long history of businesses that likely used hazardous materials. It would be difficult to attribute contaminants to particular businesses more than 400 feet from the alignment, given the density of businesses located over or adjacent to the alignment that used

hazardous materials. The regulatory database search would have identified any sites that had widespread contamination. No sites within a half-mile upgradient of the alignment were identified.

The focused study consisted of the following elements:

- A review of historical data related to the study area.
- A review of Ecology files for known and suspected contaminated sites within the study area. Files were reviewed in June 2009. Additional sites were reviewed in February 2010.
- A review of current King County Tax Assessor records for properties located adjacent to the project footprint.
- A windshield survey of the north and south portal areas to identify current land uses that could result in environmental contamination. The survey was conducted from a vehicle in July 2009, and observations were limited to those that could be made from public areas. The north portal survey was updated in January 2010. The south portal area for the 2010 alignment was included in the 2009 survey. Only prominent features could be observed or verified.
- Interviews with the Seattle Fire Marshal, King County Health Department, in July 2009.
- A summary of area geology as it applies to contaminant distribution and migration, based on Appendix P, Earth Discipline Report.

A description of each of these elements is provided in Chapter 3, Studies and Coordination, Sections 3.1 through 3.5. All known and potentially contaminated sites identified in this study were screened to assess their potential risk to the project, as described in Section 3.9. Identified sites included those where hazardous materials are likely used or stored during current operations or were likely used or stored during historical operations and those where contamination with hazardous materials or petroleum product is known or suspected, based on a regulatory database search. The sites were then further evaluated for their potential impact on the project based on their proximity to the project area, their physical setting, and the type of contamination.

The discipline report is presented in eight chapters and nine attachments. Chapter 1 summarizes the historical background related to the overarching environmental review process of which this report is a part and also summarizes the objectives, studies, findings, conclusions, and recommendations included in the report. Chapter 2 summarizes the studies conducted for this assessment of hazardous materials. Chapter 3 describes these studies in detail, as well as the process used to identify sites that may adversely affect the project. Chapter 4

discusses the physical setting of the project and describes historical land use in the three sections of the study area: the south portal area, the bored tunnel, and the north portal area. The results of environmental sampling within the study area are presented and the potential implications of these results are discussed. Sites that may pose an environmental risk to the project due to documented contamination or historical land use are listed and discussed. Chapter 5 discusses hazardous materials impacts that may occur during project operation, and Chapter 6 discusses hazardous materials impacts that may occur during construction. Cumulative effects of the proposed project when combined with the effects from other past, present, and reasonably foreseeable future projects are identified in Chapter 7. Chapter 8 provides a list of references that have been used in preparing this report.

Attachments A through G present the studies and/or the findings of studies that are discussed in Chapter 3. Attachment H presents the applicable laws and regulations, and Attachment I describes standard mitigation measures that could be used. Attachment J provides a more detailed analysis of cumulative effects.

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Chapter 3 STUDIES AND COORDINATION

This chapter summarizes the studies that were undertaken to identify potentially hazardous materials that may be present within the study area. Environmental studies were coordinated with geotechnical studies that were conducted to evaluate the preliminary design. Environmental data have been evaluated, and the findings are summarized in the *Environmental Considerations Report* (Shannon & Wilson 2010c). The findings from the *Environmental Considerations Report* are also summarized in this discipline report.

3.1 Historical Records Reviewed

Analysts reviewed the following information sources to identify historical uses of properties that are commonly associated with generation, storage, or transportation of hazardous materials. The historical review was limited to the study area (proposed bored tunnel alignment and adjacent areas within approximately 400 feet, or two city blocks). The historical land uses identified by the following historical records are discussed in greater detail in Chapter 4.

3.1.1 Sanborn Fire Insurance Maps

Historical Sanborn fire insurance maps are available for most of the study area for intermittent periods between 1888 and 1969. Analysts used the Sanborn maps to identify historical businesses by name, exact location, and unique concerns for insurance underwriters, such as large fuel tanks and chemical hazards.

3.1.2 Polk Directories

The Polk Directories identify businesses by name, type of business, and address for the years 1938 to 1990. These directories, which can be searched by address, are excellent sources of information regarding area development and property uses over time. Analysts reviewed directories for Seattle for the years 1938, 1940, 1943–1944, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, and 1989–1990 at the Seattle Public Library.

3.1.3 Aerial Photographs

Aerial photographs provide general information regarding the historical and current development within the study area. Analysts obtained black and white aerial photographs for the entire study area dated 1936, 1946, 1951, 1956, 1961, 1966, 1970, 1974, 1979, 1985, and 1992 and color photographs taken in 2000 from the WSDOT Photography Series Division and from Walker & Associates (now Aero-Metric).

3.1.4 Washington State Archive Records

Analysts used the King County Tax Assessor archives to obtain information regarding building construction dates, heat sources, presence of underground tanks, property use, and ownership within the study area. Records from approximately 1936 to 1972 were accessed at the regional branch of the Washington State Archives. Records after 1972 were accessed electronically.

3.1.5 King County Tax Assessor Records

Analysts used current King County Tax Assessor records, obtained from the King County website, to confirm the age of the buildings, current use and ownership, and current heat source. Current tax assessor records were reviewed for the blocks underlying or immediately adjacent to the SR 99 alignment within the study area.

3.2 Regulatory Records Review

Analysts reviewed federal and state databases to identify former and current land uses that could result in the contamination of soil or groundwater within the study area. The objectives of this review were (1) to identify and document reported releases of hazardous or toxic materials to the environment, and (2) to pinpoint businesses and industries that use, generate, store, transport, or dispose of regulated hazardous materials in the normal course of business and that have the potential to release hazardous or toxic material to the environment.

Environmental Data Resources, Inc. (EDR) was subcontracted to conduct a search (as recommended by ASTM International [ASTM]) of available agency databases, including those of the U.S. Environmental Protection Agency (EPA) and Ecology, for known and suspected contaminated sites within 1 mile of the project footprint.

The search identified federal National Priorities List (NPL) and Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) sites within 1 mile of the project footprint, sites on the state Confirmed and Suspected Contaminated Sites List (CSCSL), sites in the Washington Site Register of Independent Cleanup Reports (ICR), and leaking underground storage tank (LUST) sites within ½ mile of the alignment. The search distances conformed to ASTM 1527 standards. Orphan sites identified by EDR were also evaluated. Orphan sites are sites that are identified but lack distinct addresses and, therefore, cannot be plotted by EDR.

The NPL and CERCLIS sites were considered to have a low potential to adversely affect the project based on the extent and type of contamination and the relative distance of the sites from the project footprint.

Sites identified on the state lists that are located more than two blocks from the project footprint were not evaluated because they have a low potential to affect the project relative to the large number of similar sites identified in the study area.

The regulatory records search identified 183 total sites, 107 of which were unique sites within the study area. Some of the sites are included on more than one list. The EDR Study Area Report is presented in Attachment A. Sites identified in the EDR search are presented in Attachments B, C, and G. As described in Section 3.9, some of the sites listed in the EDR report were excluded from further evaluation because they are unlikely to affect the project. These sites are presented in Attachment B. The total sites and unique sites within the study area that are listed in regulatory databases are summarized in Exhibit 3-1.

Each block within the study area was assigned a number, from north to south. Block boundaries were established based on the original city plat maps; consequently, the block boundaries discussed in Chapter 4 (Exhibit 4-5) may differ slightly from the current block boundaries. Each historical or current business that potentially used hazardous materials or where a confirmed release of hazardous materials occurred was assigned a site number. Where multiple businesses occupied the same parcel, either at a different address or at a different time, all of the businesses are listed, along with the associated address, type of business, and years of operation; however, only one site number was assigned to the parcel(s). Sometimes the site boundaries overlapped because parcels were joined. The location, site number, and likely contaminant(s) for sites within this study area are discussed in Chapter 4, and the historical land use for each site is summarized in Attachment D.

3.2.1 Federal Databases

The following four EPA databases were searched.

Comprehensive Environmental Response, Compensation, and Liability Information System: The CERLIS database contains data on potentially hazardous material sites that have been reported to EPA by states, municipalities, private companies, and private persons. Sites listed in CERCLIS are either included on the NPL or proposed for inclusion on the NPL. Sites currently in the screening or assessment phase of the investigation for possible NPL inclusion may also be included in CERCLIS. One CERCLIS site was identified within the study area. The facility received a No Further Remedial Action Planned (NFRAP) designation and is not being considered for NPL designation.

National Priorities List: The NPL database is a subset of CERCLIS that identifies more than 1,200 sites (nationwide) for priority cleanup under the Superfund program. No NPL sites were identified within the study area.

Exhibit 3-1. Summary of Sites Listed on Regulatory Databases That Are Within the Study Area

Database	ERNS	RCRAINFO	LUST	VCP	CSCSL	ICR	HSL	Brownfield	CERCLIS-NFRAP	USTs	Totals
Total Listings											
RCRAINFO sites (Exhibit B-1 in Attachment B)		32									32
ERNS (Exhibit B-2 in Attachment B)	2										2
USTs removed from ground (Exhibit B-3 in Attachment B)										24	24
Release sites (Exhibit B-4 in Attachment B)[1]			18	9	19	24	1	0	0		71
Release sites and UST sites (Exhibit 4-6 and Attachment G)[1]			5	4	9	3	0	1	1	3	26
Registered USTs (Exhibit C-2 in Attachment C)										28	28
Totals	**2**	**32**	**23**	**13**	**28**	**27**	**1**	**1**	**1**	**52**	**183**
Unique Listings											
RCRAINFO sites (Exhibit B-1 in Attachment B)		26									26
ERNS (Exhibit B-2 in Attachment B)	2										2
USTs removed from ground (Exhibit B-3 in Attachment B)										9	9
Release sites (Exhibit B-4 in Attachment B)			13	0	19	7	0	0	0		39
Release sites and unique UST sites (Exhibit 4-6 and Attachment G)			4	0	9	1	0	0	0	2	16
Registered USTs (Exhibit C-2 in Attachment C)										15	15
Totals	**2**	**26**	**17**	**0**	**28**	**8**	**0**	**0**	**0**	**26**	**107**

Exhibit 3-1. Summary of Sites Listed on Regulatory Databases That Are Within the Study Area (continued)

Note: For a site on multiple lists indicating a release, the priorities for assigning it to a "unique" list were as follows: CSCSL, HSL, LUST, VCP, ICR, CERCLIS-NFRAP, and Brownfield.

Brownfields are abandoned, idle, or underused commercial or industrial properties (a subset of CSCSL).

CERCLIS-NFRAP = Comprehensive Environmental Response, Compensation and Liability Act – No Further Remedial Action Planned

CSCSL = Confirmed and Suspected Contaminated Sites List, including NFA (No Further Action) sites

ERNS = Emergency Response Notification System

HSL = Hazardous Sites List (a subset of CSCSL)

ICR = Washington Site Register of Independent Cleanup Reports

LUST = leaking underground storage tank database

RCRAINFO = Resource Conservation and Recovery Act Information (large-quantity, small-quantity, and conditionally exempt generators)

VCP = Voluntary Cleanup Program

USTs = registered underground storage tanks

[1.] The individual sites on these exhibits are listed on multiple lists; the totals will not equal the number of entries on the exhibit.

Resource Conservation and Recovery Act Information (RCRAINFO): This database contains selected information on sites that generate hazardous material or transport, store, treat, and/or dispose of hazardous material as defined by RCRA. RCRAINFO also identifies treatment, storage, and disposal (TSD) facilities with RCRA corrective action activity (CORRACTS). There are no TSD facilities listed within the study area. There are 26 unique RCRAINFO sites within the study area, including large-quantity, small-quantity, and conditionally exempt generator sites. These sites have not been identified as sites with known or suspected contamination. A list of these generators is provided in Attachment B, Exhibit B-1.

Emergency Response Notification System (ERNS): ERNS contains information on reported releases of oil and hazardous substances. Two sites within the study area have reported spills. A complete listing of ERNS sites is provided in Attachment B, Exhibit B-2.

3.2.2 Washington State Regulatory Databases

The following five Ecology databases were searched. Most of the sites appear on more than one list: a list of potential release sites (LUST or CSCSL) and one or more of the lists identifying the program under which the remediation was accomplished (the Voluntary Cleanup Program [VCP], ICR, and/or LUST). Initially USTs are also included as potential sites. Consequently, if the number of sites in each database is summed, the total will be more than the 79 unique sites on the five lists that were identified within the study area. USTs were evaluated separately, as described in Section 3.4 and in the UST study included in Attachment C. If a potential or confirmed release occurred at the site, it would also be listed on one of the other Washington State regulatory databases.

Confirmed and Suspected Contaminated Sites List: The CSCSL contains state hazardous material site records—Washington's equivalent of CERCLIS. Twenty-eight (total) sites within the study area are included on the CSCSL, as presented in Attachment G, and sites that were eliminated from further consideration are presented in Attachment B, Exhibit B-4. The potential hazard posed by one site was ranked, and this site is included on Ecology's Hazard Site List (HSL).

Voluntary Cleanup Program (VCP) List: The VCP list contains remedial action reports that Ecology has received from either the owners or operators of the sites. These actions have been conducted with Ecology review but are not under an order or decree. Thirteen (total) sites within the study area are included on the VCP list. These sites are presented in Attachment G, and sites that were eliminated from further consideration are presented in Attachment B, Exhibit B-4.

Washington Site Register of Independent Cleanup Reports: The ICR list contains remedial action reports that Ecology has received from either the owners

or operators of the sites. These actions have been conducted without Ecology oversight or approval and are not under an order or decree. Twenty-seven (total) sites within the study area are included on the ICR list. These sites are presented in Attachment G, and sites that were eliminated from further consideration are presented in Attachment B, Exhibit B-4.

Leaking Underground Storage Tank Database: The LUST database is an inventory of reported LUST incidents along with cleanup status and the affected medium (soil or groundwater). Twenty-three (total) LUST sites are located within the study area. These sites are presented in Attachment G, and sites that were eliminated from further consideration are presented in Attachment B, Exhibit B-4.

Underground Storage Tank (UST) List: This list identifies properties that have USTs registered with Ecology. Information includes operational status, removal status, and tank contents. Within the study area, 28 (total) tank sites are operating, were closed in place, or had a closure in process since 1996. The operational, closed-in-place, and closure-in-process tank sites were further evaluated in the UST study discussed in Section 3.4. Tank sites from which the tank has been removed are listed in Attachment B, Exhibit B-3 (24 (total) sites). These tank locations are not displayed on a graphical exhibit. If contamination was encountered, it is identified as a site because it also appeared on the LUST, CSCSL, VCP, or ICR lists.

3.3 Ecology Files Review

Analysts reviewed Ecology files to further evaluate the potential for the listed sites to affect the study area and the project. The sites that were reviewed were selected based on their proximity to the project area. Files for CSCSL, ICR, and LUST sites were requested from Ecology. A summary of the reviewed Ecology files that indicated a potential to affect the project is presented in Attachment G, Validated Sites. Sites that were eliminated from further consideration and the rationale for eliminating the sites are presented in Attachment B, Exhibit B-4.

3.4 UST Study

A UST study was conducted to determine whether tanks could be within a distance that would pose a risk to the bored tunnel segment of the alignment under the Bored Tunnel Alternative. Historically tanks were abandoned when no longer needed, rather than removed; residual fuel was left in the tank. Over time these tanks may have released the fuel resulting in contaminated soil and groundwater. Abandoned USTs represent multiple localized potential sources of contamination along the entire alignment. Some of these tanks could be located directly over the tunnel or within a distance where a contaminant release could adversely affect subsurface soil that would be removed for the project.

The UST study consisted of three assessments:

1. Evaluate the status of tanks registered with Ecology. Properties on which a tank is active, closed in place, or the status is unknown were retained as potential risks.
2. Identify former gas stations within the study area. Determine the current land use for the former gas station sites located adjacent to or overlying the alignment. Eliminate sites that have been substantially redeveloped within the last 20 years because the subsurface was likely disturbed and the tanks were likely removed. Retain sites that have had only a change in use or sites on which the land is currently vacant. These sites may still have USTs and pose a potential risk. The properties that have been excluded because of substantial redevelopment are also listed.
3. Identify properties within the study area on which heating oil was used. Determine the current land use of the properties that use oil to heat and that are adjacent to or overlying the alignment. Eliminate sites that have been substantially redeveloped within the last 20 years because the subsurface was likely disturbed and the tanks were likely removed. Retain properties that are currently vacant land or a surface parking lot. These sites may still have one or more oil tanks in the ground and pose a potential risk. The properties that have been excluded because of substantial redevelopment are also listed.

Properties that potentially have heating oil or fueling USTs or have registered USTs are shown in Attachment C, Exhibit C-1, and summarized in Exhibit C-2.

3.5 Windshield Survey of the Study Area

A windshield survey was conducted in July 2009 to identify current site uses in the study area that are likely to involve the use, treatment, storage, or disposal of hazardous materials and to verify the location of listed and orphan sites associated with the regulatory review, where possible. The windshield survey of the north portal area was updated in January 2010. The windshield survey of the south portal area conducted in 2009 included Alaskan Way S. to S. King Street; therefore, the south portal area was not resurveyed in 2010. All observations were made from public areas. Detailed site investigations were beyond the scope of this evaluation. Each property adjacent to the SR 99 alignment within the study area was viewed to compare the current tax assessor description of the site/buildings with observed site conditions. Findings from the windshield survey are included in Chapter 4 and Attachment E.

3.6 Potential to Encounter Asbestos

ACM may be encountered in buildings or other structures that are demolished during project construction. The potential for ACM to release asbestos fibers into the environment depends on the asbestos content, condition, and friability of the material.[2] Asbestos was used widely in building materials until 1977, when laws regulating its use and disposal were enacted. In 1986 the Asbestos Hazard Emergency Response Act (AHERA) required education agencies to inspect their schools for ACM and prepare a management plan to prevent or reduce potential exposure to asbestos. The approach was to manage the asbestos in-place. ACM removal was necessary only if the material was damaged or would be disturbed by a building demolition or renovation project. The 1994 National Emissions Standards for Hazardous Air Pollutants rule extended the standards to all buildings.

Buildings constructed before 1977 are presumed to have a high potential to contain ACM, whereas younger buildings are substantially less likely to pose a significant hazard from asbestos. The likelihood of encountering asbestos in buildings constructed after 1980 is low. Asbestos can be found in a variety of older building materials, including exterior siding, roofing shingles, flooring, sprayed-on fireproofing, insulation, soundproofing, ceiling tiles, and texturing. Asbestos was also commonly used as a major component of heating systems, gaskets, pipe wrapping, wire duct lining, and brake linings in trucks and cars. ACM has been confirmed in the Battery Street Tunnel, as described in Section 3.7.

Seven buildings would be acquired under the Bored Tunnel Alternative, including one building that would be acquired for the Curved Sixth Avenue option.

3.7 Environmental Site Assessments and Hazardous Material Surveys

In compliance with due diligence requirements, WSDOT conducted Phase I ESAs on three properties it acquired for this project. A Phase II ESA was conducted on two of these properties to address RECs. Because these properties could still contain as yet unidentified contaminants, they are identified as potentially contaminated properties in this evaluation. A hazardous materials survey of the Battery Street Tunnel has been conducted. Samples of soot have also been collected in the Battery Street Tunnel. In July 2009, Sound Environmental Strategies Corporation conducted another Phase I ESA of a parcel owned by BNSF Railway Company (BNSF) at 1550 Alaskan Way S., located south of S. Atlantic Street (Sound Environmental Strategies 2009a). The focus of the assessment was an easement area in the northern portion of the property where a footing would be installed as part of Stage 2 of the S. Holgate

[2] A friable material can be crushed with hand pressure so that the fibers are readily released into the environment.

Street to S. King Street Viaduct Replacement Project. The subject site is approximately 900 feet south of the southernmost proposed construction in S. Royal Brougham Way for the south tunnel portal. Site conditions identified during the Phase I ESA can be used as part of the overall documentation to identify types of contamination throughout the corridor. Findings relevant to the current study area include (1) the widespread presence of fill materials that may be contaminated by metals, petroleum products, and/or PAHs, and (2) historical railroad operations. Such operations may have involved spills of hazardous materials from railcars, the presence of railroad ties treated with creosote, and the application of pesticides for weed control.

In December 2009, Sound Environmental Strategies conducted five Phase I ESAs for properties on Blocks 40.1, 50.1, 60.3, and 70.4 (two sites) (Sound Environmental Strategies 2009b to 2009f). These properties are located between Mercer Street and John Street, directly west of SR 99. Identified RECs include heating oil USTs on the subject properties and adjoining/nearby properties; a hydraulic fluid leak from a hotel elevator system; and former dry cleaners, gas stations, and auto repair shops discussed in Section 4.3. One heating oil tank of note is a 9,950-gallon UST, which is reportedly located beneath the right-of-way on Sixth Avenue N. between Harrison Street and Broad Street.

In September 2006, CDM completed a Phase I ESA for the U-Park located at 550 Alaskan Way S., Project Parcel Number S212 (CDM 2006a). RECs include potential contamination of soil and groundwater with metals from former metal works that operated in the 1910s to 1920s and potential contaminants associated with the former use of the property by the railroad. A gas station that operated northeast of the property has a moderate potential to affect the property.

Phase I and Phase II ESAs were completed for the former Washington-Oregon Shippers Cooperative Association (WOSCA) and Gerry Sportswear properties located at 801 and 1051 First Avenue S., respectively (CDM 2006b). The Phase II ESA was completed in January 2007 (CDM 2007). As part of the Phase II ESA investigation, a geophysical survey was conducted to identify potential USTs, and 13 soil probes were completed to collect soil and groundwater samples for chemical analysis.

Based on the sample results, only soil appears to be contaminated with petroleum hydrocarbons. Diesel contamination was verified in soils in the central parking area of the WOSCA property, between a parking pay booth and the Gerry Sportswear building. In a soil sample collected at a depth of 4 feet bgs, diesel-range hydrocarbons were identified at a concentration of 10,000 milligrams per kilogram (mg/kg), greater than the MTCA Method A cleanup level of 2,000 mg/kg. There is no known source for the contamination, and it may have been a surface spill, which is consistent with activities associated with a railroad

freight terminal, which is the historical site use. The MTCA Method A Unrestricted Land Use category of cleanup levels was used for the evaluation because it uses conservative assumptions. Land use along the alignment is mixed, with primarily industrial and commercial uses in the southern part of the project area and mixed residential use in the area surrounding the north portal.

In April 2008, GeoEngineers conducted a Phase I ESA of Whatcom Railyard for WSDOT (GeoEngineers 2008). The identified site extends from Walker Street to S. King Street and is located between Alaskan Way S. and the viaduct. The property is owned by the City of Seattle (City) and is leased to BNSF and the Union Pacific Railroad. Approximately the northern half of the Whatcom Railyard evaluated in the ESA is applicable to the current study. The ESA concluded that metals and petroleum products associated with rail operations may be present in the soil. Other applicable findings include observation of black soil approximately 5 to 10 feet below the street elevation during construction of a building in 2008 at a property identified in this discipline report as Block 360.2. Historical land uses and other findings related to the adjacent properties are similar to those described in Section 4.3.

In October 2008, Pacific Rim Environmental, Inc., under subcontract to GeoEngineers, conducted a Hazardous Materials Survey of the Battery Street Tunnel (Pacific Rim Environmental 2008). The survey included testing for ACM, LBP, and universal waste. Under the Bored Tunnel Alternative, the disposal of tunnel lights and equipment removed from the tunnel during decommissioning could be regulated by the universal waste rule if polychlorinated biphenyls (PCBs) or mercury are present. As part of the survey, 60 samples of suspected ACM were tested. The conduits in the northbound and southbound tunnels were found to contain asbestos. In addition, the metal-clad fire doors were presumed to contain asbestos. The interior painted surfaces of the Battery Street Tunnel were tested to determine whether lead is present in the paint at concentrations greater than 1.0 milligrams per square meter (mg/m^2). LBP was identified on all painted fire doors, painted fire cabinets, and the long yellow painted lane stripe along the barrier that separates the northbound and southbound lanes. Low concentrations of mercury were found in the lamps; therefore, their disposal would be regulated. Based on the age of the light fixtures as determined by the attached stickers, the capacitors should not contain PCBs at concentrations greater than 50 parts per million (ppm), based on the labeling requirements of the Toxic Substances and Control Act. PCBs at a concentration of 2 ppm are regulated in Washington State. If there is no attached sticker, the capacitor should be treated as a PCB-containing fixture.

In October 2007, the WSDOT Hazardous Materials and Solid Waste Program collected six composite samples of soot from the ceiling of the Battery Street

Tunnel (Taylor 2007). The sampling was performed to support a determination of health and safety risks associated with disturbing the soot. The samples were analyzed for petroleum; benzene, toluene, ethylbenzene, and xylenes (BTEX); carcinogenic PAHs (cPAHs); eight RCRA metals; and asbestos. Concentrations of metals (arsenic, cadmium, and lead), cPAHs, and oil in all samples exceeded the MTCA Method A cleanup levels (except for arsenic in two of the samples). Based on the results of the TCLP analysis, five of the six samples contained lead concentrations greater than the characteristic dangerous waste criteria. One sample also had a cadmium concentration that exceeded the TCLP concentration. None of the samples contained detectable concentrations of asbestos. The study recommended that soot from the Battery Street Tunnel be handled and disposed of as dangerous waste.

In March 2004, Landau Associates collected a composite sample of grit and dust in the storage area located on top of the former operator's room within the Battery Street Tunnel (Landau 2004). The sampling was performed to support a determination of health and safety risks associated with disturbing the dust. The samples were analyzed for gasoline, BTEX, cPAHs, eight RCRA metals by TCLP methods, and asbestos. Constituents were detected in the dust; however, the concentrations were less than dangerous waste criteria. Asbestos was not detected. A paint chip collected from an overhead duct near the entrance ladder to the storage area was tested for total lead. Lead was detected in the paint sample. Recommendations included vacuuming up the dust and grit and disposing of it at a Solid Waste Landfill before any work that would disturb the dust and grit is conducted. If work involves disturbing paint similar to that found flaking off the air duct, air monitoring for lead and particulates is recommended. Additional testing would be needed to determine whether lead in the paint is present at concentrations that would exceed the dangerous waste criteria.

3.8 Subsurface Explorations

Project geologists conducted a field exploration program along the bored tunnel alignment to obtain geotechnical data in the locations of the proposed structures. Samples collected during the geotechnical field explorations were chemically analyzed at an environmental laboratory. Specifically, selected soil and groundwater samples were analyzed to identify contaminants that may affect the handling, disposal, or treatment of the respective media.

Soil samples collected by means of borings and Geoprobes® within 200 feet of the alignment were evaluated. The exploration locations are shown on Exhibit 4-3. Few borings along the bored tunnel alignment extended to the proposed depth of the tunnel; however, testing has been conducted in areas where soil and groundwater would be removed as part of the Bored Tunnel Alternative. The

additional information will be presented in the Environmental Considerations Report and addenda to the report. Summaries of the borings and groundwater monitoring wells that were evaluated and the analytical testing that was performed are presented in Attachment F, Exhibits F-1 and F-2. The results of these explorations are discussed in Chapter 4 and in the following reports:

- *Geotechnical and Environmental Data Report – SR-99: Alaskan Way Viaduct Project, Seattle, Washington* (Shannon & Wilson 2002a)
- *Geotechnical and Environmental Data Report – SR-99: Alaskan Way Viaduct and Seawall Replacement Project, Seattle*, Washington (Shannon &Wilson 2005a)
- *Utility Geoprobe Report – SR-99: Alaskan Way Viaduct and Seawall Replacement Project, Seattle*, Washington (Shannon & Wilson 2006)
- *Geotechnical and Environmental Data Report,* Electrical Utility Explorations – *SR-99: Alaskan Way Viaduct and Seawall Replacement Project, Seattle*, Washington (Shannon & Wilson 2007a)
- *Geotechnical Data and Engineering Report for TS&L Studies – SR 99: Alaskan Way Viaduct Project, Seattle, Washington* (Shannon & Wilson 2007b)
- *Geotechnical and Environmental Data Report,* Phase 1 Archeological Explorations – *SR 99: Alaskan Way Viaduct and Seawall Replacement Project, Seattle*, Washington (Shannon & Wilson 2007c)
- *Geotechnical Data and Engineering Report,* Phase 1 Electrical Utility Explorations (Shannon & Wilson 2007d)
- *Geotechnical Data and Engineering Report – S. Holgate Street to S. King Street Viaduct Replacement Project* (Shannon & Wilson 2008a)
- *Geotechnical and Environmental Data Report – SR 519 Intermodal Access Project* (Shannon & Wilson 2008b)
- *Environmental Considerations Report – S. Holgate Street to S. King Street Viaduct Replacement Project* (Shannon & Wilson 2008c)
- *Draft Geotechnical and Environmental Data Report, Central Waterfront Tunnel* (Shannon & Wilson 2010a)

3.8.1 Soil Sampling and Analysis

Soil samples were analyzed for petroleum hydrocarbons either by hydrocarbon identification (HCID), Northwest total petroleum hydrocarbon–gasoline-range (NWTPH-G) and/or Northwest total petroleum hydrocarbon–diesel-extended (NWTPH-Dx) methods. Most samples were also analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Selected samples were

also analyzed for semivolatile organic compounds (SVOCs) or PAHs. These samples were collected in railyards and in areas where creosote-treated piles may have been used. Samples from borings located near historical or current businesses that may have used solvents were analyzed for VOCs. The chemical analyses were performed by CCI Analytical Laboratories, Inc., of Everett, Washington; OnSite Environmental Inc., of Redmond, Washington; and Fremont Analytical of Seattle, Washington.

Environmental sampling and testing of soil and groundwater were performed along the bored tunnel alignment at proposed tunnel depths. Shallow samples were collected if contamination was suspected based on field observations. Samples from the tunnel alignment were tested for metals, VOCs, and corrosion characteristics, including pH. Other samples were tested for VOCs, PAHs, and petroleum hydrocarbons based on field observations. Environmental samples were also collected from borings drilled in the vicinity of the north and south portals, within the interval that would be excavated for the project. The findings are presented in the *Environmental Considerations Report* (Shannon & Wilson 2010c).

3.8.2 Groundwater Sampling and Analysis

Groundwater from each monitoring well was analyzed for a variety of potential contaminants, depending on the results of the soil testing, adjacent land use, and general location. Chemical analyses included VOCs; gasoline; diesel; PAHs; methane; total sulfides; total and dissolved metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc; and general water quality parameters.

Most of the chemical analyses of the groundwater samples were performed by CCI Analytical Laboratories, Inc., OnSite Laboratories, and Fremont Analytical. The methane analyses were performed by OGW Research Labs, Inc., of Tukwila, Washington.

Groundwater samples were also collected from monitoring wells. They were tested for VOCs; gasoline; diesel; PAHs; methane; total sulfides; and total and/or dissolved metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. These findings are presented in the *Environmental Considerations Report* (Shannon & Wilson 2010c).

3.9 Site Screening Criteria and Evaluation Criteria

3.9.1 Listed Sites with Documented, Suspected, or Potential Releases

A regulatory database search was performed by EDR (2009) for documented, suspected, or potential release sites within a distance of 1 mile from the project footprint. Sites with documented releases are defined as those that appear in the

regulatory database search as having reported a release of contaminants into the soil, sediment, or groundwater of a property. Other sites identified in the regulatory database search include generators of hazardous wastes (not necessarily indicating a release) and registered USTs.

Federal NPL and CERCLIS sites within 1 mile of the project footprint, and state CSCSL, ICR, and LUST sites within ½ mile of the project footprint were identified. No NPL sites were identified that have potential to adversely affect the project. One CERCLIS-NFRAP site that was identified was considered to have a moderate potential to adversely affect the project based on historical operations that likely involved solvent use.

Sites identified on the state lists that are located more than two blocks (approximately 400 feet) from the project footprint were not evaluated because they have a much lower potential to affect the project than the large number of similar types of sites identified in the study area.

Within the study area, there are 183 listed sites, some of which are on multiple lists. Of the 107 unique sites identified within the study area, 52 were eliminated from the evaluation as being unlikely to affect the project based on the following screening criteria:

- Sites listed solely on the RCRAINFO database (Attachment B, Exhibit B-1): 26 of 32 sites. Inclusion on the RCRAINFO list indicates that a site uses or generates regulated materials as part of its business function but gives no indication of releases to soil or groundwater.
- Sites listed solely on the ERNS database (Attachment B, Exhibit B-2): 2 sites. Inclusion on this list indicates that a spill has occurred on the site. These sites are not included on other lists; there is no indication of soil or groundwater contamination.
- Sites listed on the UST list, where the tank has been removed from the site (Attachment B, Exhibit B-3): 24 sites (total). Many (14) of these sites also appear on other lists (LUST, VCP, CSCSL, and ICR) as potential release sites and were therefore retained for further evaluation. Eight of the remaining UST-removed sites are unique to the UST list and were excluded; two other sites that also appear on the RCRAINFO list were also excluded at this point (a total of 10 excluded sites). One of these initially excluded sites was considered further because of the historical land use: dry cleaning, printing, and auto repair were conducted at the site. This evaluation process identified nine UST sites that were excluded from further evaluation (see Exhibit 3-1). Registered USTs that are still underground are described in Attachment C.

- Sites identified solely because of a registered UST that may still be in the ground (Attachment C-2): 28 sites (total). Of the 28 sites that have at least one tank that is still in the ground, 12 of the sites also have had a confirmed release (included on the LUST, CSCSL, or ICR list) and were retained for further evaluation. One other site that had a UST was retained because of the historical land use at the site. Consequently, 15 unique sites were excluded from further consideration. All registered tanks were evaluated separately in the UST study for their potential impact on the Bored Tunnel Alternative (see Attachment C).

Of the remaining 55 sites, 11 are located downgradient of the alignment and are unlikely to affect the project. Twenty-eight sites are located upgradient or crossgradient of the alignment and have been excluded for a variety of reasons, including distance from the project area, distance to the crown of the tunnel, type of contaminant, apparent completion of remediation, and expected excavation depth for the Bored Tunnel Alternative in the area. The step-by-step process used to assign risk to the environment posed by each of these sites is illustrated in Exhibit 3-2. The impact level is based on the contaminants that are present at the site and the site's proximity to the project area, as described in Section 3.9.3, Site Screening – Current Approach. Sites with documented, suspected, or potential releases that may adversely affect the project have been retained as validated sites (16 sites) and are presented in Exhibit 4-6 and Attachment G. The 39 excluded sites and the rationale for their exclusion are indicated in Attachment B, Exhibit B-4.

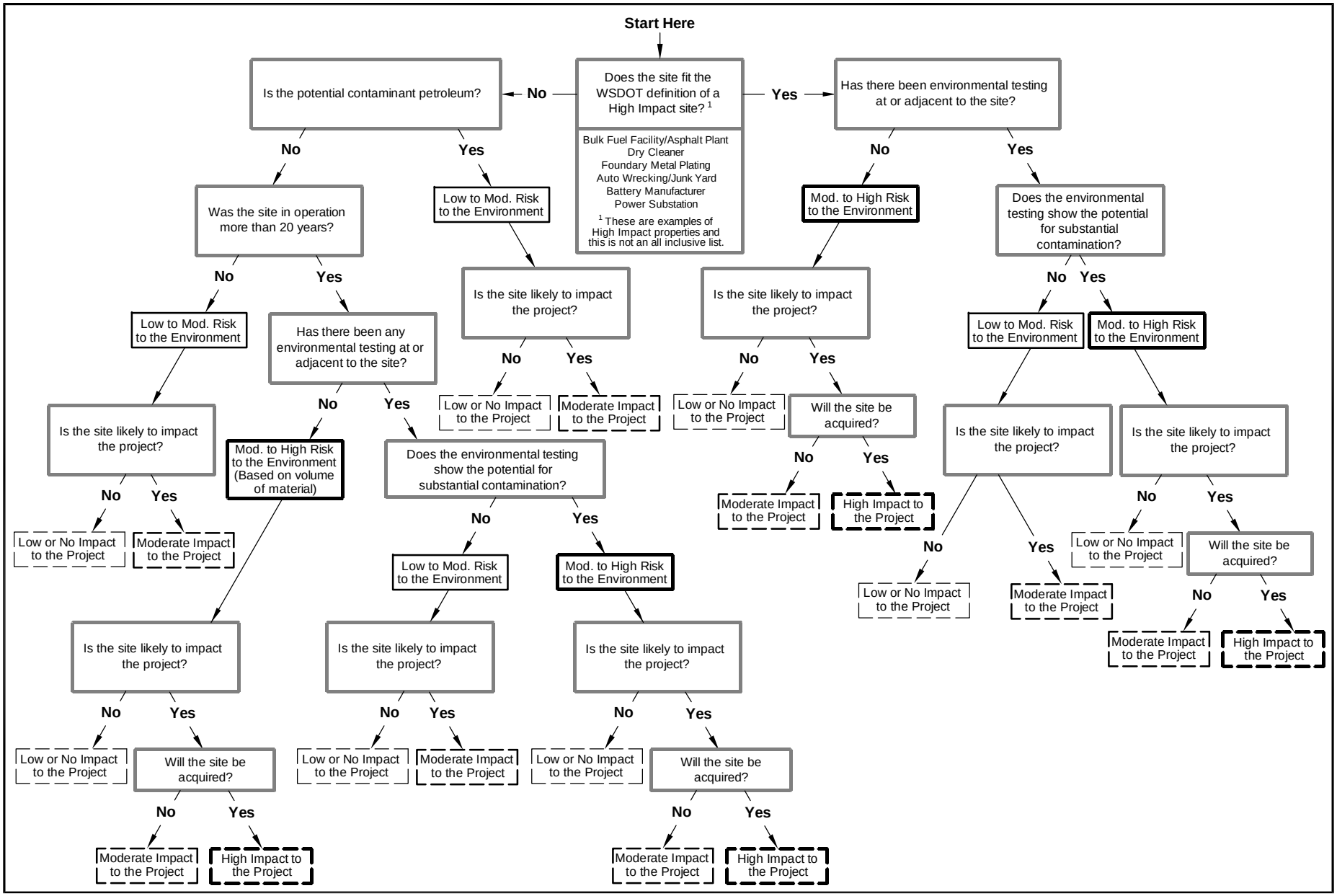

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Exhibit 3-2
Property Evaluation Decision Tree

3.9.2 Potential Releases Based on Historical Uses

A list of the historical businesses and industries within the study area that are likely to have been associated with the generation, storage, or transportation of hazardous materials was developed based on a review of historical records discussed in Section 3.1. Exhibit 3-3 lists the identified industries and associated contaminants that were considered to have the potential for historical releases. Although a variety of contaminants may have been used at some sites, only the contaminants most likely to be encountered at each business type are identified.

Exhibit 3-3. Types of Businesses and Typical Related Contaminants

Business	Likely Contaminants	Typical Analytes
Auto service	***Petroleum***, solvents	Kerosene, turpentine, methylene chloride, BTEX, TCE, PCE, Stoddard solvent, hydrofluoric acid, asbestos,
Auto washing	***Petroleum,*** PAHs	
Auto wrecking/junkyard	***Petroleum***, metals	Gasoline, lead, antifreeze, oils, battery acid
Batteries	***Metals***, other	Lead, battery acid
Blacksmiths	***Metals,*** PAHs	
City Light (power) substation	***PCBs,*** oils	
Cleaners/laundry	***Solvents,*** phosphates	Carbon tetrachloride, TCE, PCE, cis-1,2-DCE, vinyl chloride, Stoddard solvent
Coal storage/bunkers	***Petroleum***, ***PAHs***, metals	Arsenic, mercury, cadmium, boron
Dyers	***Solvents***	
Foundry	***Metals,*** solvents	Chromium, cadmium, lead, copper, nickel, zinc, iron, phenols, toluene
Gas station	***Petroleum***	BTEX
Gas station with auto service	***Petroleum***, solvents	BTEX, TCE, PCE
Hat cleaners	***Solvents***	TCE, PCE, cis-1,2-DCE, vinyl chloride
Laundry/laundromat only	***Solvents***	TCE, PCE, cis-1,2-DCE, vinyl chloride
Lithographers	***Solvents***, metals	Methanol, toluene, TCE, methylene chloride, petroleum, naphtha, IPA, copper, zinc,, barium, lead (before 1970), arsenic, selenium, mercury, cadmium, hexavalent chromium

Exhibit 3-3. Types of Businesses and Typical Related Contaminants (continued)

Business	Likely Contaminants	Typical Analytes
Machinists	***Metals,*** solvents, petroleum	Oil, PCE, TCE, cis-1,2-DCE, vinyl chloride
Manufacturing chemists	***Solvents,*** petroleum	
Metal plating	***Metals,*** solvents	Mercury, BTEX, TCE, PCE
Oil burner repair/sales	***Petroleum***	
Painters	***Solvents***, metals	BTEX, TCE, PCE, cis-1,2-DCE, vinyl chloride, turpentine, mineral spirits
Photo finishers	***Solvents***, metals	Silver, zinc, phenols, surfactants
Plastic fabricators	***Solvents***	Tetrahydrofuran, dichloromethane, acetone, IPA, benzyl chlorofuran
Printers	***Solvents***, metals	BTEX, TCE, PCE, cis-1,2-DCE, vinyl chloride, turpentine, mineral spirits, silver
Railroads	***Petroleum, PAHs,*** solvents, paint, fungicides, insecticides	Creosote
Sawmill	***Petroleum***	Oils
Sheet metal works	***Metals,*** solvents	PCT, TCE, cis-1,2-DCE
Trunk manufacturers	***Solvents***, metals	
Upholstery cleaners	***Solvents***	TCE, PCE, cis-1,2-DCE, vinyl chloride
Welding	***Metals,*** solvents	Zinc, cadmium, beryllium, mercury, lead, PCT, TCE, cis-1,2-DCE

Note: ***Bold/italic*** text indicates predominant contaminant, most likely to pose a problem.
BTEX = benzene, toluene, ethylbenzene, xylenes
cis-1,2-DCE = cis-1,2-dichloroethene (daughter product of tetrachloroethylene
IPA = isopropyl alcohol
PAH = polycyclic aromatic hydrocarbon
PCBs = polychlorinated biphenyls
PCE = tetrachloroethylene
TCE = trichloroethylene,
Vinyl chloride = (daughter product of tetrachloroethylene)

Properties with heating oil tanks were also identified from archived tax assessor records. These tanks are not required to be registered and are not included in the state UST databases. Properties where the only potential source of contamination is a documented or suspected heating oil UST were eliminated from further consideration because heating oil releases typically involve small volumes of oil and heating oil has low mobility. Potential heating oil tanks are presented in Attachment B, Exhibit B-5. The potential presence of a heating oil UST on properties adjacent to the alignment is evaluated in the UST study (Attachment C).

3.9.3 Site Screening – Current Approach

Businesses within the study area that potentially used hazardous materials were evaluated in two steps. The first step was to assign the level of potential risk to the environment based on the type of business, how long it operated, and whether any environmental testing has been conducted. Twenty years of operation was used as a threshold in characterizing whether a business had been in operation a long time and, therefore, had more opportunities to contaminate the site. If there were more releases, either a greater volume of soil would be contaminated or the levels of contamination would likely be higher. The sites were differentiated as having either a low/moderate risk to the environment or a moderate/high risk to the environment.

The second step was to rank each site based on its potential to adversely affect the project. Based on the site's proximity to the alignment, the likelihood that the site would adversely affect the project, and the assigned level of impact, the site was assigned a not likely, low, moderate, or high potential impact. Thus, for each site within the study area, there is a risk to the environment classification and an impact level based on the contaminants that may be present at the site and the site's proximity to the alignment.

WSDOT's risk analysis requires that sites of concern be evaluated for risk to the environment, risk to the construction project, and WSDOT's liability, as described in *Guidance and Standard Methodology for WSDOT Hazardous Materials Discipline Reports* (WSDOT 2009a). Although accomplished in steps that differ from WSDOT's steps for identifying sites of concern and potential risk, WSDOT's criteria have been incorporated into the current site screening and risk analysis approach. The process outlined in the decision tree in Exhibit 3-2 was used to classify each site's risk to the environment and its potential impact on the project.

Sites that pose a risk to the environment and have a potential for adversely affecting the project have been retained as validated sites. Sites most likely to adversely affect the project meet one of the following criteria:

- The site is adjacent to the alignment at a portal or ramp.
- The site overlies or is adjacent to the bored tunnel where the crown of the tunnel is less than 100 feet bgs. This includes sites north of the south portal to Yesler Way and sites south of the north portal to Fourth Avenue.

In general, the criteria in Exhibit 3-4 were used to characterize the potential impact posed by the validated sites.

Exhibit 3-4. Criteria for Characterizing Level of Impact

Potential Impact and Remediation	Proximity/Future Ownership	Category of Potential Environmental Risk
Low; remediation is straightforward.	Property is located adjacent to the project footprint.	Low to moderate
Moderate; remediation is straightforward.	Project is expected to acquire the site and/or have a temporary or permanent easement.	Low to moderate
Moderate; remediation is complex.	Property is located adjacent to the project footprint, but Project is not acquiring the property.	Moderate to high
High; remediation is complex.	Project is expected to acquire the site or have a temporary or permanent easement, where the crown of the tunnel is less than 100 feet below ground surface.	Moderate to high

WSDOT's guidance (WSDOT 2009a) defines low, moderate, and high-impact sites as follows:

Low Impact: Low-impact sites are those where a potential concern exists because of known historical activities, but either the likelihood for the site to affect the project is low or the contamination was previously remediated.

Moderate Impact: Moderate-impact sites are those where a concern exists because of known historical activities, and/or the site has the potential to adversely affect the project, but there is no conclusive evidence.

High Impact: High-impact sites are those where a concern exists because of known historical activities, contamination is known and extensive, and the site is likely to adversely affect the project. In general, high-impact sites are defined as properties that have a potential for substantial soil, groundwater, or sediment contamination, or properties for which the information necessary to predict remedial costs is lacking. Such a site may be contaminated over a large area by a single contaminant or over a smaller area by multiple contaminants. High-impact sites typically are large, have large volumes of contaminated materials, or have a long history of industrial or commercial use.

In the evaluation process, sites that are very unlikely to have an impact on the project because of their lateral and vertical distance from the project area have been eliminated from further consideration and are designated as having no impact. They still may pose a risk to the environment, but that does not carry through to an impact on the project.

In addition to the impact category, the potential remediation was assessed as either straightforward or complex, as presented in Exhibit 3-4, and defined below.

Straightforward: Sites characterized as having straightforward remediation are typically small to medium in size, and the potential contaminants are not

extremely toxic or difficult to treat. Examples of straightforward sites are gas stations, auto repair shops, most USTs, aboveground storage tanks (ASTs), buildings that contain ACM, or materials that contain LBP.

Complex: Sites characterized as requiring complex remediation include sites likely to have widespread contamination or potential contaminants that are difficult to treat. Complex sites typically require additional research, investigation, and possibly regulatory involvement. Examples of complex sites are dry cleaners, wood treating operations, metal plating facilities, or other operations that use or used large amounts of hazardous materials.

Remediation approaches have not been assigned to validated sites that would not be acquired for the Bored Tunnel Alternative. In these cases, the property owner would be responsible for remediation. However, the site could still adversely affect the project because contaminants could migrate from the site and affect soil beneath the site or adjacent to the site.

The validated sites are discussed in Section 4.4.

3.9.4 Site Screening Before June 2009

Although there have been changes in terminology and the evaluation process since most of the sites were identified and ranked, the first step of evaluating risk to the environment is essentially the same, as described below. Because the same process was used to screen sites, sites evaluated before 2009 can be seamlessly integrated with sites screened after June 2009.

In 2003 and 2005, when most of the sites were identified, sites were classified as either "reasonably predictable" (RP) or "substantially contaminated" (SC) based on the type of remediation that would be required if the site was contaminated. Each site was then assigned a high-, moderate-, or low-impact category based on its proximity to each of the alternative alignments. Similar to the current risk evaluation procedure, this method initially evaluated all the sites for their potential effect on the environment independent of their proximity to the project area, followed by an evaluation of their potential impact on the project.

Sites where the likely contaminant is petroleum (i.e., gas stations and auto repair sites) were classified as RP because petroleum remediation is typically straightforward. Sites such as bulk fuel facilities, asphalt plants, dry cleaners, foundries/metal plating facilities, auto wrecking yards/junkyards, battery manufacturers, and power substations were classified as SC because they may be contaminated over a large area by a single contaminant or over a smaller area by multiple contaminants. SC sites are typically large, have a large volume of contaminated materials, or have a long history of industrial or commercial use. A 20-year operation period was used as a threshold in characterizing whether a

business had been in operation a long time. Sites in operation at least 20 years and on which the potential contaminant was something other than petroleum were classified as SC; sites in operation less than 20 years were classified as RP.

Exhibit 3-2 illustrates the decision process used to categorize environmental risk and potential project impacts posed by each site. Under this revised risk evaluation procedure, sites formerly classified as RP would be considered to pose a low to moderate risk to the environment. Sites formerly classified as SC would be considered to pose a moderate to high risk to the environment.

Each site was then evaluated for its likelihood to adversely affect the project, based on the contaminants that may be present at the site and the site's proximity to the project area, similar to the 2009 screening approach.

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Chapter 4 AFFECTED ENVIRONMENT

The study area extends from about S. Atlantic Street, north along Alaskan Way to approximately Marion Street, and then moves northeast to First Avenue. The bored tunnel alignment continues under First Avenue north to approximately Pine Street, where it curves eastward to a northern access site located at Sixth Avenue N. and Thomas Street. The northern limit of the study area is at Roy Street. The study area passes through highly developed industrial and commercial areas of Seattle that were first developed between the 1870s and the early 1900s and have a long and varied land use history. As a result of the industrial and commercial use of this area, hazardous materials may have been released into the surrounding environment from a wide range of sources. Also, the placement of fill and the construction of roads and piers may have adversely affected environmental conditions in the southern portion of the study area.

The physical environment in the study area is another major factor that must be considered in evaluating the extent of potential contaminant releases. The most important characteristics of the physical environment are the soil and groundwater conditions in and near the project footprint. These physical characteristics affect the potential for vertical and lateral migration of contaminants and, therefore, the potential for contamination from nearby releases to migrate to soils within the project footprint or to be present in groundwater that would be encountered during construction. The presence of hazardous materials in the soils or groundwater could have broad implications for the construction approach and costs of the Bored Tunnel Alternative.

The following discussion of the affected environment summarizes the physical environment of the study area, field data from exploration programs, historical land uses, and the potential and known distribution of contaminants in the study area. The study area is shown in Exhibit 4-5 and discussed from south to north. Sites shown in Exhibit 4-5 are identified based on historical land use and regulatory lists documenting suspected or confirmed contaminant releases. Data from the field exploration program were used to support the site identification; however, no sites were identified based solely on contaminants detected in soil and or groundwater samples collected as part of the exploration program. The site-specific historical and regulatory listed information shown in Exhibit 4-5 is also presented in Attachment D, Exhibit D-1.

4.1 Physical Environment

This section presents a description of the physical environment and how it relates to the movement of contaminants. The physical environment within the study area varies substantially from south to north and from the waterfront to the east.

The southern area and waterfront is underlain by 40 to 80 feet of recent deposits of sand and silt, including fill up to 30 feet thick. The fill contains substantial amounts of wood debris such as sawdust and creosote-treated piles. The water table in the south area is approximately 6 to 10 feet bgs. The northern area is characterized by up to 40 feet of interlayered fine-grained and coarse-grained soils that locally perch groundwater. These soils are underlain by very dense sand and gravel. The regional water table is approximately 70 to 80 feet bgs at the north portal.

The movement of a contaminated material is influenced by the subsurface conditions and the physical properties of the contaminant, including its density and solubility in water. A contaminant may migrate as a pure liquid or as a dissolved constituent in groundwater. Consequently, understanding groundwater movement is the primary means of assessing potential contaminant migration pathways.

Groundwater flows most readily through coarse-grained soils such as sand and gravel. Groundwater does not flow readily through fine-grained soils, such as silt and clay, or through till, which is a mixture of silt, clay, sand, and gravel deposited and consolidated by glaciers.

Liquid contaminants on or near the ground surface may move downward through coarse-grained soils. This movement is typically enhanced by infiltration of precipitation or other surface water, which can either physically transport the contaminant or carry it downward in solution. Similarly, a solid contaminant can be mobilized downward into the soil column when it is dissolved in water. A contaminant that moves downward to the shallow groundwater will then behave differently, depending on its solubility in water and whether it is lighter or heavier than water.

- Contaminants that are soluble in groundwater (such as some solvents) tend to dissolve and move in the direction of groundwater flow within coarse-grained soils.
- If the contaminant is not highly soluble in water and is lighter than water (such as oil and gasoline), it can float on the surface of the groundwater.
- If the contaminant is not highly soluble or is present in concentrations that exceed its solubility in water and is heavier than water (such as creosote and some dry-cleaning solvents), it can sink through the water column, moving downward until it reaches the fine-grained soil that separates shallow groundwater and deep groundwater. Dense solvents can migrate through clay and till.

The study area is situated in the Seattle Basin, which is filled with over 1,500 feet of glacial and nonglacial sediments overlying bedrock. Glacial deposits are those that are deposited by the action of glaciers; nonglacial deposits are those that are deposited in

the absence of glaciers. Many of the glacial and nonglacial sediments have been glacially overridden, which means that the soils were compacted by the weight of overriding glacial ice as the glaciers advanced through the region. Repeated glaciations (glacial events) of the region strongly influenced the present-day topography, geology, and groundwater conditions in the Program area. The topography is dominated by a series of north-south-trending ridges and troughs formed by glacial erosion and sediment deposition. Puget Sound, Lake Washington, and other large water bodies now occupy the major troughs. As a result of repeated glaciations, sediment distribution in the Puget Sound area is complex. Each glaciation deposited new sediments and partially eroded previous sediments. During intervening periods when glacial ice was not present, normal stream processes, wave action, and landslides eroded and reworked some of the glacially derived sediments, further complicating the geologic setting.

Groundwater flow in the Seattle area is controlled by this complex distribution of fine- and coarse-grained deposits, local topography, and areas where precipitation recharges the aquifers. Groundwater recharge typically occurs in the upland areas of Seattle, flowing downward to discharge into areas that include Elliott Bay and Lake Union.

4.1.1 South Portal Area

At the south portal of the tunnel near the intersection of S. King Street and Alaskan Way S., the double-level roadway would extend south of the tunnel and unbraid as it becomes shallower. About the first 1,000 feet of the roadway south of the portal would be in a cut-and-cover tunnel. At the south end of the cut-and-cover tunnel, the roadway would be side-by-side and extend about 15 and 25 feet bgs for the southbound and northbound alignments, respectively. The side-by-side roadway would extend about another 550 feet in a retained cut before reaching existing grade north of S. Royal Brougham Way. On- and off-ramps would also be constructed in retained cuts on either side of the side-by-side main roadway. The retained cuts and cut-and-cover sections of the roadway and ramps would likely be supported by diaphragm walls, such as secant pile walls or slurry walls. The south portal area would also include a tunnel operations building, located in the block bounded by S. Dearborn Street, Alaskan Way S., and Railroad Way S. Portions of the building would extend underground to at least 80 feet bgs.

Along the south portal area, approximately 40 to 80 feet of recent sand and silt deposits overlie glacially overridden sand, gravel, and silt. The recent sand and silt soils consist of fill soils of variable compositions, sand, fine sand and silt deposited by the Duwamish River, and sandy beach soils. Below the recent deposits lie approximately 80 to 100 feet of glacially overridden silt, sand, and gravel. Fill in the south portal area contains substantial amounts of wood and debris. The wood debris consists of horizontal and vertical timbers and piles, mill ends, sawdust, and wood chips. The depth and extent of the wood debris varies along the alignment. According to

historical information, the northern half of the south portal area is located near the former site of a large sawmill (Yesler's Mill). There were likely large deposits of floating wood, piles for pier structures, and wood debris in this area before fill was placed in the area around 1900. Coal (cinders) has also been identified in the fill and may be associated with a former coal pier at S. King Street. Fill also contains debris that is likely from the Seattle Fire of 1889. In addition to debris, the fill contains low to moderate levels of contaminants, as discussed in Sections 4.2 and 4.3. A profile of subsurface conditions and the proposed excavation is presented in Exhibit 4-1.

Shallow groundwater is first encountered at a depth of approximately 6 to 10 feet bgs; deep groundwater is encountered in a thin layer of coarse-grained water-bearing soil that is approximately 30 to 50 feet bgs in the vicinity of the south portal. Shallow and deep groundwater zones are separated by fine-grained soils, which do not allow the shallow and deep groundwater to readily interact. Fine-grained soils and till occur below the deep groundwater zone. Groundwater flows predominantly toward Elliott Bay.

4.1.2 Bored Tunnel

The bored tunnel alignment would begin near S. King Street and extend north generally along Alaskan Way, west of the existing viaduct. North of S. Washington Street, the tunnel would extend under the existing viaduct near Yesler Way, where the top of the tunnel would be within about 20 feet of the tips of the piles that support the existing viaduct. North of Yesler Way, the tunnel would extend beneath buildings until about University Street, where the tunnel would be located beneath First Avenue. The tunnel would continue along First Avenue and then turn north near Stewart Street until it ends near the intersection of Sixth Avenue N. and Thomas Street. The bored tunnel would be approximately 1.7 miles long and 54 feet in diameter (outside edge of liner). At the south portal, the tunnel invert would be about 75 feet bgs. The maximum depth of the tunnel invert (about 270 feet bgs) would be located near Virginia Street. At the north portal, the tunnel invert would be about 90 feet bgs. The roadway in the bored tunnel would be a double-level configuration, with the southbound lanes on the upper level and the northbound lanes on the lower level.

The bored tunnel would extend primarily through glacially overridden soil deposits. Between S. King Street and Yesler Way, the bored tunnel alignment is west of the existing viaduct. In this area, the subsurface conditions consist of approximately 30 to 40 feet of recent sand, gravel, and silt deposits, overlying glacially overridden soils. The fill soils in the vicinity of Yesler Way contain wood debris layers up to 20 feet thick. The glacially overridden deposits underlying the recent deposits in this area consist primarily of very dense till and till-like sand and gravel.

GENERALIZED ENGINEERING SOIL UNIT EXPLANATION

1 ENGINEERED AND NON-ENGINEERED FILL:
Includes granular and cohesive FILL

2 RECENT GRANULAR DEPOSITS:
Loose to dense SILT and SAND with gravel; includes normally consolidated alluvium, beach deposits, reworked glacial deposits, and recessional ice-contact deposits.

3 RECENT CLAY AND SILT:
Soft to very stiff CLAY and SILT with fine sand beds; includes normally consolidated estuarine deposits, and recessional lacustrine deposits.

4 TILL DEPOSITS:
Dense to very dense, silty SAND and GRAVEL, and hard, silty CLAY with sand and gravel; cobbles and boulders are common in these deposits; includes glacially overconsolidated till, glaciomarine drift, and till-like deposits.

5 COHESIONLESS SAND AND GRAVEL:
Very dense SAND and GRAVEL to SAND with variable silt; cobbles can be found in these deposits; includes glacially overconsolidated fluvial and glacial outwash deposits.

6 COHESIONLESS SILT AND FINE SAND: Very dense SILT, silty fine SAND, and fine sandy SILT with trace of clay; predominantly cohesionless; includes glacially overconsoidated lacustrine deposits.

7 COHESIVE CLAY AND SILT:
Very stiff to hard, silty CLAY and clayey SILT with trace of sand and gravel; scattered cobbles and boulders can be found in these deposits; includes glacially overconsolidated lacustrine, peat, and paleosol deposits.

8 TILL-LIKE DEPOSITS:
Dense to very dense, unsorted mixture of SILT, SAND, and GRAVEL, but are highly variable spatially; cobbles and boulders are common in this deposit. This ESU can have a similar appearance to the Till but can grade in a short distance to a clean or relatively clean sand. The spatial variability of the Till-Like ESU makes it difficult to correlate between borings. This unit can be adjacent to, and transitional in nature with, Cohesionless Sand and Gravel and Till ESUs as described above.

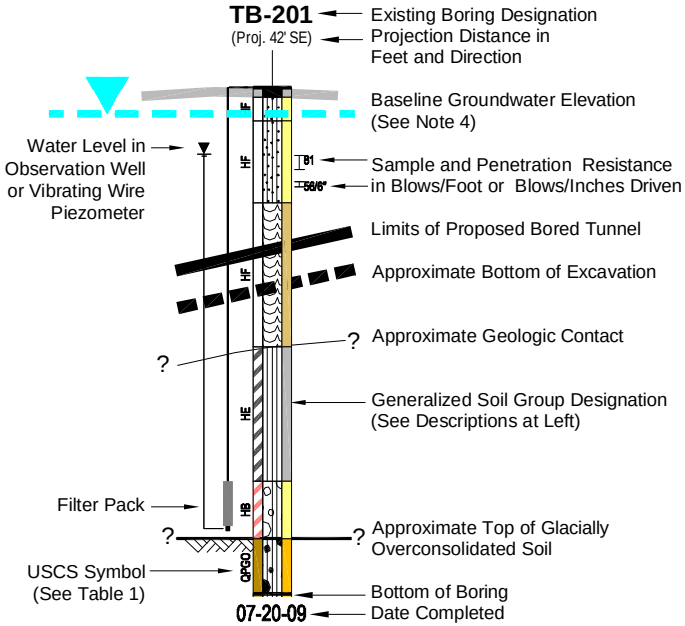
PEAT OR WOOD

0 20 40 — Vertical Scale in Feet

0 100 200 — Horizontal Scale in Feet

Vertical Exaggeration = 5X

LEGEND



NOTE: Borings shown as gray on profiles and cross sections represent areas where subsurface information exits on both sides of the alignment and the contact information was interpolated along the centerline.

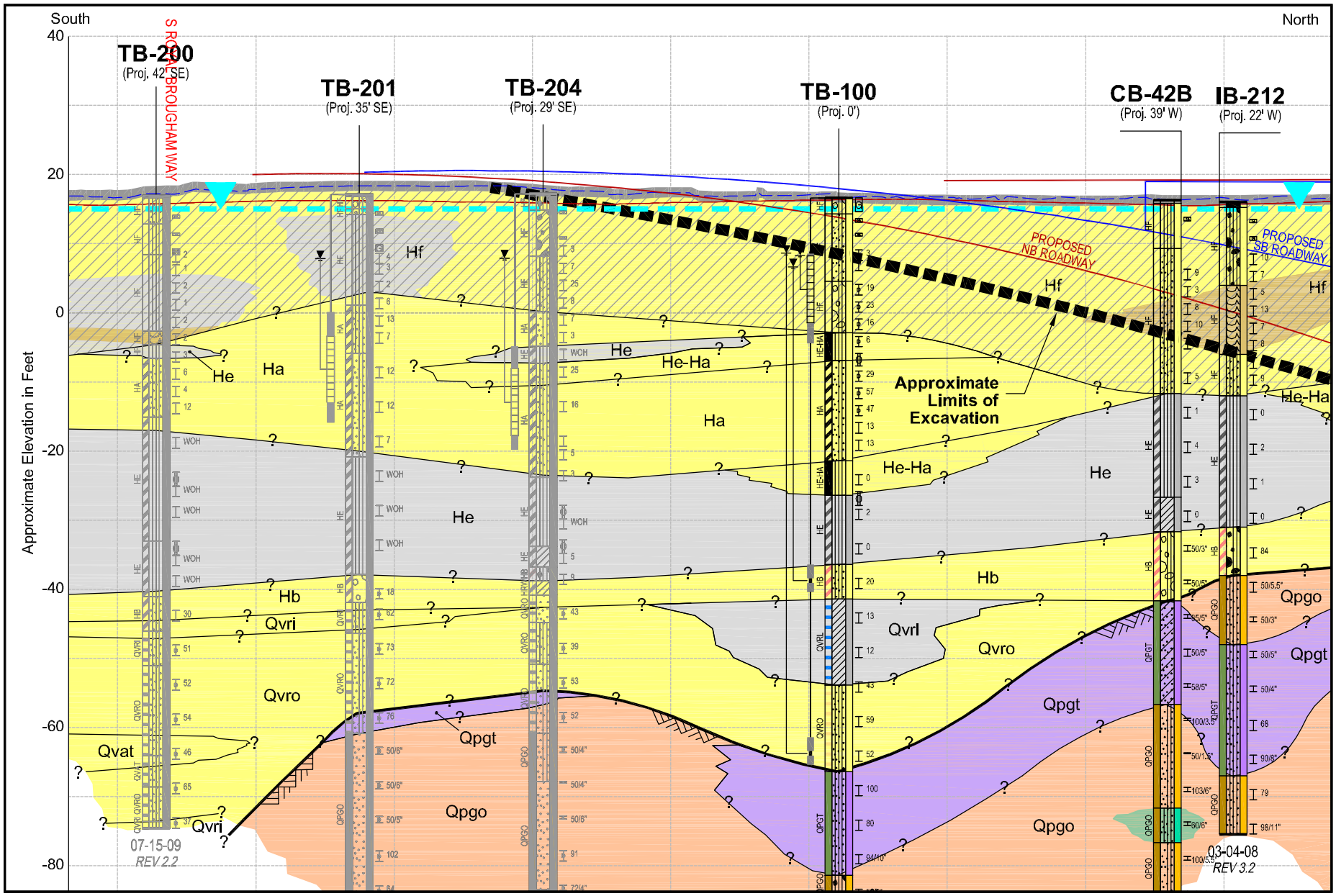
NOTES

1. Existing grade adapted from City of Seattle GIS data files *"topo_all.dwg"* received 3-11-02. Existing grade along proposed tunnel and tunnel depth are taken from Parsons Brinckerhoff *"CL_PROF_TUNNEL.dgn"* received 2-26-10. Approaches are based on *BT May 10 - To Nykamp 051910.dgn,* received 5-19-10, from Parsons Brinckerhoff
2. This profile is based on subsurface explorations performed through March 2010. Variations will exist between this profile and actual conditions.
3. Vertical Datum: NAVD88.
4. Baseline groundwater elevation represents a maximum for the regional groundwater table. Perched groundwater may be encountered at higher elevations than indicated by the baseline groundwater elevation.

Filename: J:\211\20447-096\21-1-20447-096 EIS Profile.dwg Date: 06-15-2010 Login: sac

PROFILE OF SUBSURFACE CONDITIONS AND PROPOSED EXCAVATION - SOUTH AREA

Exhibit 4-1
Sheet 1 of 4



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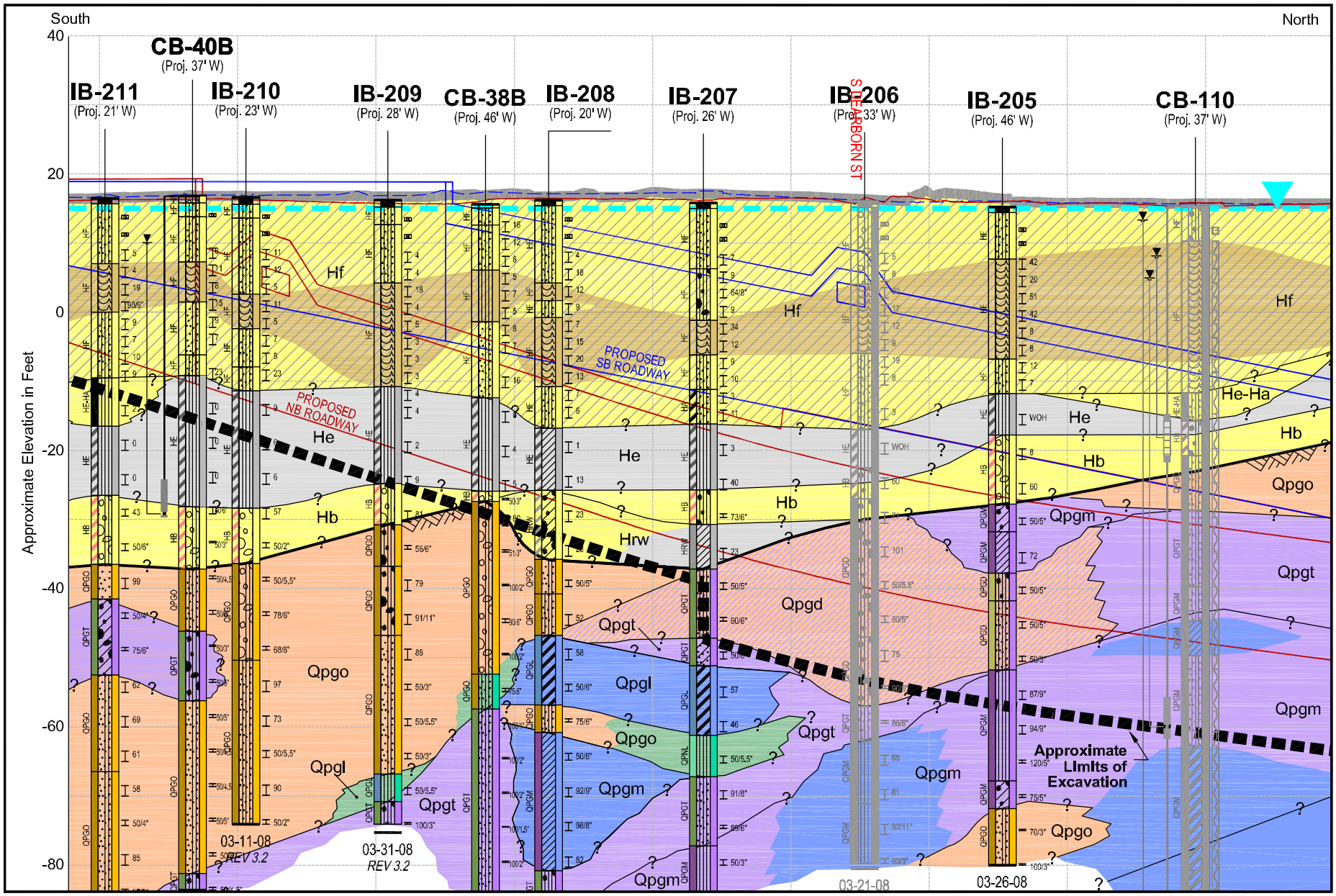
PROFILE OF SUBSURFACE CONDITIONS AND PROPOSED EXCAVATION - SOUTH AREA

Exhibit 4-1
Sheet 2 of 4



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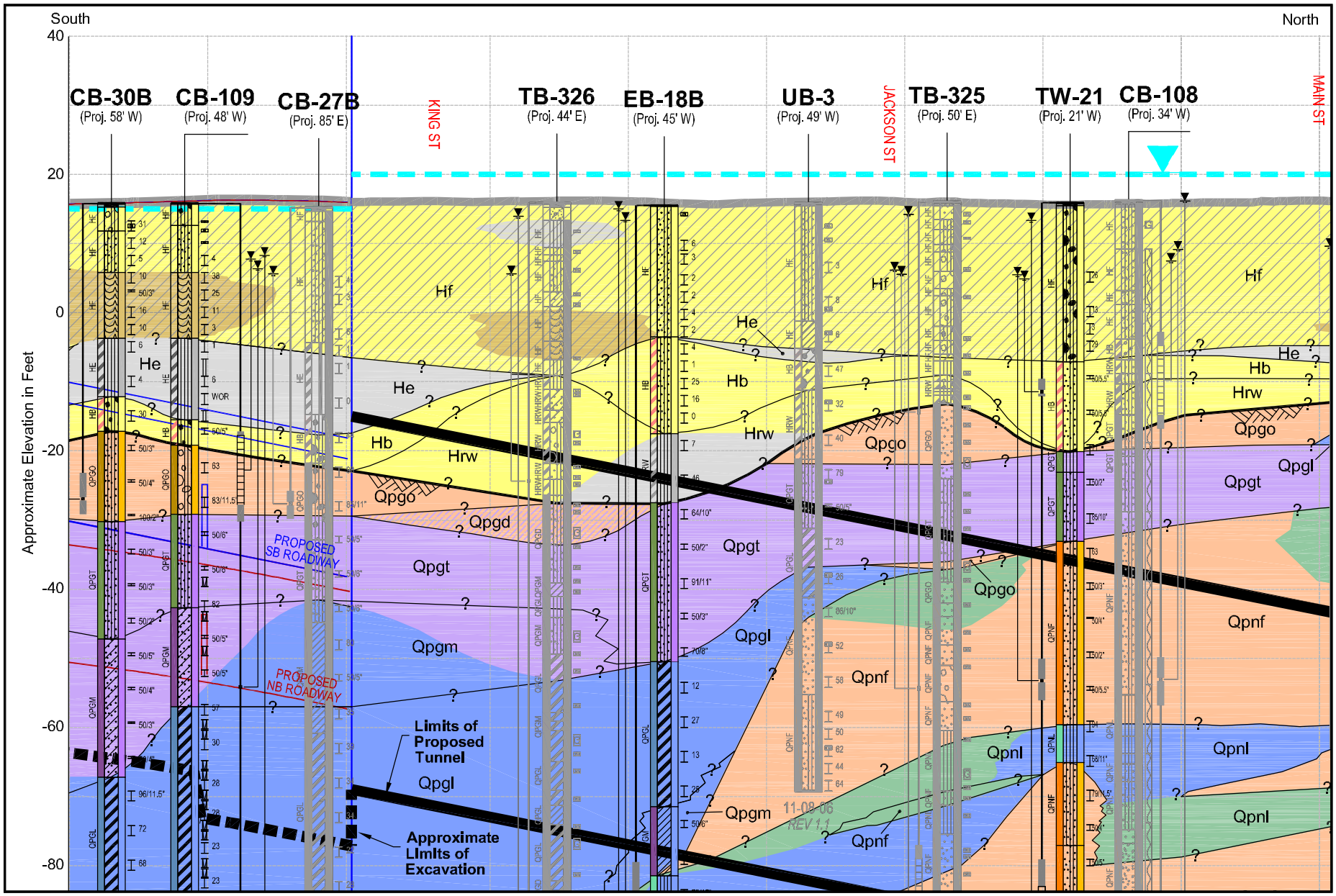
PROFILE OF SUBSURFACE CONDITIONS AND PROPOSED EXCAVATION - SOUTH AREA

Exhibit 4-1
Sheet 3 of 4



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PROFILE OF SUBSURFACE CONDITIONS AND PROPOSED EXCAVATION - SOUTH AREA

Exhibit 4-1
Sheet 4 of 4

North of Yesler Way, the bored tunnel would extend beneath downtown Seattle at depths of more than 100 feet bgs. Fine-grained and coarse-grained soils are found along the alignment in this area. At the south end of the bored tunnel alignment, groundwater is encountered within the fill about 8 to 12 feet bgs. The depth to water increase to the north to about 150 feet bgs near Lenora Street because of the increase in the ground surface elevation. North of Lenora Street, the depth of the water table decreases as the ground surface elevation decreases, with a depth to the water table of about 70 to 80 feet near Thomas Street. The direction of groundwater flow is predominantly toward Elliott Bay. In the northern portion of the bored tunnel alignment, till or fine-grained soils are often found at the ground surface or at shallow depths below the ground surface. These soils reduce the amount of precipitation that infiltrates the ground surface; consequently, contaminants would generally not migrate downward. Shallow groundwater is encountered infrequently, and when encountered, is found as small zones perched on top of fine-grained soils.

4.1.3 North Portal Area

At the north portal of the tunnel, near the intersection of Sixth Avenue N. and Thomas Street, the double-level roadway would exit the tunnel and extend north in a cut-and-cover tunnel for the first 50 feet as it unbraids and becomes shallower. At the north end of the cut-and-cover tunnel, the northbound and southbound roadways would be side-by-side and about 35 and 20 feet bgs, respectively. They would continue in a retained cut and reach existing grade near Broad Street, which would be filled in as part of the Bored Tunnel Alternative. Along the cut-and-cover section in the north portal area, the retained excavation would be filled in after the roadway structure is constructed The retained cuts and cut-and-cover sections of the roadway and ramps would likely be supported by soldier pile and lagging walls and/or diaphragm walls, such as secant pile walls. The north portal area would also include a tunnel operations building located east of Sixth Avenue N. between Thomas Street and Harrison Street, on the west half of the block. Portions of the building would extend underground to match the tunnel grade in this area (up to about 80 feet bgs).

The surface streets above the SR 99 roadway would be connected at John, Thomas, and Harrison Streets. The retained cut roadway along Mercer Street from Fifth Avenue N. to Dexter Avenue N. would be widened from four lanes to six lanes, requiring construction of new retaining walls for the widened roadway.

A connection from Mercer Street to the surface street grid would be constructed along Sixth Avenue N. Two options are being considered for Sixth Avenue N. and the southbound on-ramp: the Straight Sixth Avenue option and the Curved Sixth Avenue option. The Straight Sixth Avenue option proposes a new roadway that would extend Sixth Avenue N. from Harrison Street to Mercer Street in a typical grid formation. The new roadway would have signalized intersections at Republican and Mercer Streets. The Curved Sixth Avenue option proposes a new roadway that would extend Sixth

Avenue N. in a curved formation between Harrison and Mercer Streets. The new roadway would have a signalized intersection at Republican Street.

In addition, Mercer Street would be widened, requiring a retained cut about 20 feet deep. The Broad Street retained cut roadway would be vacated and filled in from Taylor Avenue N. to about Ninth Avenue N. Other fills would also be placed within the cut-and-cover sections above the finished roadway structures to restore the surface grade.

The north end of the project area is underlain by interlayered fine-grained and coarse-grained soils. Silt, sand, and clay with varying amounts of gravel extend to depths of 15 to 40 feet bgs. In contrast to fill in the south portal area, fill in the north portal area contains little debris and consists primarily of native material placed during the Denny Regrade project, as discussed in the GCR (Shannon & Wilson 2010b. These soils are underlain by very dense sand and gravel, with increasing silt content north of the north portal. A profile of subsurface conditions and the proposed excavation is presented in Exhibit 4-2.

The depth to groundwater is a function of the ground surface elevation and the presence of occasional perched water-bearing zones. Between and beneath the perched water-bearing zones that typically exist in the upper 20 feet of soil, the fine-grained soils may be unsaturated down to the underlying water table aquifer. Near the north end of the project area, the regional water table is between 70 and 80 feet bgs, as the ground surface dips down toward Lake Union. The direction of groundwater flow is predominantly north and east toward Lake Union.

4.2 Field Data

Soil and groundwater samples have been collected from borings, monitoring wells, and Geoprobe® explorations completed as part of the Program. Soil and groundwater samples were analyzed for potential contaminants primarily to characterize waste from the exploration program. Explorations with environmental sample results are shown in Exhibit 4-3 and include explorations drilled between 2002 and April 2010. Some of these sampling points are located within 200 feet of the proposed bored tunnel alignment and provide data for a screening-level evaluation of soil and groundwater quality. Most of the borings located along Alaskan Way between S. King Street and Columbia Street were advanced for the purpose of evaluating other alternatives or for utility relocation and were completed above the proposed depth of the bored tunnel. However, ground improvement may be performed in this section of Alaskan Way, and the spoils would include potentially contaminated soil above the tunnel commingled with grout. Exhibits F-3 and F-4 in Attachment F show the sampling locations and analytical results for

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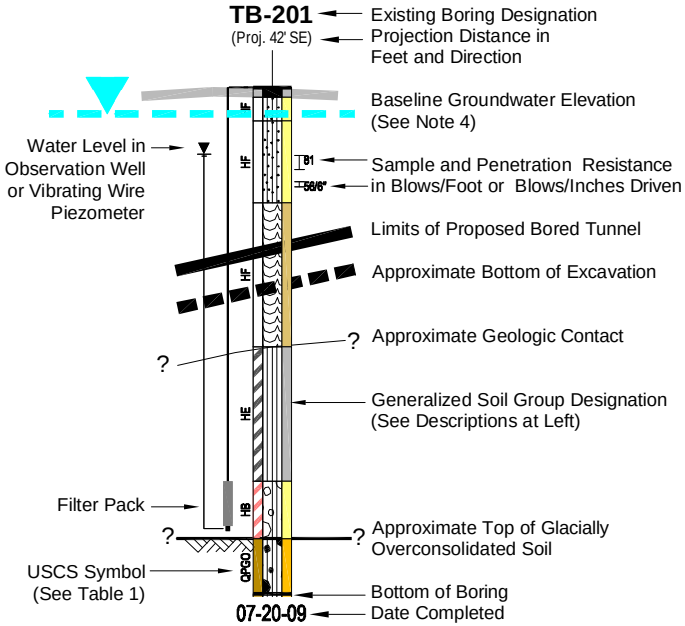
PEAT OR WOOD

0 20 40 — Vertical Scale in Feet

0 100 200 — Horizontal Scale in Feet

Vertical Exaggeration = 5X

LEGEND



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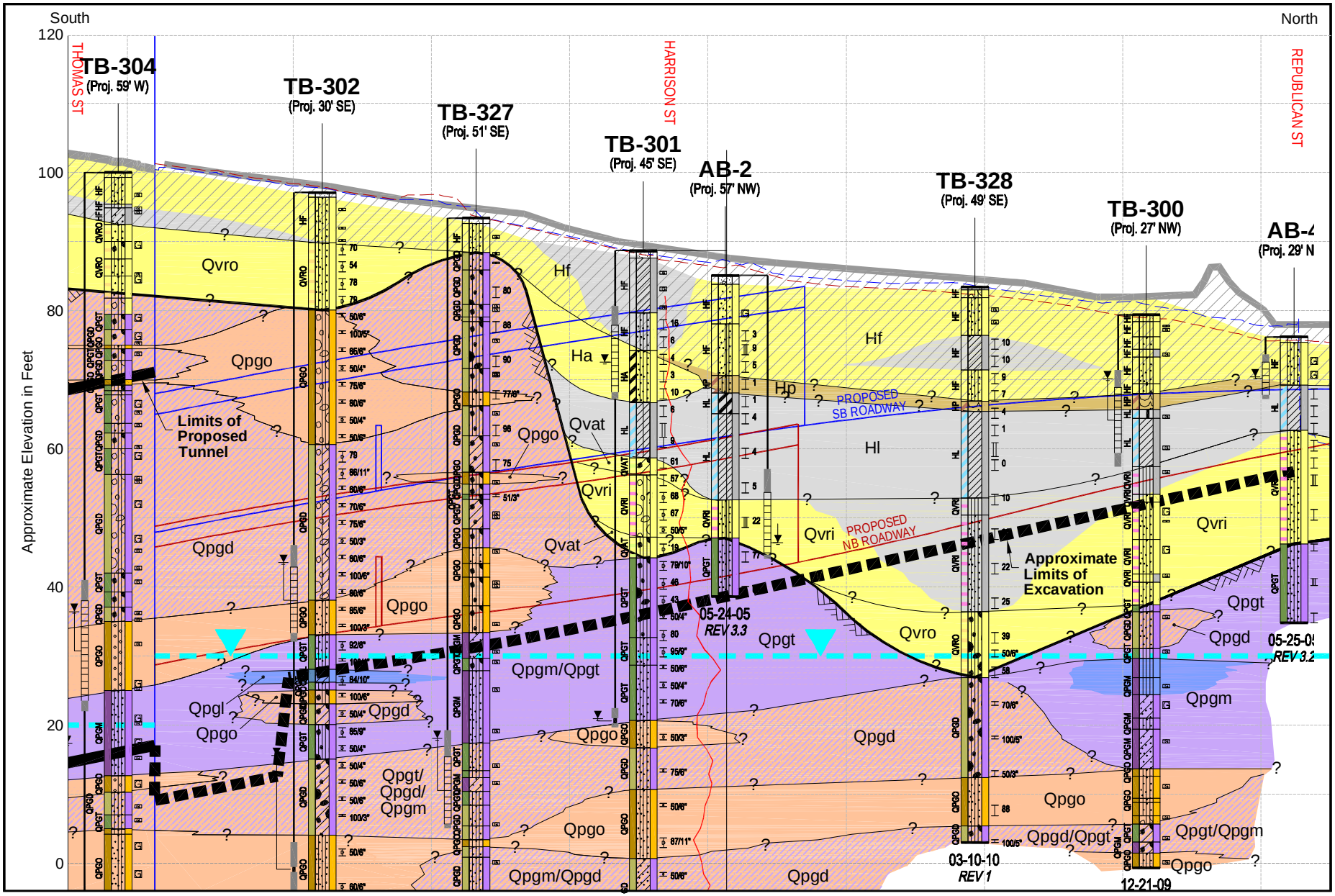
PROFILE OF SUBSURFACE CONDITIONS AND PROPOSED EXCAVATION - NORTH AREA

Exhibit 4-2
Sheet 1 of 2



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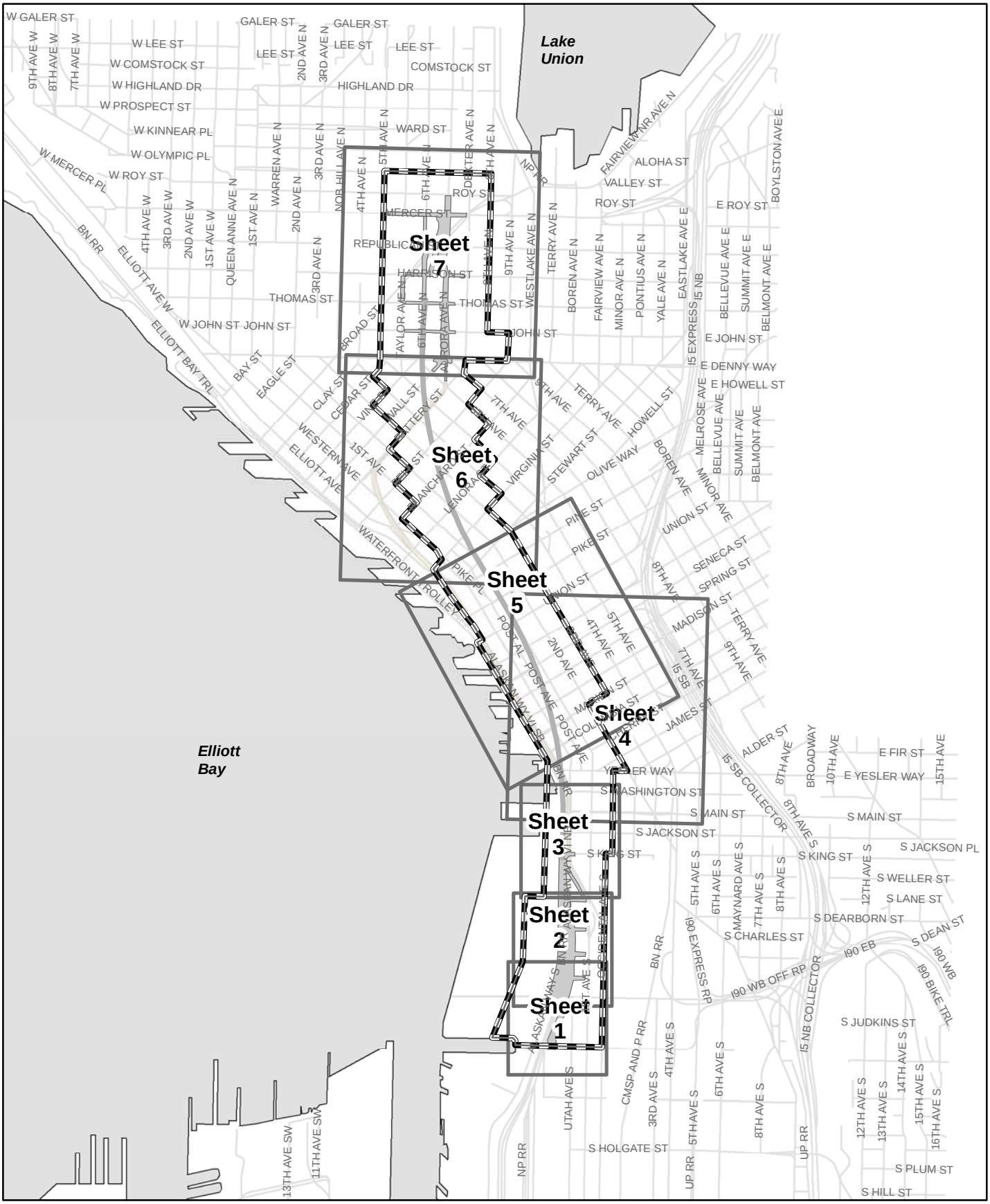
PROFILE OF SUBSURFACE CONDITIONS AND PROPOSED EXCAVATION - NORTH AREA

Exhibit 4-2
Sheet 2 of 2



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INDEX FOR BORINGS WITH ENVIRONMENTAL TEST RESULTS

N

0 1,000 2,000 4,000 Feet

Exhibit 4-3
Sheet A

LEGEND

Explorations

Study Area

Alaskan Way Viaduct Project Element

To be Decommissioned

North and South End Project Streets

South End Project Streets

Bored Tunnel

North End Project Streets

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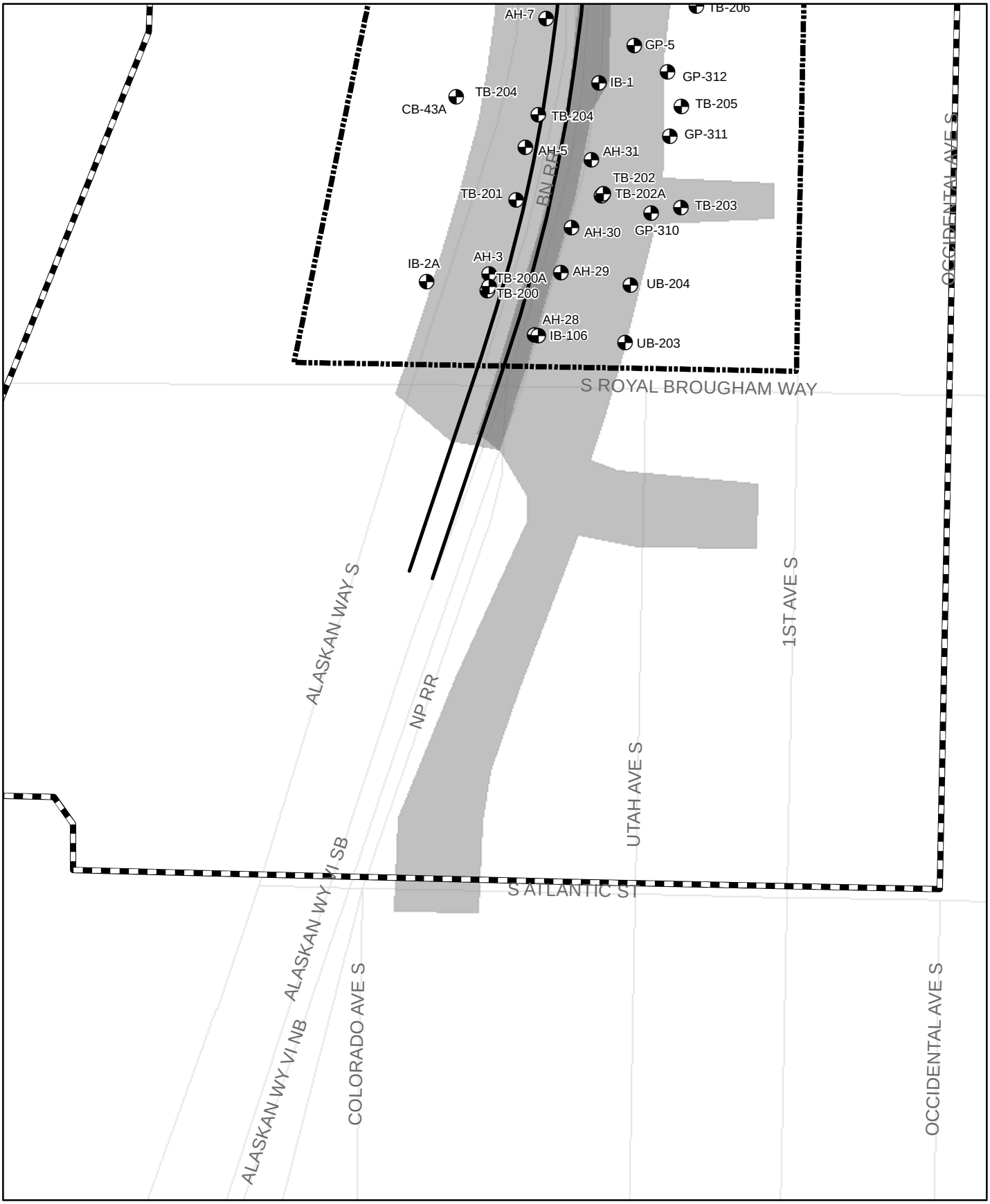
LEGEND FOR BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet B



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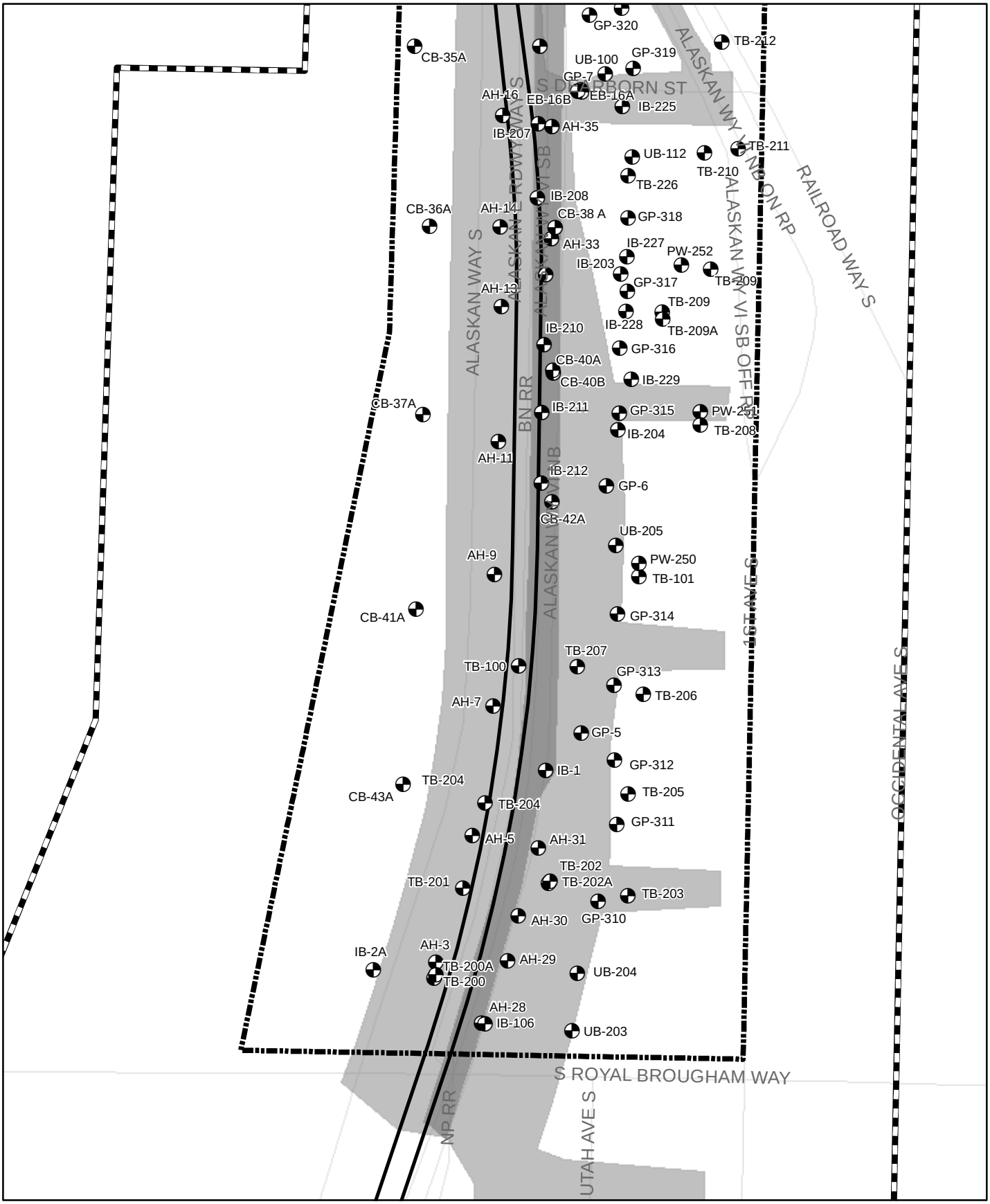
Feet

BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 1 of 7



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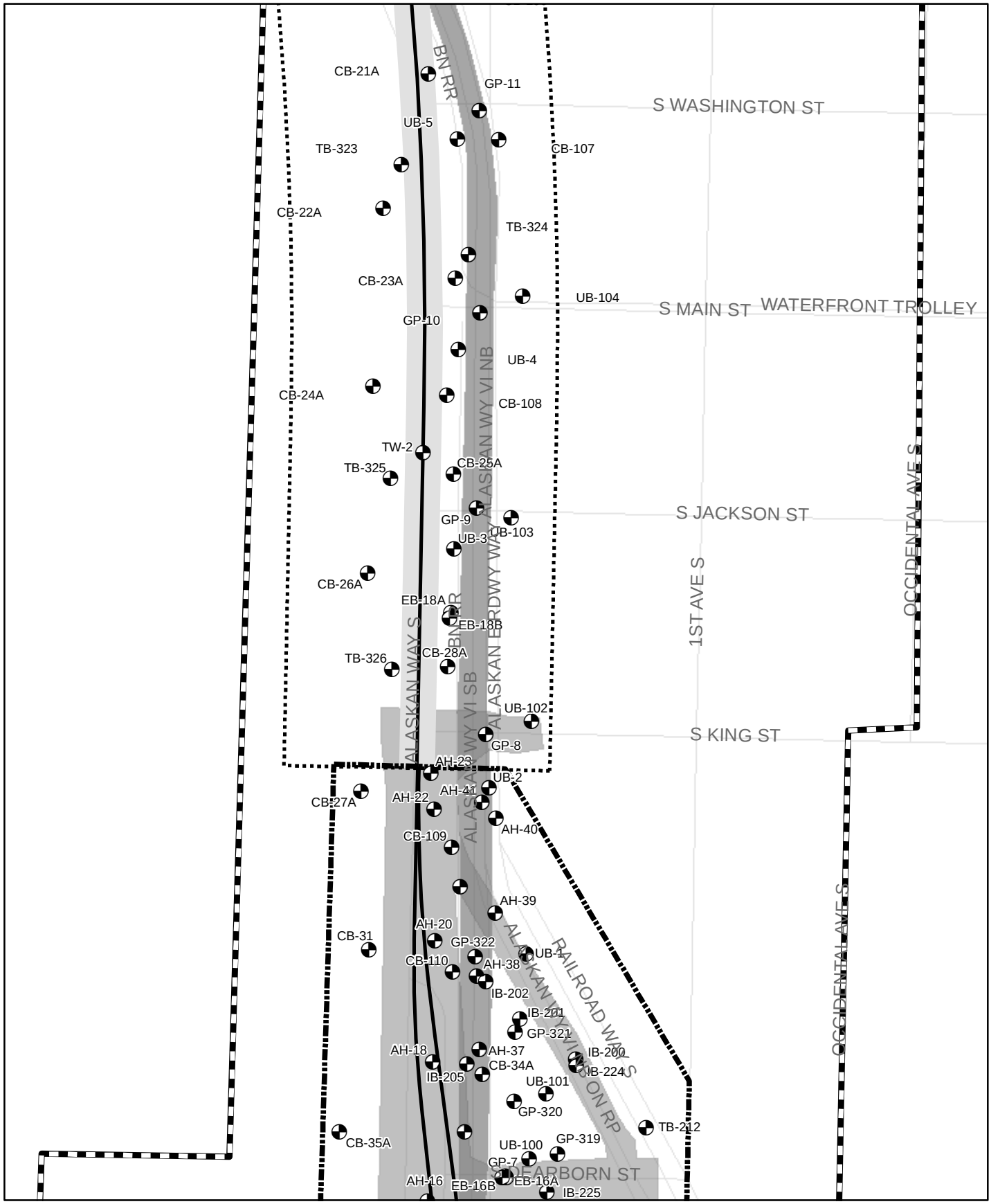
Feet

BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 2 of 7



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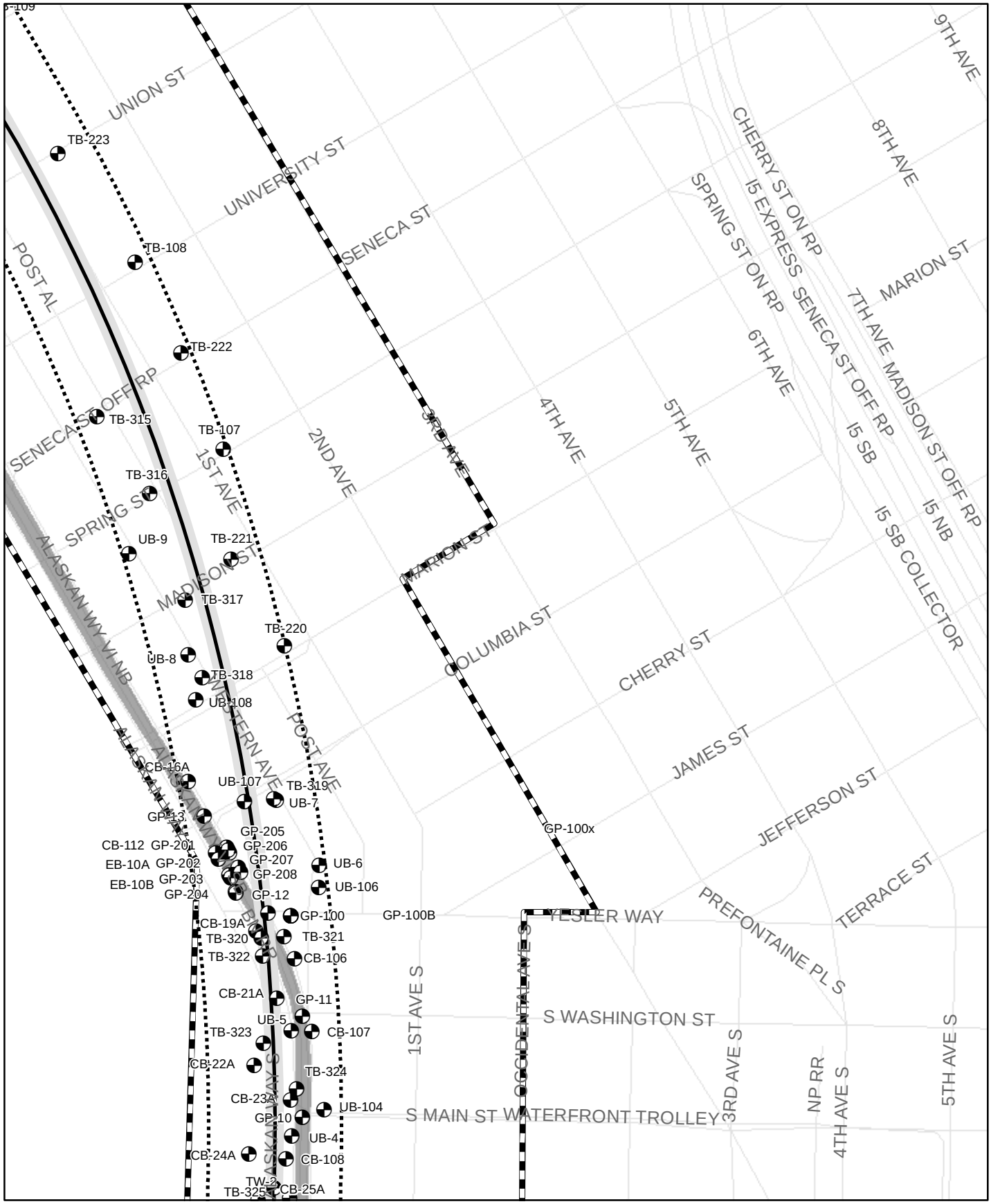
Feet

BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 3 of 7



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USTsGasOilLegend.mxd 6/15/2010 (ATJ)

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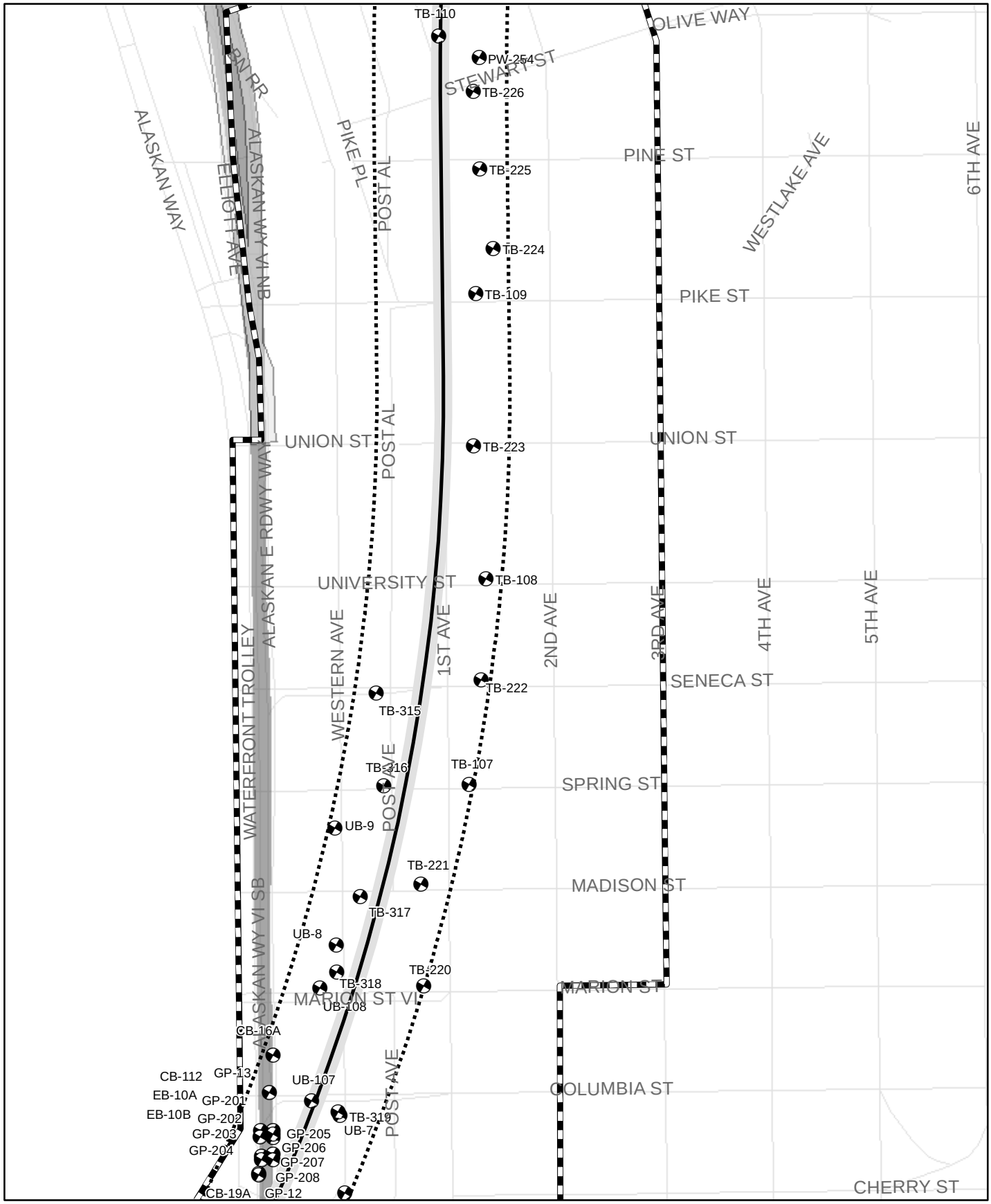
BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 4 of 7



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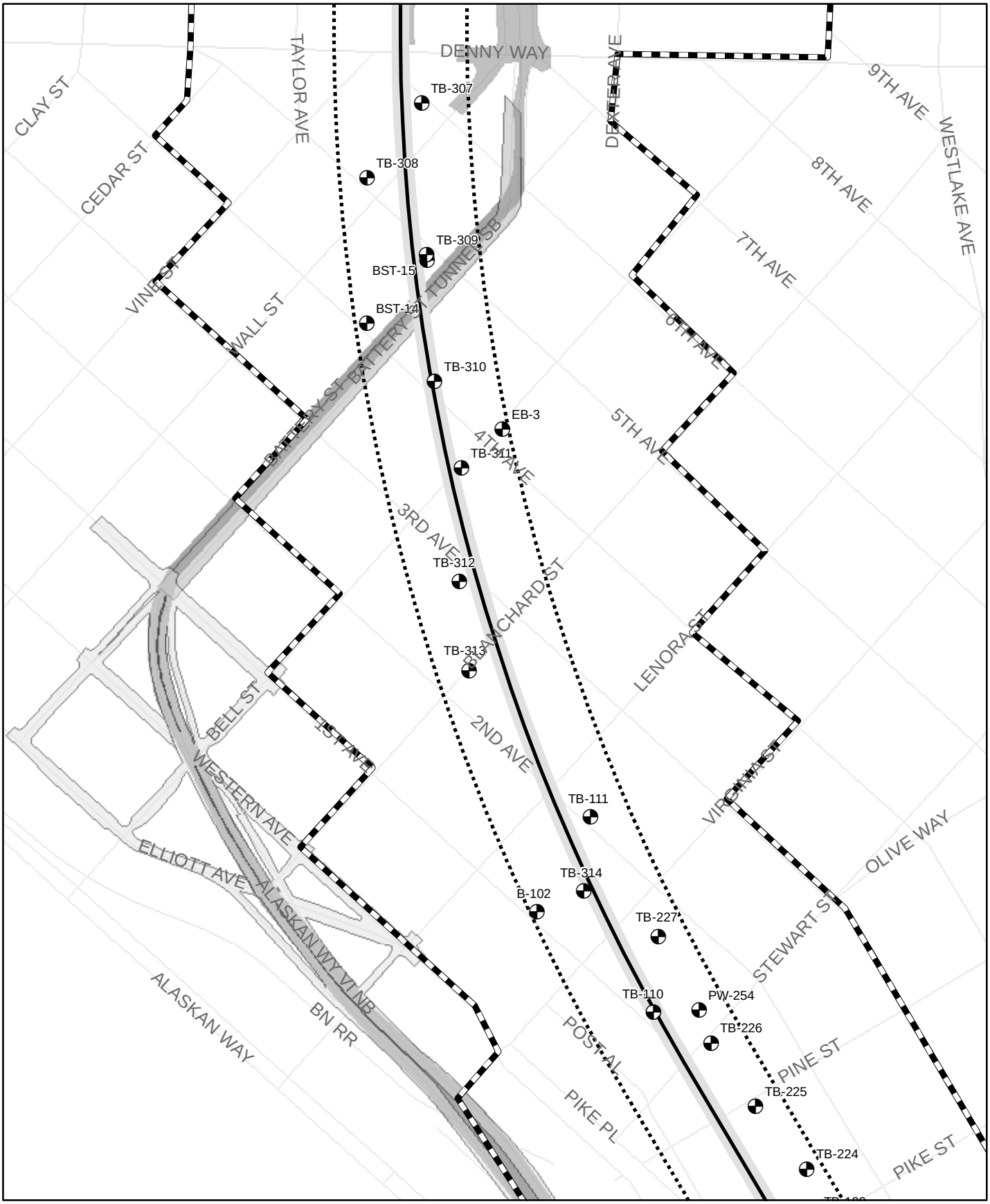
BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 5 of 7



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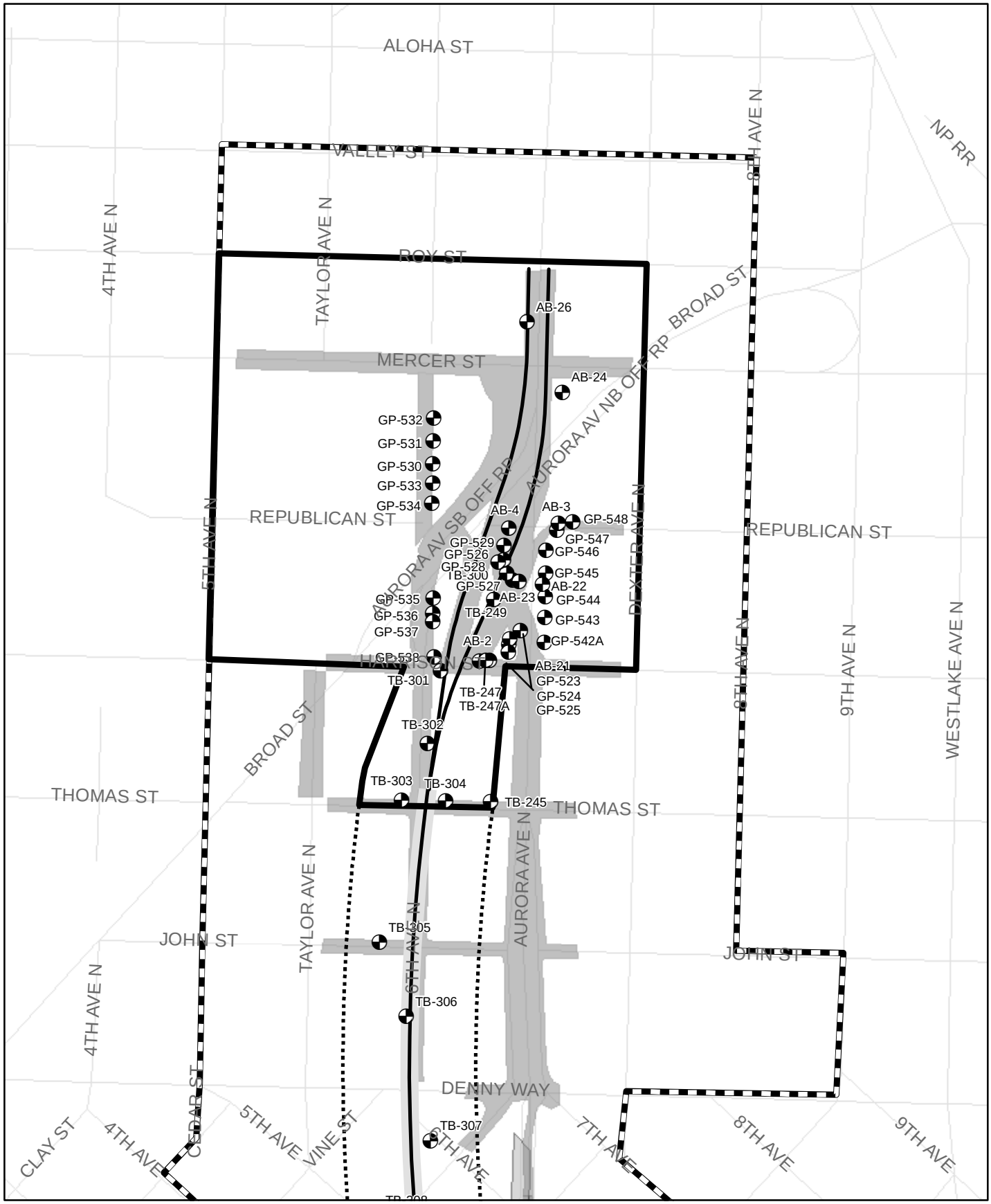
BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 6 of 7



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BORINGS WITH ENVIRONMENTAL TEST RESULTS

Exhibit 4-3
Sheet 7 of 7

organic compounds that have been detected in soil and groundwater samples collected for the Program. The samples were analyzed for both organic and inorganic analytes; however, because metals were detected in most samples, the metals data were not compiled for this report. Complete results are presented in the reports listed in Section 3.8. Analytical results for the detected compounds are summarized below.

4.2.1 Soil

Soil samples were analyzed for a broad suite of potential contaminants. Few contaminants were detected at concentrations greater than the MTCA Method A cleanup levels for unrestricted land use. The MTCA Method A Unrestricted Land Use category of cleanup levels was used for the evaluation because of the mixed land use along the corridor; it uses conservative assumptions. The north end of the project area consists primarily of commercial land use and includes hotels. The sampling locations and the types and concentrations of contaminants exceeding the MTCA Method A cleanup levels are presented in Exhibit 4-4.

All samples with concentrations of metals that exceeded MTCA Method A cleanup levels were collected from fill soil, except for one sample from boring TB-226. Arsenic was detected at 47 mg/kg, greater than the MTCA cleanup level of 20 mg/kg in native soil. The sample was collected from the tunnel zone, which is 189 feet bgs. Arsenic concentrations greater than the MTCA Method A cleanup level were detected at four other locations at concentrations ranging from 21 to 37 mg/kg. Lead was detected in fill soil at concentrations greater than or equal to the MTCA Method A cleanup level of 250 mg/kg at 15 locations; the concentrations ranged from 250 to 4,400 mg/kg. Although the concentrations of total lead were elevated, follow-up testing by the TCLP indicated that soil at only two locations would be classified as dangerous waste. Samples from UB-107 and UB-9 were collected well above the expected depth of the bored tunnel. Only boring UB-107 on Columbia Street, between Western Avenue and Alaskan Way S., was located near a potential ground improvement area, where fill soil may be removed as part of the spoils. Cadmium (borings AH-22 and EB-10A) and mercury (boring UB-3) were each detected at concentrations slightly greater than their respective MTCA Method A criterion. Boring AH-22 was located in the south portal area and borings EB-10A and UB-3 were located in the tunnel area, near Yesler Way and S. Jackson Street, respectively. The source of metals in fill soils is unknown.

Exhibit 4-4. Soil Samples With Concentrations That Exceeded MTCA Method A Cleanup Levels

Boring Designation	Area[1]	Soil Origin	Depth (feet bgs)	Analyte and Method						
				Diesel/Oil, Petroleum-NWTPH-Dx (mg/kg)	Gasoline, Petroleum/Benzene -NWTPH-G/B (mg/kg)	Arsenic, EPA 6010 (mg/kg)	Lead, EPA 6010 (mg/kg)	Lead, TCLP EPA 6010 (mg/L)	Other Metal Cadmium, Mercury, EPA 7470 (mg/kg)	Total cPAHs, EPA 8270 (mg/kg)
AH-22	South portal	Fill	18.5		58T/ND				2.2 Cadmium	2.09
AH-23	South portal	Fill	17							33.9
CB-108	Tunnel[2]	Fill	3	2,300Y						
CB-21A	Tunnel[2]	Fill	20				250	0.36		
CB-31	South portal	Fill	2.5				1,000	0.38		
CB-36A	South portal	Fill	10				760	ND		0.102
CB-37A	South cut-and-cover tunnel	Fill	8				290	ND		
CB-37A	South cut-and-cover tunnel	Fill	15			27	280	See 8 ft		
CB-43A	South cut-and-cover tunnel	Fill	2.4				250	0.21		
EB-10A	Tunnel	Fill							3.8 Cadmium	
GP-13	Tunnel[2]	Fill	5.5	2,500Y						
GP-201	Tunnel[2]	Fill	5.5							0.521
GP-205	Tunnel[2]	Fill	6							0.668
GP-206	Tunnel[2]	Fill	6.5							0.144
GP-311	South cut-and-cover tunnel	Fill	0.5				350	0.52		0.202

Exhibit 4-4. Soil Samples With Concentrations That Exceeded MTCA Method A Cleanup Levels (continued)

Boring Designation	Area[1]	Soil Origin	Depth (feet bgs)	Analyte and Method						
				Diesel/Oil, Petroleum-NWTPH-Dx (mg/kg)	Gasoline, Petroleum/Benzene -NWTPH-G/B (mg/kg)	Arsenic, EPA 6010 (mg/kg)	Lead, EPA 6010 (mg/kg)	Lead, TCLP EPA 6010 (mg/L)	Other Metal Cadmium, Mercury, EPA 7470 (mg/kg)	Total cPAHs, EPA 8270 (mg/kg)
MTCA Method A cleanup level for unrestricted land use				2,000	G: 30/100[4] B: 0.03	20	250	5	2 Cadmium 2 Mercury	0.1
GP-314	South cut-and-cover tunnel	Fill	0.8			37	440			
GP-314	South cut-and-cover tunnel	Fill	2							1.45
GP-321	South portal	Fill	4	2,800			820	1.1		2.54
IB-1	South cut-and-cover tunnel	Fill	2			29				
TB-101	South end surface	Fill	1.1				290	ND		0.668
TB-203	South cut-and-cover tunnel	Fill	5.5				260	3.8		
TB-211	South portal	Fill	4.8		ND/1.5					
TB-226	Tunnel[3]	Native	189			47				
TB-325	Tunnel	Fill	9.5				280			
UB-103	Tunnel[2]	Fill	1.1		130/0.19	21				
UB-107	Tunnel[2]	Fill	10.5				720	8.6		

Exhibit 4-4. Soil Samples With Concentrations That Exceeded MTCA Method A Cleanup Levels (continued)

Boring Designation	Area[1]	Soil Origin	Depth (feet bgs)	Analyte and Method						
				Diesel/Oil, Petroleum-NWTPH-Dx (mg/kg)	Gasoline, Petroleum/Benzene -NWTPH-G/B (mg/kg)	Arsenic, EPA 6010 (mg/kg)	Lead, EPA 6010 (mg/kg)	Lead, TCLP EPA 6010 (mg/L)	Other Metal Cadmium, Mercury, EPA 7470 (mg/kg)	Total cPAHs, EPA 8270 (mg/kg)
UB-205	South cut-and-cover tunnel		7.5							0.183
UB-3	Tunnel[2]	Fill	18.5						2.3 Mercury	5.08
UB-6	Tunnel[2]	Fill	18.5				740	3.5		
UB-9	Tunnel[5]	Fill	19.5				4,400	10		
MTCA Method A cleanup level for unrestricted land use				2,000	G: 30/100[4] B: 0.03	20	250	5	2 Cadmium 2 Mercury	0.1

Note: A blank cell indicates that either no test for the analyte was performed, or the concentration was less than the MTCA Method A cleanup level.

B = benzene
bgs = below ground surface
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
EPA = U.S. Environmental Protection Agency
G = gasoline-range
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
MTCA = Model Toxics Control Act
ND =not detected
NWTPH-Dx = Northwest total petroleum hydrocarbon–diesel-extended
NWTPH-G = Northwest total petroleum hydrocarbon–gasoline-range
T = sample chromatogram is not similar to gasoline
TCLP = Toxicity Characteristic Leaching Procedure
Y = silica gel cleanup

1. No compounds or elements have been detected at concentrations greater than MTCA Method A cleanup levels in soils in the north portal or north end surface area.
2. Occurs in fill in the southern portion of the bored tunnel between S. King Street and Marion Street, where ground improvement may be performed.
3. The only sample with a MTCA exceedance in native soil.
4. Gasoline-range TPH cleanup level is 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present.
5. Occurs in fill; ground improvement is not expected to be necessary in this area; except for particular buildings, which have not been identified.

Petroleum hydrocarbons and related compounds at concentrations greater than the MTCA Method A cleanup levels were primarily encountered along Alaskan Way S. in the southern part of the study area. All samples with concentrations that exceeded MTCA were collected from fill soils that were either in areas of potential ground improvement in the tunnel section or in the south portal or southern surface street areas. Diesel and/or oil were detected in three locations at concentrations greater than the MTCA cleanup level. Borings CB-108 and GP-13 were located in potential areas of ground improvement for the tunnel, and boring GP-321 was located in the south portal area. The detected concentrations of oil ranged from 2,300 to 2,800 mg/kg, exceeding the MTCA Method A cleanup level of 2,000 mg/kg. In 12 locations along the waterfront, cPAHs were detected at concentrations greater than the MTCA cleanup levels. When adjusted for toxicity equivalency factors as required by MTCA, the concentrations ranged from 0.11 to 33.9 mg/kg, greater than the cleanup level for total cPAHs of 0.1 mg/kg. Gasoline was detected at five locations; however, only the concentration in boring UB-103, at 130 mg/kg, exceeded the MTCA Method A cleanup level of 30 mg/kg. Benzene was also detected at boring UB-103, located near S. Jackson Street, at a concentration greater than the cleanup level of 0.03 mg/kg. Although the gasoline was detected at a depth of 9 feet bgs, well above the tunnel zone, ground improvement may be performed near S. Jackson Street. A gasoline cleanup level of 100 mg/kg is applicable only if benzene is not detected in the sample. Benzene was detected at a concentration greater than the cleanup level at one other location, boring TB-211, located in the south portal area.

All organic compounds detected in borings located in the bored tunnel area were collected from fill soil above the tunnel zone, with the exception of a sample from boring UB-104. Diesel (110 mg/kg) and oil-range hydrocarbons (120 mg/kg) were detected in the sample collected from boring UB-104 at 70 feet bgs. The boring was located near Alaskan Way S. and S. Main Street, where piles were used to support former roads and railroads, and the contamination is likely associated with a treated pile. The tunnel invert is deeper than 70 feet in this section. Two common laboratory contaminants, p-isopropyltoluene and toluene, were detected at very low concentrations in four other native soil samples from the tunnel section and were not evaluated further.

Although the concentrations did not exceed MTCA Method A cleanup levels for soil, a few solvents were detected along the alignment, such as the degreasing and dry-cleaning solvent tetrachloroethylene, which was detected at four locations: two borings at the north end (AB-3 and AB-4) and two borings in the southern part of the tunnel (GP-100 and UB-5).

Borings AB-3 and AB-4 were drilled one block north of the north portal, on Republican Street, on the east and west sides of Aurora Avenue, respectively. In

boring AB-3, tetrachloroethylene was detected in three samples collected at 5, 10, and 20 feet bgs, at concentrations of 0.0013, 0.001, and 0.0014 mg/kg, respectively. In boring AB-4, tetrachloroethylene was detected at 0.0011 mg/kg in a sample collected at 2.5 feet bgs. These concentrations are an order of magnitude less than the MTCA Method A cleanup level of 0.05 mg/kg.

Borings AB-3 and AB-4 were drilled just north of a former laundry that operated between 1950 and 1960 and may have also had dry-cleaning operations. The former laundry was located at 606 Harrison Street, the current City maintenance yard. Another former dry cleaner, the Vagabond Inn site, has reported a release of tetrachloroethylene and its breakdown products to Ecology. The Vagabond Inn site is located one block south, between Thomas and Harrison Streets along Aurora Avenue, adjacent to the proposed tunnel operations building. A summary of the Vagabond Inn site is presented in Attachment G. Additional environmental samples were collected by Geoprobe® for the engineering design. The Geoprobes® were advanced to approximately 30 feet bgs, in the right-of-way along Aurora Avenue, south of Republican Street and south of Harrison Street at the eastern edge of the two former dry-cleaning/laundry operations. Tetrachloroethylene was detected in two of the samples collected adjacent to the Vagabond Inn site. The concentrations of tetrachloroethylene detected at depths of 20 to 25 feet bgs were less than the MTCA Method A cleanup level. Solvents were not detected in the Geoprobe® samples collected adjacent to the City maintenance yard.

Trichloroethylene solvent was detected (at levels below the MTCA Method A cleanup level) at three locations: borings UB-1 and UB-2 in the south portal area and Geoprobe® location GP-100, which is near Yesler Street and Alaskan Way S. The source of the solvent at these locations is unknown.

Sampling results from borings drilled along the waterfront in the tunnel area and in the south portal area indicate that contaminants, including lube oil, heavy-range petroleum hydrocarbons, PAHs, and metals are present in the fill. Gasoline was encountered in a few isolated locations. Isolated occurrences of diesel and oil-range hydrocarbons at varying depths may be associated with treated piles along the waterfront.

A few samples from each boring along the alignment were analyzed for pH. By EPA Method 9045, pH ranged from 4.5 to 9.8; using ASTM Method D4972, pH ranged from 4.9 to 9.5. For samples that were analyzed using both methods, EPA Method 9045 yielded results that were approximately 0.6 pH units higher. The results indicated that fill soils in the south end tend to have higher pH concentrations. However, pH above 8.5 was measured in samples collected along the bored tunnel, predominantly south of Stewart Street. In approximately 25 percent of the 303 samples, pH was greater than 8.5. Disposal of soil with a pH

greater than 8.5 could be regulated by the local health department and Ecology because of potential effects on surface water, depending on whether the extent of the area containing soils with the higher pH levels is fairly localized.

4.2.2 Groundwater

Large-scale contamination or contaminated groundwater plumes have not been detected along the bored tunnel alignment; however, isolated instances of low-level contamination have been identified. Depending upon the concentrations of the contaminants, pretreatment may be required prior to discharge to the combined sewer. If groundwater is reinjected, the water must meet Washington's Water Quality Standards for Groundwater, as discussed in Section 6.1, Construction Effects.

Scattered detections of petroleum hydrocarbons were encountered along the alignment. Lubricating oil, diesel, and gasoline each exceeded the MTCA Method A cleanup level once. The detections were along the waterfront portion of the bored tunnel and in the south portal area and in the north portal area.

Low concentrations of PAHs were detected at monitoring well locations that were installed in areas of long-term railroad use and/or in fill along Alaskan Way S. When adjusted for toxicity equivalency factors, four of the samples exceeded the MTCA Method A cleanup level of 0.1 microgram per liter (μg/L) for total PAHs.

Scattered detections of VOCs were encountered in shallow groundwater in the south portal Area, bored tunnel along the waterfront, and in the north portal area at concentrations well below the MTCA Method A cleanup levels, with the exception of one sample that contained solvents typically associated with dry-cleaning and degreasing operations. The breakdown products of the solvent tetrachloroethylene were detected in groundwater collected from monitoring well AB-4. Monitoring well AB-4 was installed at the northwest corner of Republican Street and Aurora Avenue and was completed in perched groundwater. Vinyl chloride and 1,2-dichloroethylene were detected at concentrations of 0.25 and 0.27 μg/L, respectively. The concentration of vinyl chloride (0.25 μg/L) was slightly greater than the MTCA Method A cleanup level of 0.2 μg/L, and the concentration of 1,2-dichloroethylene (0.27 μg/L) was well below the MTCA Method A cleanup level of 5 μg/L. Tetrachloroethylene was also detected in soil at this location.

Groundwater samples were analyzed for both total and dissolved metals. Because of the high turbidity associated with groundwater samples collected with a Geoprobe®, elevated concentrations of metals may not be representative of actual groundwater conditions. Testing for dissolved metals was also performed to better understand the impact of the sampling technique.

The five MTCA metals (arsenic, cadmium, chromium, lead, and mercury) were detected in groundwater samples collected along the alignment. Total concentrations of the arsenic and cadmium were sometimes above MTCA Method A cleanup levels. Dissolved concentrations were below MTCA cleanup levels. Mercury was detected only at concentrations below the MTCA Method A cleanup level.

Dissolved methane has been detected in 30 borings along the alignment. Concentrations ranged from 0.01 to 110 mg/L, with the highest concentrations encountered at monitoring wells TB-204 and TB-206, which are located on Alaskan Way S., about 400 feet north of S. Royal Brougham Way. Hydrogen sulfide (H_2S) may also be present; it occurs in areas of natural degradation of wood waste (organic matter) and could be associated with the breakdown of bunker fuel. Abundant wood waste is present between Railroad Way S. and S. King Street.

Additional groundwater monitoring wells will be installed to screen for potential contaminants in groundwater that may affect discharge. The results will be evaluated and presented as part of the ongoing engineering design.

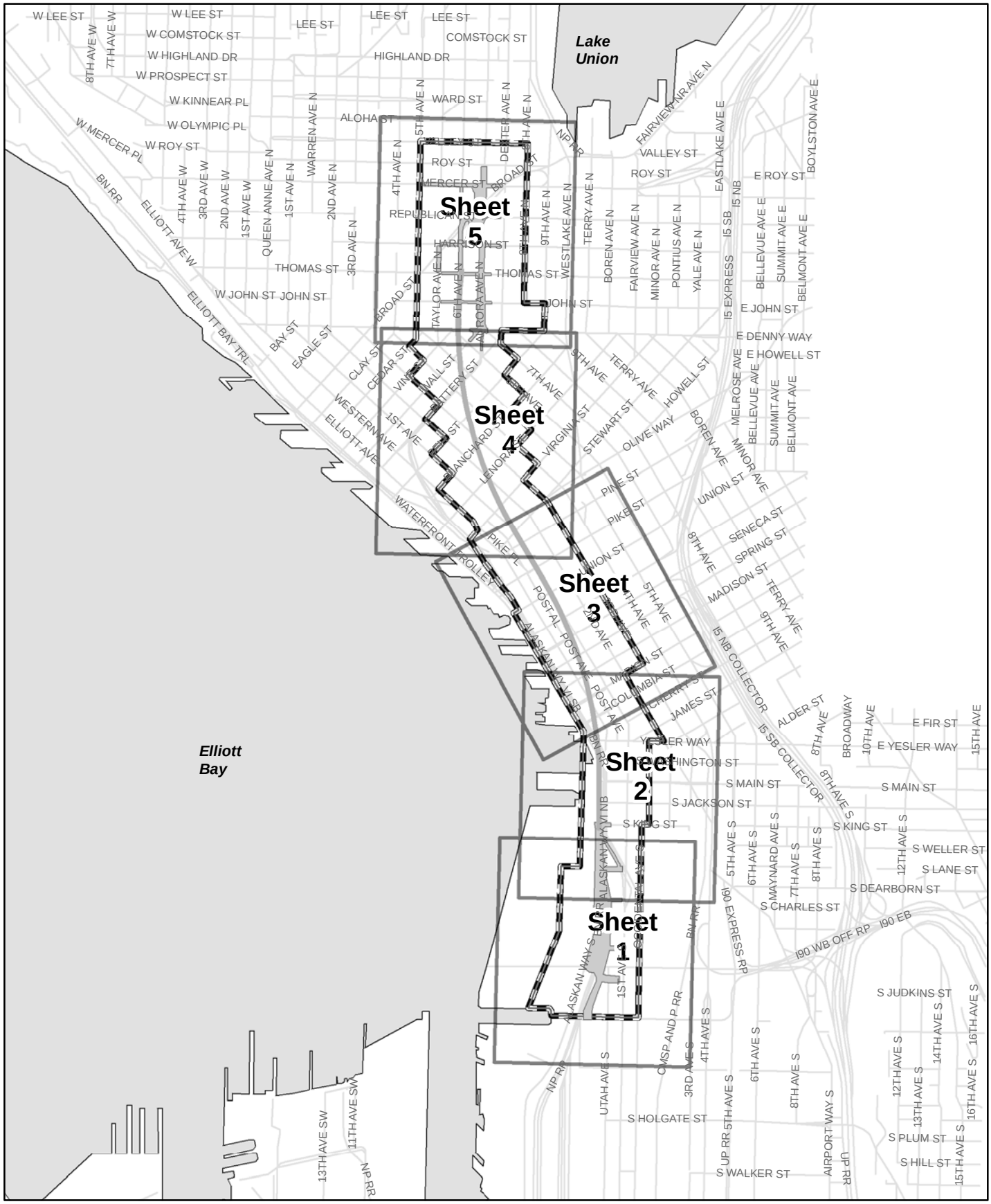
4.3 Historical Land Use

Historical land use activities in the study area were reviewed to identify properties that have a high potential for contamination with hazardous materials. Information about historical land use was obtained through a review of data from public agencies and library resources. The land use of concern, source of information, documented years of operation, and potential contaminants for each site are presented in Attachment D. The location and potential contaminants for each site are shown on Exhibit 4-5.

4.3.1 Contaminants of Concern

Based on historical activities, six general types of contaminants of concern have been identified in the study area; these contaminant types have varying levels of toxicity and mobility that determine the significance of their presence to the project.

- **Mid- to Heavy-Range Petroleum Hydrocarbons** (referred to in the text as oil). These contaminants include diesel, bunker fuel, and lube oils. Historical uses were widespread and associated with a variety of land uses. Lube oils were used extensively by the railroads. Diesel was used to heat businesses and homes. For the most part, these contaminants are relatively low in toxicity, are not particularly mobile, and tend to float on the water table rather than being dissolved or dispersed throughout the water column. As a result, any given leak or release of diesel or oil is not likely to have resulted in widespread contamination.



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INDEX OF SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

Exhibit 4-5

Sheet A

LEGEND

(See Exhibit D-1 for a summary of each site)

Risk to the Environment Hazardous Materials

Gasoline

Low to Moderate Risk

Moderate to High Risk

Solvents

Low to Moderate Risk

Moderate to High Risk

Petroleum (diesel and/or oil)

Low to Moderate Risk

Moderate to High Risk

Metals

Low to Moderate Risk

Moderate to High Risk

PCBs

Low to Moderate Risk

Moderate to High Risk

Pah

Low to Moderate Risk

Moderate to High Risk

Impact Ranking for Validated Sites:

1 Low

1 Moderate

1 High

Documented Release

-2 **Parcel w/Site Designation -** if a site consists of multipal parcels, each parcel recieves the same site designation.

60.2 **Block w/Designation**

Study Area

Alaskan Way Viaduct Replacement Project

Alaskan Way Viaduct and Battery Street Tunnel to be Decommissioned

Alaskan Way Viaduct Program Element

Historic Railroad Use

Fill

LEGEND FOR SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

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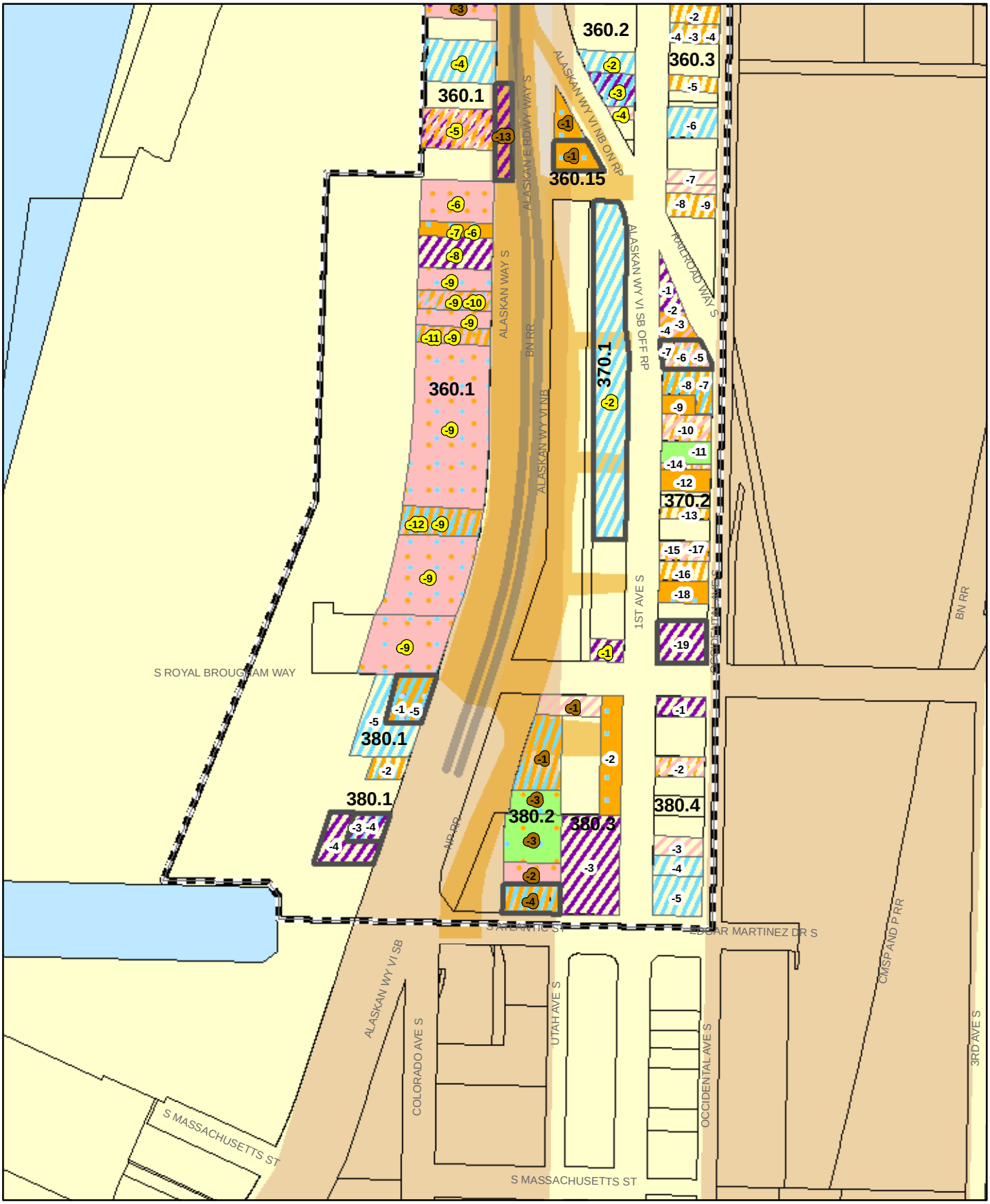
Exhibit 4-5
Sheet B



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PLAN OF SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

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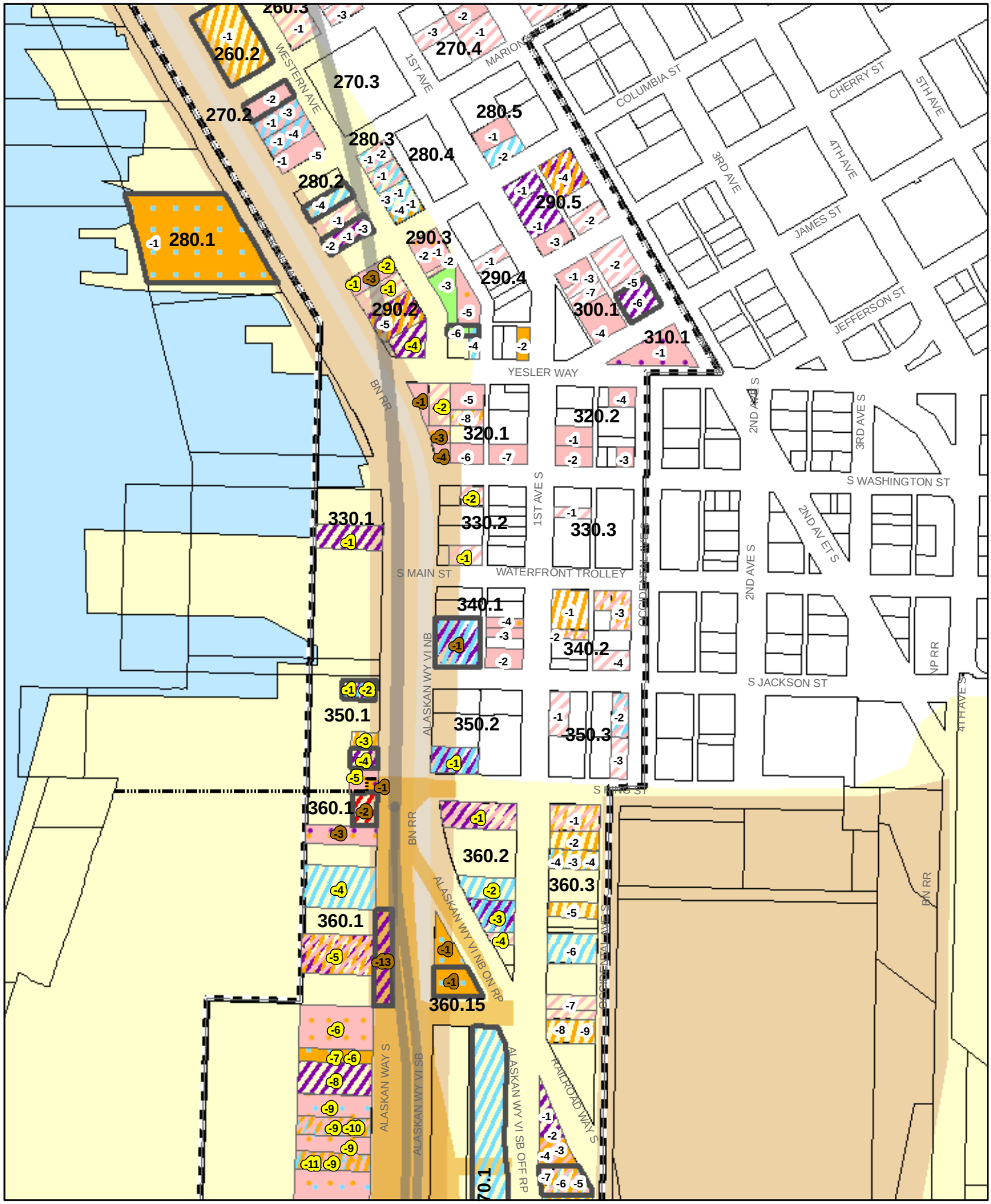
NOTE: See Exhibit 4-5, Sheet B for Legend of Documented and Potential Contaminant Releases

Exhibit 4-5
Sheet 1 of 5



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PLAN OF SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

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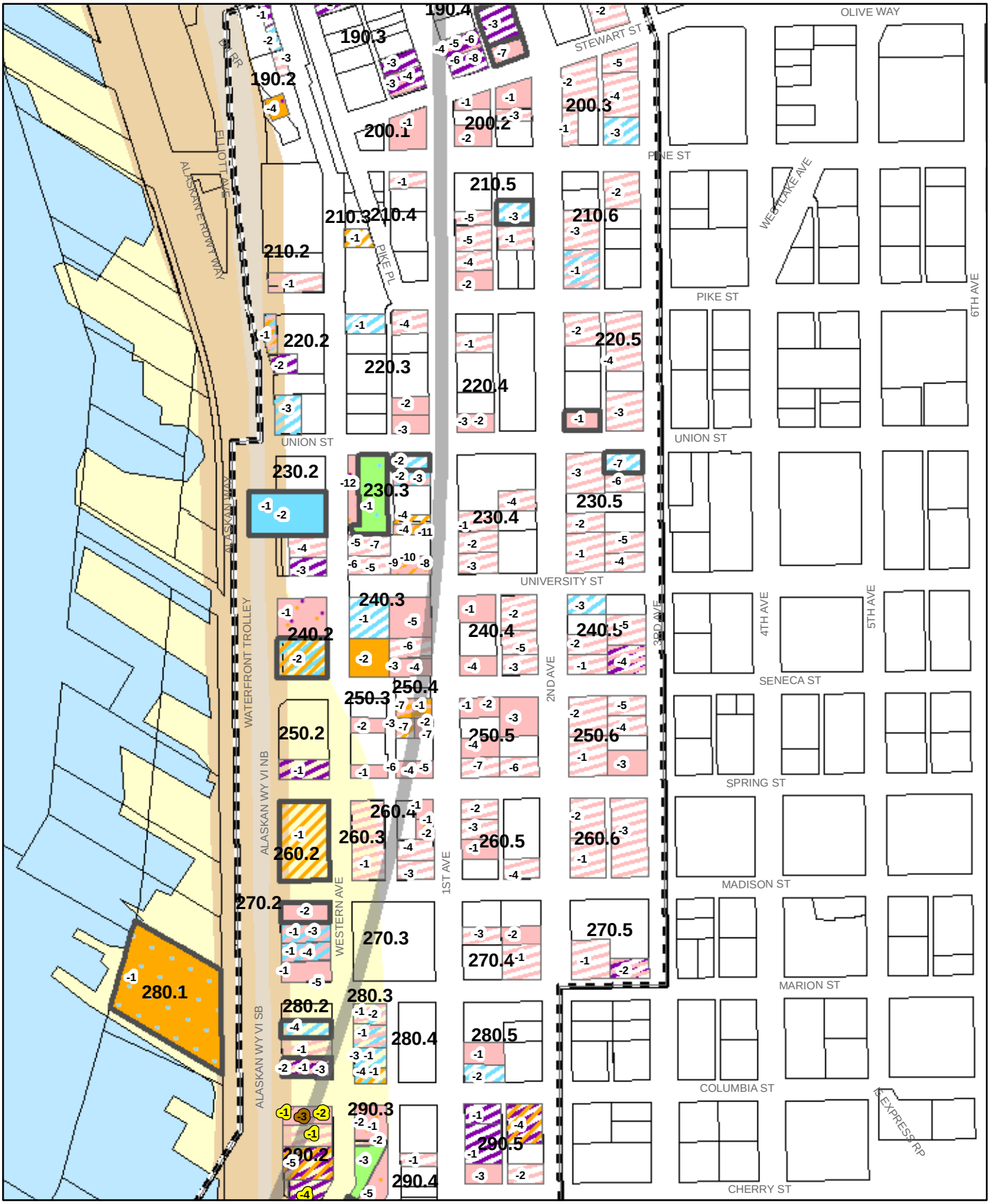
NOTE: See Exhibit 4-5, Sheet B for Legend of Documented and Potential Contaminant Releases

Exhibit 4-5
Sheet 2 of 5



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PLAN OF SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

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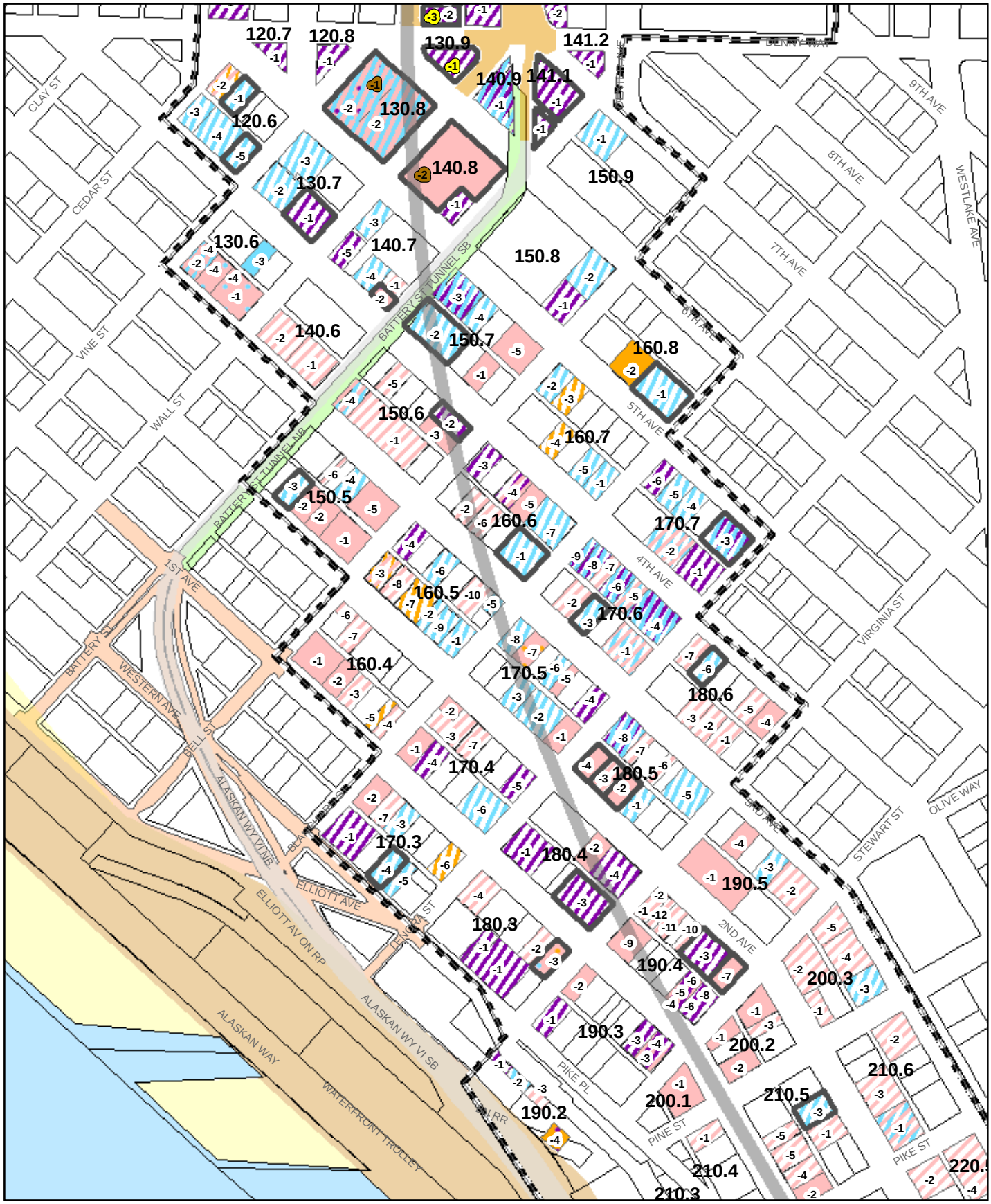
NOTE: See Exhibit 4-5, Sheet B for Legend of Documented and Potential Contaminant Releases

Exhibit 4-5
Sheet 3 of 5



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PLAN OF SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

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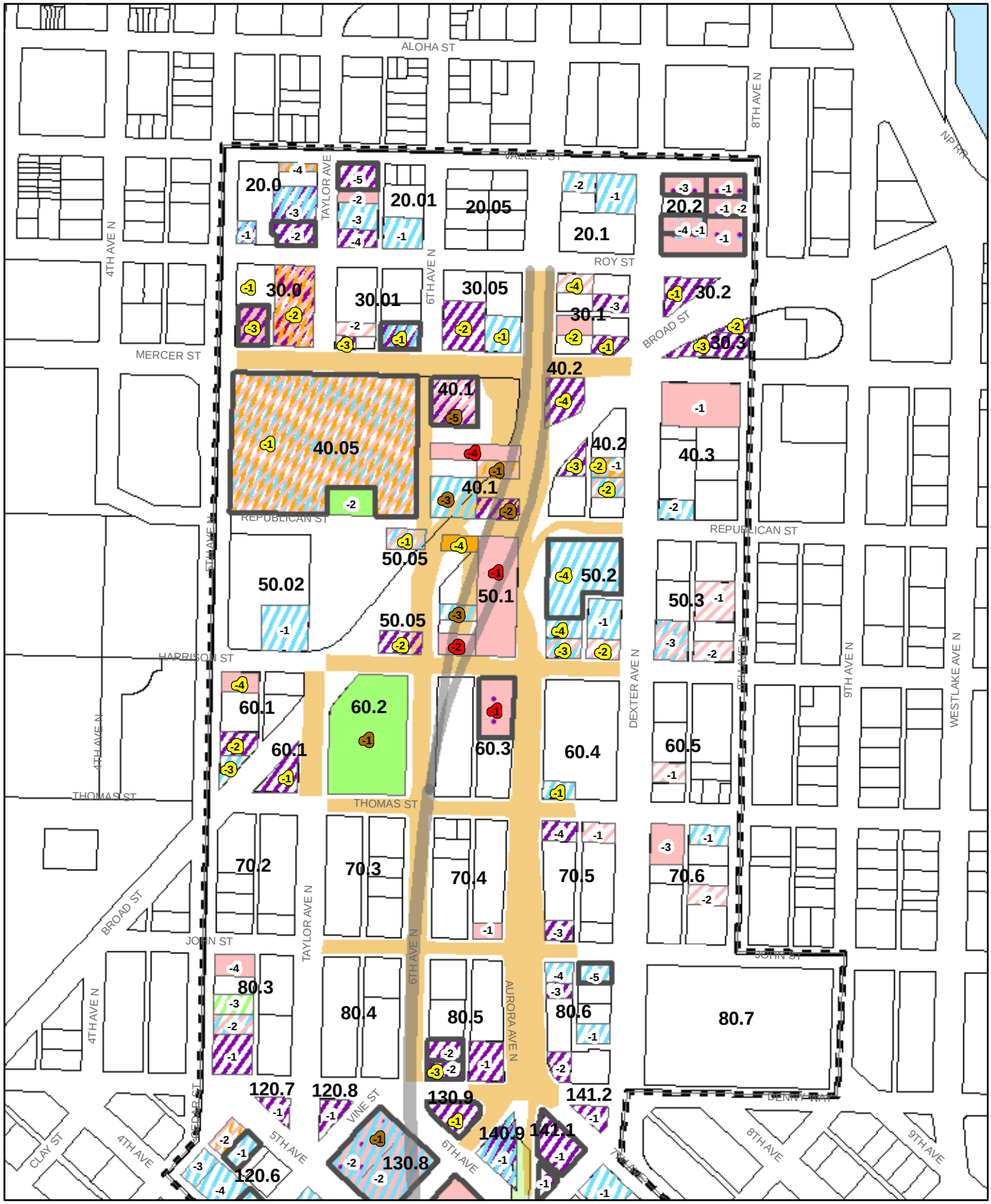
NOTE: See Exhibit 4-5, Sheet B for Legend of Documented and Potential Contaminant Releases

Exhibit 4-5
Sheet 4 of 5



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PLAN OF SITES WITH DOCUMENTED AND POTENTIAL CONTAMINANT RELEASES

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0 200 400 800 Feet

NOTE: See Exhibit 4-5, Sheet B for Legend of Documented and Potential Contaminant Releases

Exhibit 4-5
Sheet 5 of 5

- **Gasoline.** Gasoline contamination generally results from leaks and spills associated with former gas stations and vehicle maintenance facilities. Gasoline is relatively mobile in the environment and is more toxic at lower concentrations than heavier grades of hydrocarbons. Gasoline also tends to float on the water table; however, more soluble components such as benzene, toluene, ethylbenzene, and xylenes (BTEX) may be present, depending on the age of the release. These volatile compounds can pose a substantial risk to humans and the environment and are highly soluble and mobile in groundwater.
- **PAHs.** PAHs, some of which are carcinogenic, are present in heavy-range petroleum hydrocarbons and are also created during burning as a result of incomplete combustion. They are also present in creosote. PAHs may be associated with petroleum releases such as leaking heating oil USTs, lubricating oils used by railroads, burned timbers, and creosote-treated timbers or pilings used to support railroad trestles or the former elevated roadway (Alaskan Way S.). In general, PAHs are relatively insoluble in water and bind to soil particles. Consequently, although some of the compounds are extremely toxic to humans, they are relatively immobile.
- **Metals.** Heavy metals, including arsenic, cadmium, chromium, lead, zinc, and copper, are associated with metal works, foundries, and plating operations. Metal-contaminated sites have the greatest effect on the soils and groundwater directly underlying the site; however, metals may also move off site with groundwater. Because of the limited mobility of metals, downgradient soils are not likely to be highly contaminated as a result of groundwater migration.
- **Halogenated Solvents.** Trichloroethylene and tetrachloroethylene were used historically as solvents in dry cleaning and for degreasing in a variety of businesses. These compounds result in breakdown products such as dichloroethylene and vinyl chloride. A variety of businesses such as machine shops and metal works tended to use small volumes of solvents. Solvents are highly toxic at low concentrations and are highly mobile in soil and groundwater. Most solvents are denser than water and, therefore, tend to move downward through the subsurface and water column. Unlike most contaminants, solvents can migrate relatively readily through fine-grained soils.
- **PCBs.** The most likely sources of PCBs are spills or leaks of dielectric fluids from PCB-containing equipment such as transformers or switches, which are often found at power stations. PCBs are associated with junkyards because of the historical mismanagement of used electrical

equipment. PCBs tend to adhere to organic matter in soil and do not readily migrate from soil to groundwater.

Elevated pH is also potentially toxic in aquatic environments. Surface water that comes in contact with high pH material may also develop high pH levels. When discharged to a body of water, the affected surface water may adversely affect organisms in the aquatic environment. Elevated pH may occur naturally in soils, or result from manmade material such as new concrete. As discussed in Section 4.2, elevated pH has been encountered frequently in fill in the south end of the study area, and in native soil along the bored tunnel section. Surface water that comes in contact with the elevated pH material may need to be neutralized before it may be discharged.

Large quantities of fill and wood have also been encountered in the southern portion of the study area, and the presence of these materials may affect the disposal options for the Bored Tunnel Alternative. Fill materials were placed in the tidelands in the 1910s to 1920s around pile-supported railroad lines and around a parallel, wood-planked timber trestle roadway that extended along the waterfront to Smith Cove. Reportedly, many of the piles were treated with creosote (composed of PAHs and petroleum compounds). Because of the toxic constituents of creosote, these treated timbers pose a hazard to human health and the environment, both from the timbers themselves and from contamination that has leached from the wood to the adjoining soil and groundwater. The timbers appear to be closely spaced and would complicate the excavation, handling, and disposal of fill materials. In addition to the creosote and timbers, the fill materials likely contain a variety of other contaminants. Petroleum hydrocarbons are relatively common contaminants in the fill materials. Metals, construction debris, and other constituents are also likely to be present in the fill.

The decay of wood and sawdust, which was used as fill at the south end of the study area, can result in the production of methane and H_2S. Methane is a flammable gas that can explode under certain conditions. H_2S poses problems for workers because it is heavier than air and sinks in trenches, displacing air. In addition, H_2S can dissolve in water. King County Metro has established discharge criteria for H_2S in the municipal sewer system.

4.3.2 Major Cuts and Fills in the Study Area

During the last century, fill material was placed to depths of 5 to 50 feet along E. Marginal Way S. and the Port of Seattle facilities. Much of the shallow soil in the south end and along the waterfront was dredged from the Duwamish Waterway and hydraulically placed (placed by using water). A variety of pile-supported structures, dock facilities, and railroad tracks were formerly located along the southern portion of the proposed alignment. Concrete, wood, human-

made debris, ship ballast, sawmill by-products, trees, and other waste and debris are also likely to be present in the fill. Piles from former structures and railroad alignments were likely left in place and are now buried. Multiple structures and multiple reconstructions and realignment of railroad tracks likely occurred. A large number of piles, some closely spaced, may be present. Abandoned piles, trees, and other wood that has been continuously saturated and buried may be in relatively sound condition.

Front Street, now known as First Avenue, was located adjacent to the original shoreline of Elliott Bay. By 1885, the City had created a 120-foot railroad right-of-way 60 feet offshore, extending from S. King Street to Smith Cove. The original Seattle waterfront from S. King Street to Union Street was destroyed in the great Seattle fire of 1889, which consumed 30 city blocks. When the area was rebuilt, piles were used to support piers, and the railroad trestles and timber walkways provided access from the piers to land. Many of the piles were likely treated with creosote. The area between the end of the piers and the land was gradually filled with soil, wood waste, ship ballast, and various other types of refuse, including burned waste from the fire.

By the late 1800s, S. King Street terminated at a coal wharf, which also housed machine shops and a roundhouse for railcars. Metal works, metal plating shops, machine shops, and foundries were located on wharves both north and south of the S. King Street Wharf throughout the early 1900s.

Transit sheds for a variety of goods, including coal, grain, fish, and dry goods, were located on the piers. Terminal 46, located adjacent to the proposed alignment, is used as a container transfer facility for the Port of Seattle.

The commercial district around Pioneer Square was initially developed in 1885. Within a year of the 1889 fire, the area was rebuilt. Many of these buildings were constructed of brick and housed retail/commercial businesses, offices, and hotels. Scattered throughout this section of Seattle were numerous dry cleaners, laundries, print shops, and gas stations. Although several dry cleaners remain, many of the gas stations are closed. Retail, office, and small commercial businesses dominate this section of Seattle. The historic Pioneer Square area has undergone little redevelopment. Along First Avenue, redevelopment has occurred; however, interspersed are many buildings constructed in the 1920s and 1930s. In addition, some sites have been converted to parking lots.

The southern portion of Denny Hill was regraded between 1903 and 1908, allowing for the expansion of commercial activities. By the 1930s, gas stations/ repair shops also occupied this area.

As described above, tetrachloroethylene, a solvent used in dry cleaning and metal degreasing, has been detected in perched groundwater one block north of the

north portal. At the Vagabond Inn site, located on the parcel adjacent to the proposed north tunnel operations building, a tetrachloroethylene release was reported to Ecology; however, no cleanup was documented.

The north portal area currently has a mixture of commercial/retail and residential uses. Most of the gas stations and dry cleaners are no longer operating; however, many of the sites that were once used for these purposes have been converted to surface parking. Redevelopment has occurred throughout this area. New condominiums, some with retail space on the ground floors, have been constructed in the Belltown district.

City combined sewer outfalls are located along the waterfront at S. Washington Street, Madison Street, University Street, and Vine Street. King County combined sewer outfalls are located at S. Lander Street, S. Royal Brougham Way, S. King Street, and Denny Way. City storm drains are located at S. Spokane Street, S. Hind Street, S. Washington Street, Seneca Street, and Pine Street. There is also a permitted discharge of backwash water from the Western Avenue steam plant's water treatment system to Elliott Bay (Aura Nova Consultants, Inc. Contractor Team 1995). Elevated concentrations of highly mobile contaminants, particularly gasoline and solvents, may be present in the permeable backfill of the sewer system. Also, metals and poorly soluble organics may be present in sediment near the outfalls.

H_2S is locally present in the subsurface, either as the result of a contaminant release or as a natural by-product of the breakdown of organic matter under oxygen-reducing conditions. H_2S can dissolve in groundwater at concentrations exceeding King County Metro's discharge criterion, necessitating treatment before discharge. At this concentration, H_2S also poses a potential hazard to site workers. At low concentrations, H_2S presents a nuisance odor. Although H_2S could result from wood and sawdust decay anywhere along the waterfront, to date it has been encountered only at the waterfront at the end of University Street, directly south of a Bunker C fuel release from the power company's site. Since Bunker C fuel can contain high levels of sulfur compounds, this appears to be the most likely source of the H_2S; however, the H_2S could be associated with a sewer release.

4.4 Validated Sites

Each of the validated sites described in this section is adjacent to or overlies the project footprint where the crown of the bored tunnel would be less than 100 feet bgs and would have a potential impact on the project. Sites adjacent to the right-of-way may adversely affect the project through off-site migration of contaminants, particularly via shallow utilities that may affect surface elements of the Bored Tunnel Alternative, and by the vertical migration of solvents that may

contaminate soil in the bored tunnel section of the project area. Because of their proximity, sites adjacent to the right-of-way have a greater potential for adverse effects than sites that are farther away. The potential risks posed by the validated sites have been characterized as low, moderate, or high, depending on the type of contaminant, whether contamination is documented, and whether the site would be acquired and is likely to affect the project.

The validated sites are identified by their site number, type of business or historical land use, and parcel number. The site location relative to the alignment, the sources of information on historical land use, a relevant description of the documented or potential contamination, planned construction, and the potential impact and rationale for the determination are also summarized. Sites identified as having a high or moderate potential impact are presented in Exhibit 4-6, and sites that pose a low potential impact are presented in Exhibit G-1 in Attachment G. All sites within the study area that pose a risk to the environment are also described in Attachment D.

The subsurface in the south portal area is characterized by up to 25 feet of fill. The fill is a fine- to medium-grained sand containing wood debris, creosote-treated timbers, burned wood, and coal. The potential for contamination from the fill and long-term industrial use of the area, including railroad use, results in sites with the potential for dispersal of low-level contamination, primarily heavy oil and PAHs, with localized areas of solvent, elevated concentrations of metals, and fuel contamination. In addition, shallow groundwater (6 to 10 feet bgs) is likely to facilitate the dispersal of contaminants. Ten sites in the south portal area, including one site (Site 360.15-1) that has already been acquired, are considered to have a moderate potential impact because of the unknown nature of the fill and long-term former industrial land use. Fifteen sites, including two that have already been acquired (Sites 370.1-1 and 370.1-2), pose a low potential impact. Although none of these sites are locations of long-term industrial use, they are likely to be underlain by fill. PAHs at concentrations greater than the MTCA Method A cleanup levels were encountered in fill soils collected from soil borings located in the Alaskan Way S. right-of-way near S. Dearborn Street.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
South Portal							
380.3-1	Former cleaning compounds company 95 S. Royal Brougham Way King County Parcel #7666206966	S. Royal Brougham Way	Adjacent south of the project area. Probably upgradient of the project area. Groundwater is estimated to be 6 to 10 feet bgs. Partial acquisition of site's western portion.	Polk directories, current assessor records, windshield survey	A former cleaning products company was present from at least 1938 to 1944. Recent assessor records indicate that the site building was constructed in 1914. Partial acquisition would not include any buildings. The area to be acquired is being used as a construction laydown yard (2009). Potential contaminants in soil and groundwater from historical land use include solvents. Other contaminants from either the historical land use or because the area was filled include petroleum and metals. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**Yes**	**Moderate - Potentially Complex** Site is adjacent to the project area. A portion of the site would be acquired. Shallow groundwater is present. Contamination is not known to exist, but solvent contamination is possible based on site use history. Construction may include shallow excavations for surface street and utility construction.
380.2-1	Former fuel company 1207 Utah Avenue S. King County Parcel #7666207001/ 7666206966	S. Royal Brougham Way	Approximately 80 feet south of the project area (S. Royal Brougham Way). Probably upgradient of the project area. Groundwater is estimated to be 6 to 10 feet bgs. Partial acquisition of site's western portion.	Assessor archive, Polk directories, current assessor records, windshield survey	Former fuel company offices were indicated in the archive records and Polk directories, and more recently the site was listed as a cargo and operating terminal. Partial acquisition would not include any buildings. The area to be acquired is being used as a construction laydown yard (2009). Potential contaminants in soil and groundwater from historical operations include petroleum. Metals may also be present in fill soil, and if burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**Yes**	**Moderate - Straightforward** A portion of the site would be acquired. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the commercial use history and the presence of fill materials. Construction may include shallow excavations for surface street and utility construction.
380.2-2	Former iron works/foundry 1237 Utah Avenue S. King County Parcel #7666206966	S. Atlantic Street	Approximately 500 feet south of the project area. Probably upgradient of the project area. Groundwater is estimated to be 6 to 10 feet bgs. Partial acquisition of site's western portion.	Assessor archive, Polk directories, Sanborn maps, windshield survey	Former business present from 1902 through 1949. Partial acquisition would not include any buildings. Potential contaminants in soil and groundwater from historical land use include solvents and metals. Petroleum may be present in fill soil, and if burned material, coal, or heavy oil is encountered, PAHs may also be detected. Site was observed to currently be paved parking area.	**Yes**	**Moderate - Potentially Complex** A portion of the site would be acquired. Shallow groundwater is present. The site has industrial use history and fill materials. Solvent contamination could have affected soil and groundwater. Construction may include shallow excavations for surface street and utility construction.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
380.2-3	Former junk company 1247 Utah Avenue S. King County Parcel #7666207006/ 7666207012/ 7666207025	S. Atlantic Street	Approximately 300 feet south of the project area. Probably upgradient of the project area. Groundwater is estimated to be 6 to 10 feet bgs. Partial acquisition of site's western portion.	Assessor archive, Sanborn maps, windshield survey	Former business present from 1903 through 1951. Partial acquisition would not include any buildings. Potential contaminants in soil and groundwater from historical land use include PCBs and metals. Petroleum may be encountered as a result of historical land use or could be present in the fill. If burned material, coal, or heavy oil is encountered, PAHs may also be detected. Current site was observed to be a paved parking area.	**Yes**	**Moderate - Potentially Complex** A portion of the site would be acquired. Shallow groundwater is present. The site has industrial use history and fill materials. PCBs, if present, would increase complexity of remediation. Construction may include shallow excavations for surface street and utility construction.
380.2-4	Former can company 1259 Utah Avenue S. King County Parcel #7666207006/ 7666207012	S. Atlantic Street	Approximately 550 feet south of the project area. Probably upgradient of the project area. Groundwater is estimated to be 6 to 10 feet bgs. Partial acquisition of site's western portion.	Assessor archive, Sanborn maps, windshield survey	Archive information indicates that a can company formerly occupied a 1902-constructed warehouse. Partial acquisition would not include any buildings. There is a potential for the presence of metals from the past site use and petroleum contamination from a former UST. Potentially affected media include soil and groundwater. Current site was observed to be a paved parking area.	**Yes**	**Moderate - Straightforward** A portion of the site would be acquired. Shallow groundwater is present. The site has industrial use history, fill materials, and a former UST. Construction may include shallow excavations for surface street and utility construction.
360.1-1	Former plating works, boiler works, brass foundry, tin shop, blacksmith, machine shops/ gasoline and oil 501–505 Alaskan Way S. King County Parcel # 7666207697			Sanborn maps	Former business present from at least 1916 to 1950. Potential contaminants in soil and groundwater include solvents, metals, gasoline, and petroleum. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**Temporary Tieback**	**Moderate - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history (particularly metal plating) and the presence of fill materials. The bored tunnel crown is approximately 30 feet bgs in the site vicinity.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
360.1-2	WSDOT King & Alaskan Way S. and former copper works and machine shop 429 Alaskan Way S. (EDR Map No. 232) King County Parcel #7666207695			Ecology CSCSL site (ID #1709769), Sanborn maps	The following information was obtained from an Ecology file review. Borings for the Alaskan Way Viaduct Project were drilled in the right-of-way adjacent to the former copper works. cPAHs were encountered in two borings at concentrations greater the MTCA Method A cleanup levels. cPAHs were detected in boring AH-22 at 18.5 feet bgs (0.92 mg/kg), in boring AH-23 at 17 feet bgs (14.9 mg/kg) and a 26 feet bgs (20.11 mg/kg) (adjusted toxicity equivalency factor values). The Site Hazard Assessment was cancelled in fall 2008. The source of the PAHs is unknown. No other information was available in 2010. Former business was present in 1916. Potential contaminants in soil and groundwater include solvents and metals.	**No**	**Moderate - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has documented contamination, and excavated soils could be contaminated. The bored tunnel crown is approximately 30 feet bgs in the site vicinity.
360.1-3	Former brass foundry, plating, sheet metal works, machine shop, and gas station 501 Alaskan Way S. King County Parcel #7666207695			Assessor archive, Polk directories, Sanborn maps	Former businesses present from at least 1916 to 1950. Potential contaminants in soil and groundwater include solvents, metals, gasoline, and petroleum.	**No**	**Moderate - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history (particularly metal plating) and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 95 feet bgs.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
360.1-13	SR 519 Street Improvement Alaskan Way S. right-of-way (EDR Map No. 250) Adjacent to King County Parcel 7666207695			Ecology CSCSL site (ID#8748379)	Most recent Ecology documentation is a 8/25/2003 report of subsurface investigation at nine locations in the Alaskan Way S. right-of-way; contaminant concentrations in soil included TPH-G at 730 mg/kg, TPH-oil at 2,200 mg/kg, cPAHs at nine of nine locations at >0.1 mg/kg (highest concentration 9.75 mg/kg), lead up to 1,800 mg/kg, arsenic at 73 mg/kg, and cadmium at 4.2 mg/kg. The highest concentrations in soil are above the respective MTCA Method A cleanup levels. Maximum groundwater concentrations in µg/L: arsenic 92, cadmium 11, chromium 740, copper 480, lead 6,300, mercury 4.0, nickel 690, and zinc 1,200. For those hazardous substances for which a cleanup level has been established, the concentrations exceed the respective MTCA Method A cleanup level for groundwater. There was no additional information based on a file review in 2010.	**Already been acquired (site is in right-of-way)**	**Moderate - Potentially Complex** Site is adjacent to the west side of the project area at the cut-and-cover tunnel alignment and area where the tunnel returns to grade (excavations to approximately 75 feet bgs). An easement to install tiebacks for the retaining wall will be acquired. Shallow groundwater is present. Soil and groundwater contamination is present at greater than MTCA Method A cleanup levels for gasoline, petroleum, PAHs, and metals. Excavated soil could be contaminated.
360.15-1	WSDOT (former sheet metal works and freight depot) 90 S. Dearborn (EDR Map #236) King County Parcel #7666206941/ 7666206945	S. Dearborn Street	Adjacent north and west of the project area and potentially below construction to widen Dearborn Street. Probably downgradient of the project area. Perched groundwater is estimated to be 8 to 12 feet bgs. The site has been acquired.	Ecology CSCSL and Brownfield site (ID#6305156), assessor archive, Sanborn maps, windshield survey	Sheet metal works was present in 1916 and was replaced by a freight depot in 1931. Currently site is used as a parking lot (paved and unpaved). From Ecology file review: A heating oil UST was removed in April 2007. Approximately 32 cubic yards of petroleum-contaminated soil was excavated to 9 feet bgs; unable to excavate north and south of tank. The extent of off-site migration is unknown, but contamination likely has migrated east and south into right-of-way. Groundwater was encountered 8.5 feet bgs. Further assessment was recommended, but nothing in Ecology's file indicates whether assessment or further remediation was performed (2009). Potential contaminants include petroleum, metals, and PAHs in soil and groundwater. The site has been ranked as having the lowest assessed risk to human health and environment (WARM BIN #5). Its status is "awaiting remedial action."	**No (already acquired)**	**Moderate - Straightforward** Site is beneath and adjacent to the project area. The site is already owned by WSDOT. The south tunnel operations building is proposed for this block. Shallow groundwater is present. The site has known petroleum contamination. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 75 feet bgs.
Bored Tunnel							

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
340.1-1	Old Seattle Parking Garage 74 Jackson Street (EDR Map No. 225) King County Parcel #5247800150			Ecology LUST site (ID #19537471), assessor archive, Polk directories, Sanborn maps	Archive record indicates that the parking garage was built in 1909, had oil heat, three gas tanks, and vehicle steam cleaner. Historical information indicates that the garage also had an auto body and repair shop; garage present from at least 1938 to 1990. Ecology's summary is as follows. Two abandoned USTs found near footings of buildings; closed-in-place in 1994. Soil samples indicate that gas and diesel are above MTCA Method A. Groundwater was not tested. In 2003, Ecology sent a letter requesting that the owner remediate the site for petroleum contamination concentrations above MTCA Method A and provided information on the VCP. No further information in file; tanks and contamination likely still in place (2010). Gasoline and petroleum (diesel- and oil-range hydrocarbons) may be encountered in soil and groundwater. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Moderate - Straightforward** Site is adjacent to and upgradient of the project area where the tunnel crown is approximately 45 feet bgs. The site has known petroleum contamination.
320.1-3	Former machine shop and metal stamping 112 Alaskan Way S. King County Parcel #5247800025			Assessor archive, Sanborn maps	A factory building was constructed in 1902, and the indicated business was present in at least 1969. Potential contaminants in soil and groundwater include solvents and metals. Other contaminants may be encountered in fill soil.	**No**	**Moderate - Potentially Complex** Site is adjacent to and upgradient of the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 70 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated.
320.1-4	Former printer/mimeo 114 Alaskan Way S. King County Parcel #5247800030			Assessor archive, current assessor records, Polk directories, Sanborn maps	Historical information indicates that the three-story building was constructed in 1900 or 1908; the referenced businesses were present from at least 1938 to 1980. Potential contaminants in soil and groundwater from former land use include solvents. Other contaminants may be encountered in fill soil.	**No**	**Moderate - Potentially Complex** Site is adjacent to and upgradient of the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 70 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated.
290.2-3	Former printers,			Polk directories	Businesses were present from at least 1938 through	**No**	**Moderate - Potentially Complex**

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
	publishers, and marine gasoline and diesel company 71–79 Columbia Street King County Parcel #7666202565				1985. Potential contaminants in soil and groundwater from former land use include solvents, gasoline, and petroleum. Other contaminants may be encountered in fill soil.		Site is below the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 90 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated with solvents, which is denser than water. Petroleum products, if present would affect shallow soil, near the water table.
140.8-2	Seattle Post Intelligencer 521 Wall Street (EDR Map No. 73) King County Parcel #0697000064	Wall Street	Adjacent west of bored tunnel segment. Probably upgradient of the project area. Regional groundwater is estimated to be 130 feet bgs. No planned acquisition.	Ecology CERCLIS-NFRAP (ID#1000576) and CSCSL-NFA site (ID#2173), assessor archive, Sanborn maps	Newspaper operated until recently at a building constructed in 1947–1948. Archive information indicates that the facility had oil burner heat, presses, and ink storage. There was an anonymous complaint in 1979 regarding discharge of spent fixer and other photographic chemicals down the sewer drain. As of 1994, chemicals were transported to a photo processor for disposal. Potential contaminants in soil and groundwater include solvents.	**No**	**Moderate - Potentially Complex** Site has no documented contamination. The tunnel will be constructed below the site, and the tunnel crown is approximately 100 feet bgs. Compensation grouting may be performed to prevent settlement of the building. Historical operations likely involved solvent use, with potential (historical) disposal to sewer. Soil excavated from tunnel zone could be contaminated.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
130.8-1	Grosvenor House Vine Street and former dry cleaner, printer and auto repair businesses 505 Vine Street (EDR Map No. 69) King County Parcel #0697000025			Ecology UST site (ID #21511577), assessor archive, current assessor records, Polk directories, Sanborn maps	Archive records indicate that a two-story garage and storage building was constructed in 1949–1950; two 1,000-gallon tanks were listed. Historical records indicate that the businesses were present from at least 1951 through 1970. Ecology records indicate that three USTs were removed from the site. Potential contaminants in soil and groundwater include petroleum, gasoline, and solvents.	**Temporary Construction Easement**	**Moderate - Potentially Complex** Site is adjacent to or beneath the project area (bored tunnel). A subsurface easement would be acquired for the parcel number. The site has no documented contamination, but the potential exists based on the use history and former presence of USTs. The tunnel crown is approximately 95 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated with solvents based on historical land use; however, petroleum is unlikely to reach the tunnel depth.
North Portal							
60.3-1	Vagabond Inn (former laundry) 327–329 Aurora Avenue N. (EDR Map No. 43) King County Parcel #1991200800 & relation to adjacent parcels south (Parcel #199120815) and west (Parcel #1991200845)	Harrison Street	Adjacent west of the project area. Probably upgradient of the project area. Groundwater is estimated to be 20 feet bgs. The site would be acquired.	Ecology CSCSL and VCP site (ID#95376999), assessor archive, Polk directories, Sanborn maps, windshield survey	A dry cleaner (and gas station) operated from at least 1946 through 1951. The dry cleaner operated from 1946 to 1957 or 1958 according to information provided by the property owner's environmental consultant. A three-story hotel was constructed in 1961 and is present at the site. The following information was obtained from reports and records in Ecology's file. Dry cleaning solvents (trichloroethene and tetrachloroethene) have been documented in soil and groundwater, and the concentrations exceed MTCA Method A cleanup levels (MTCA-A) at some locations. A "hot spot" has been identified in the parking lot. A boring (B-2) identified tetrachloroethene at 6,300 mg/kg at a depth of 13 feet, above the MTCA-A level of 0.05 mg/kg. During a 2001 investigation in the hotel's parking lot adjacent to Aurora Avenue, solvents were detected in every soil sample collected between the depths of 10 and 60 feet bgs. Solvents were also detected in a groundwater sample collected 60 feet bgs. A 2003 investigation collected soil samples from under the building	**Temporary tieback on site;adjacent parcel west acquired; adjacent parcel south temporary tieback**	**High - Potentially Complex** Site is adjacent to the project area. A temporary tieback easement will be acquired for the site. A temporary tieback easement will be acquired for the adjacent parcel, south of the site. The adjacent parcel west of the site will be acquired. The tunnel operations building, with a foundation requiring excavation to approximately 80 feet bgs will be constructed on the adjacent parcel (west) of the site. The temporary tiebacks will extend onto the property and the property south of this site. Solvent contamination is known to exist in soil and groundwater at a depth of 60 feet. The western and southern extents of contamination have not been established and solvent contamination from the dry cleaning operation may have migrated onto adjacent parcels.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
					using angled drilling methods. Solvents were detected in most of the samples collected under the south side of the motel, but concentrations were significantly less or nondetections under the north side. Gasoline related to a former gas station was detected in the western part of the parcel.		
					Subsurface conditions summarized by the site's environmental consultant are consistent with soil conditions encountered in borings drilled for the AWV Program. The subsurface consists of an approximately 10-foot-thick layer of fill overlying an approximate 5-foot-thick layer of medium dense silty sands. This is underlain by a sequence of soft clays to a depth of about 30 feet. A sequence of clayey and silty gravels that contain discontinuous and localized water-bearing zones underlie the clays. Perched groundwater was encountered in a discontinuous zone at a depth of approximately 46 to 50 feet in the center of the west side of the site and at 66 feet at the boring installed in the middle of the parking lot approximately 15 feet west of Aurora Avenue. The majority of the soil contamination encountered south of the building is contained in the blue clay layer present at a depth of 10 to 20 feet bgs. Soil contamination exceeding MTCA Method A extends to a depth of at least 50 feet in the center of the site and at the southern part of the building. The property owner is applying for a Brownsfield loan (2009) to conduct cleanup, to consist of excavating the "hot spot" soil and "enhanced natural attenuation of residual levels of chlorinated solvents in the underlying aquifer."		Soil that would be excavated for the north tunnel operations building and spoils from the tiebacks (if used) could be contaminated with solvents. Solvent contaminated waste (soil, spoils, and/or water) from the site, or adjacent parcels affected by the site, would be considered a dangerous waste and require special handling and disposal. Solvent contamination has also been detected in the Aurora Avenue right-of-way adjacent to the parcel at depths of 20 to 25 feet bgs. This area will likely be filled when Aurora Avenue is brought to grade.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
60.2-1	Public utility 319 Sixth Avenue N. King County Parcel #1991200405	Harrison Street	Approximately 300 feet west of the project area. Probably upgradient of the project area. Regional groundwater is estimated to be 70 feet bgs. No planned acquisition.	Assessor archive, Polk directories, Sanborn maps, current assessor records	Transfer yard/substation structures include a one-story control building, a one-story shop, a pump room, and a crane tower, built in 1950. Potential contaminants in soil include PCBs.	**Temporary tieback**	**Moderate - Potentially Complex** Site is adjacent to the project area. A temporary tieback easement would be acquired. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Spoils could be contaminated and would require special handling if contaminated, but site remediation would not be the responsibility of the project. The north portal would be excavated to an approximate depth of 90 feet bgs. The west side of the portal is adjacent to the property.
50.1-1	Former dry cleaner 606 Harrison Street King County Parcel #1988201090	Harrison Street	Adjacent east and west of the project area at Broad Street and Aurora Avenue, respectively. Probably upgradient of the project area. Perched groundwater is estimated to be 10 to 20 feet bgs. The eastern part of the tax parcel (which includes this site) would be acquired.	Assessor archive, Polk directories, Sanborn maps, windshield survey	A dry cleaner occupied a building constructed in 1944–1945 through at least 1960. PCE has been detected in soil samples collected from borings drilled for the project in the right-of-way along Aurora Avenue at the intersection with Republican Street. Vinyl chloride, a breakdown product of PCE, was detected in perched groundwater encountered approximately 5 feet bgs. An equipment storage shed is present in the north part of the site (Seattle Department of Transportation yard); the south part of the site is part of an unpaved parking lot. Potential contaminants in soil and groundwater include solvents.	**Yes**	**High - Potentially Complex** Although the business may have operated less than 20 years, it operated before regulations were in place that controlled the use and disposal of solvents. Solvents have been detected in soil and groundwater samples collected adjacent to the site. Soil will be excavated to construct ramps for the project. At the south end of the parcel the excavation would extend to a maximum depth of about 35 feet and a width of about 150 feet.
50.1-2	Former laundry dye supply and furniture repair business 600 Harrison Street King County Parcel #1988201090	Harrison Street	Adjacent east and west of project area at Broad Street and Aurora Avenue, respectively. Probably upgradient of the project area. Perched groundwater is estimated to be 20 feet bgs. The site would be acquired.	Assessor archive, Polk directories, Sanborn maps, windshield survey	Records indicate that a laundry dye supply company and furniture repair business, that included paint spraying, occupied a 1924-built warehouse at this site through at least 1950. No buildings currently exist on the site. Potential contaminants in soil and groundwater include solvents.	**Yes**	**High - Potentially Complex** Contamination is not known to exist, but solvent contamination is possible based on site use history. Site conditions should be documented prior to construction use. Soil will be excavated to an estimated depth of 50 feet bgs for the project.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
50.1-3	Former auto repair 410 Sixth Avenue N. King County Parcel #1988201090	Harrison Street	Adjacent east and west of the project area at Broad Street and Aurora Avenue, respectively. Probably upgradient of the project area. Perched groundwater is estimated to be 20 feet bgs. The site would be acquired.	Polk directories, Sanborn maps, windshield survey	An auto repair shop operated from at least 1950 through 1969. No buildings currently exist on the site (part of the Seattle Department of Transportation yard). Potential contaminants in soil and groundwater include petroleum.	**Yes**	**Moderate - Straightforward** Site has no documented contamination. Most likely contaminants are petroleum products. Site conditions should be documented prior to construction use. Soil will be excavated to an estimated depth of 50 feet bgs for the project.
40.1-1	Former machine shop 650 Broad Street King County Parcel #1988201155	Republican Street	Beneath the project area and adjacent west. Probably upgradient of the project area. Perched groundwater is estimated to be 10 feet bgs. The site would be acquired for the Curved Sixth Avenue option.	Sanborn maps, windshield survey	A machine shop was shown on the 1950 Sanborn map. A fitness building constructed in 1994 occupies at least part of the site. Potential contaminants in soil and groundwater include metals and solvents.	**Option**	**Moderate** (for Curved Sixth Avenue option); **low (**for the Straight Sixth Avenue option, which does not require acquisition) **- Potentially Complex** Within or adjacent to project area. Shallow groundwater is present. Contamination is not known to exist, but solvent contamination is possible based on site use history. Construction may include shallow excavations for surface street and utility construction.
40.1-2	Former gas station 624 Republican Street King County Parcel #1988201175	Republican Street	In the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 feet bgs. A 1,000-square-foot triangular parcel in the southeast area of the site would be acquired.	Assessor archive, Polk directories, Sanborn maps, windshield survey	A gas station was present from 1933 through at least 1951. Part of the site is in the current Broad Street alignment. No buildings currently exist on the site. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**Yes**	**Moderate - Straightforward** Shallow groundwater is present. Contamination is not known to exist. Portion of parcel is part of Broad Street; contaminants likely excavated during construction of the street. Construction may include shallow excavations for surface street and utility construction.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
40.1-3	Former auto repair 604 Republican Street King County Parcel #1988201155	Republican Street	Adjacent west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 feet bgs. The site would be acquired for the Curved Sixth Avenue option.	Polk directories, Sanborn maps, windshield survey	An auto repair shop was present from at least 1938 through 1950. A fitness building constructed in 1994 occupies at least part of the site. Potential contaminants in soil and groundwater include petroleum.	**Option**	**Moderate** (for Curved Sixth Avenue option)); **low** (for Straight Sixth Avenue option, which does not require acquisition) - **Straightforward** Adjacent to project area. Shallow groundwater is present. Contamination is not known to exist. Construction may include shallow excavations for surface street and utility construction.
40.1-4	Former paint removing company 526 Sixth Avenue N. King County Parcel #1988201155	Republican Street	Adjacent west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 feet bgs. At least part of the site would be acquired for the Curved Sixth Avenue option.	Polk directories, windshield survey	A paint-removing company operated from at least 1938 through 1960. An office building constructed in 2009 occupies at least part of the site. Potential contaminants in soil and groundwater include metals and solvents.	**Option**	**High** (for Curved Sixth Avenue option); **low** (for Straight Sixth Avenue option, which does not require acquisition) - **Potentially Complex** Adjacent to the project area. Shallow groundwater is present. Contamination is not known to exist, but solvent contamination is possible based on site use history. Construction may include shallow excavations for surface street and utility construction.
40.1-5	Seattle City Seattle Center (former paint company) 601 Mercer Street/520 Fifth Avenue N. (EDR Map No. 26) King County Parcel #1988201155	Mercer Street	Approximately 200 feet west of SR 99. Adjacent to the south side of Mercer Street. Probably upgradient of the project area. Perched groundwater is estimated to be 10 feet bgs. May be acquired.	Ecology ICR site, Sanborn maps, windshield survey	Former company was present at least in 1950. An office building constructed in 2009 occupies at least part of the site. Contaminated soil was encountered during construction of a sports training facility that cojoined blocks 40.05, 50.05 and Site 40.1-5. Remediation of petroleum began with former bus barn at Site 40.05-1 in 1989 (LUST ID#2593) and continued as an ICR under the name Seattle City Seattle Center in 1996. Affected soil was excavated and transported to adjacent bus barn site for landfarming; no assessment or clean up was conducted. Approximately 4,100 cy of PCS was excavated and disposed of off-site in 1997, leaving only isolated areas of soil contamination at concentration above MTCA Method A. Elevated gasoline and benzene levels remain in site	**North side of property may be acquired. Excavation may occur to lower Sixth Avenue to Mercer Street grade.**	**Moderate - Potentially Complex** Within or adjacent to the project area. Shallow groundwater is present. Site has documented contamination whose status is unknown; the potential for contamination still exists. Excavation may occur to adjust street grades and utilities.

Exhibit 4-6. Validated Sites With High or Moderate Potential Impact (continued)

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
					groundwater but the contaminants are not migrating off the site. Recent explorations (2006) indicate only localized soil contamination is present. Fifth Avenue N. Parking Garage 2008 cleanup report (Block 50.02) describes cleanup undertaken during construction of new parking garage; residual contamination remains in soil: Stoddard solvent to the west and south and gasoline to the south and east (Harrison Street and Taylor Avenue N.) of the parking garage construction excavation.		
					Report indicates that restrictive covenant will be implemented. A groundwater remediation program was initiated in 2008 and was still active in 2010. Potential contaminants in soil and groundwater include solvents and gasoline.		

Notes:

bgs = below ground surface
CERCLIS-NFRAP = Comprehensive Environmental Response, Compensation and Liability Information System - No Further Remedial Action Planned
CSCSL = Confirmed and Suspected Contaminated Sites List
cy = cubic yards
Ecology = Washington State Department of Ecology
EDR = Environmental Data Resources, Inc.
ESA = Environmental Site Assessment
ICR = Washington Site Register of Independent Cleanup Reports
NFA = No Further Action
LUST = leaking underground storage tank
mg/kg = milligrams per kilogram
MTCA = Model Toxics Control Act
PAH = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
PCE = tetrachloroethylene
PCS = petroleum-contaminated soil
UST = underground storage tank
VCP = Voluntary Cleanup Program
[1.] Site names are provided for all sites that are listed on Washington State Department of Ecology databases. The name shown in this table is the current Department of Ecology site name. All other sites have been identified based on former land use; contamination has not been confirmed at these sites.

In the bored tunnel alignment, 7 sites are considered to have a moderate potential impact, and 15 sites are considered to have a low potential impact. Sites at both ends of the tunnel were identified because of likely long-term use of solvents and because the crown of the tunnel would be less than 100 feet bgs.

The north portal area is underlain by interlayered fine-grained and coarse-grained soils. Localized perched water has been encountered; however, it is not consistent from site to site. The regional groundwater is 70 to 80 feet bgs. The combination of local perched water and a deep regional groundwater reduces the potential for lateral migration of contaminants. Three sites in this area are considered to have a high potential impact, and four sites are considered to have a moderate potential impact. Another site would have either a high or low potential impact (Site 40.1-4), and two other sites would have either a moderate or low impact, depending on whether the sites are acquired for the Curved Sixth Avenue option (Sites 40.1-1 and 40.1-3). Twenty-six sites were determined to have a low potential impact because of the potential for solvent contamination. Soil and deep groundwater contamination has been confirmed at a former dry cleaner site (Site 60.3-1). Although only tiebacks would be installed on the site, because the groundwater has been contaminated, the site may have affected an adjacent property that would be acquired.

Chapter 5 OPERATIONAL EFFECTS, MITIGATION, AND BENEFITS

Operational effects are those that occur over the long term once the facility is in use. This chapter discusses different types of operational effects, mitigation, and benefits potentially resulting from the Viaduct Closed (No Build Alternative) and the Bored Tunnel Alternative.

5.1 Operational Effects of the Viaduct Closed (No Build Alternative)

Both federal and Washington State environmental regulations require agencies to evaluate a No Build Alternative to provide baseline information about existing conditions in the project area. For this project, the No Build Alternative is not a viable alternative because the existing viaduct is vulnerable to earthquakes and structural failure due to ongoing deterioration. Multiple studies of the viaduct's current structural conditions, including its foundations in liquefiable soils, have determined that retrofitting or rebuilding the existing viaduct is not a reasonable alternative. At some point in the future, the roadway will need to be closed.

The Viaduct Closed (No Build Alternative) describes what would happen if the bored tunnel or another build alternative is not implemented. If the existing viaduct is not replaced, it will be closed, but it is unknown when that would happen. However, it is highly unlikely the existing structure could still be in use in 2030.

The Viaduct Closed (No Build Alternative) describes the consequences of suddenly losing the function of SR 99 along the central waterfront based on the two scenarios described below. All vehicles that would have used SR 99 would either navigate the Seattle surface streets to their final destination or take S. Royal Brougham Way to I-5 and continue north. The consequences would be short-term and would last until transportation and other agencies could develop and implement a new, permanent solution. The planning and development of the new solution would have its own environmental review.

Under Scenario 1, there would be a sudden, unplanned closure of SR 99 between S. King Street and Denny Way due to some structural deficiency, weakness, or smaller earthquake event. Under this scenario, SR 99 would be closed for an unknown period of time until a viaduct replacement could be built. Severe travel delays and congestion would be experienced, and utilities on and underneath the viaduct would likely be damaged and would require repair or replacement.

Scenario 2 considers the effects of a catastrophic failure and collapse of SR 99. Under this scenario, a seismic event of similar or greater magnitude than the 2001

Nisqually earthquake could trigger failure of portions of the viaduct. This scenario would have the greatest effect on people and the environment. Failure of the viaduct could cause injuries and death to people traveling on or near the structure at the time of the seismic event. This type of event could cause buildings to be damaged or collapse and cause extensive damage to utilities. Travel delays would be severe. The environmental effects and length of time it would take to repair the SR 99 corridor are unknown, but the effects would be substantial.

During a seismic event, the soil along the existing viaduct would likely liquefy, causing a substantial reduction in soil strength. Also, the existing Elliott Bay Seawall would likely fail. The combination of weak soil and seawall collapse could lead to the collapse of the viaduct. If lead or asbestos materials are present in the viaduct, this material could become airborne. If the seawall collapses, contaminated surface and subsurface soil near the seawall would be mobilized. In addition, shallow sediment in Elliott Bay would be disturbed and the water column would potentially be exposed to contaminated subsurface sediment.

Operational effects related to hazardous materials are primarily associated with stormwater quality. Most of the stormwater runoff from the study area currently discharges to the combined sewer system. The combined sewer system discharges to Puget Sound through the West Point wastewater treatment plant. Sometimes, during heavy rains, stormwater in the combined sewer system discharges flows directly to Elliott Bay or Lake Union without treatment as a combined sewer overflow. Runoff from smaller portions of the study area discharges directly to Elliott Bay and Lake Union. The pipes within these drainage systems are owned and maintained by private entities, King County, or SPU. The stormwater system is discussed in Appendix O, Surface Water Discipline Report.

If the viaduct is closed and not replaced, the area of pollutant-generating impervious surface (PGIS) would decrease; however, because the surface streets would then carry more vehicles, the pollutant loading on the existing streets would increase. Because of the likely increase in traffic congestion, the increase in number of vehicles is difficult to estimate (see Appendix C, Transportation Discipline Report).

Other operational effects would include potential catastrophic spills of hazardous material or wastes resulting from vehicle accidents.

Hazard identification codes must be displayed on all vehicles transporting pressurized, flammable, oxidizing, toxic, radioactive, and/or corrosive materials. A hazardous material spill or a fire from a vehicle accident could result in hazardous conditions within the study area.

- The atmosphere could become toxic with chemical fumes or smoke.
- The spill or fire could result in physical hazards to people.
- Emergency response vehicles could have limited access.

Subsurface utility corridors and the surrounding coarse backfill could act as preferential pathways for contaminant migration. Contaminants can move easily and can travel long distances along utility corridors as dissolved compounds in shallow groundwater or as free product. As a result, contaminants can affect properties at some distance from the original source of contamination.

5.2 Operational Effects of the Bored Tunnel Alternative

The Bored Tunnel Alternative includes a 1.7-mile-long bored tunnel through downtown Seattle and the south and north portal areas. The south end of the project area for the Bored Tunnel Alternative is S. Atlantic Street, and the north end is Roy Street. After the tunnel and portal areas are constructed and traffic is rerouted onto the new SR 99 alignment, the existing viaduct structure would be removed.

Compared with the existing conditions, the Bored Tunnel Alternative would maintain or reduce pollutant loading and could improve the quality of stormwater runoff discharged from the study area to surface water. Under the Bored Tunnel Alternative, surface street improvements would include stormwater flow control and water quality treatment measures in compliance with Seattle's drainage code. Stormwater quality would be maintained or potentially improved compared to existing conditions. Surface water in the tunnel would be discharged to the combined sewer system. A discussion of stormwater treatment is provided in Appendix O, Surface Water Discipline Report.

A risk associated with an indirect effect of the Bored Tunnel Alternative (and most transportation facilities) would be the potential catastrophic spills of hazardous materials or wastes resulting from vehicle accidents once the road is operational. The environmental impacts may be less in a tunnel because the spill would be contained. However, the potential threat to the health and safety of responders and vehicle occupants would be greater under the Bored Tunnel Alternative than under the Viaduct Closed (No Build Alternative) because the Bored Tunnel Alternative would result in enclosed space with limited access and egress.

Under the Bored Tunnel Alternative, subsurface utility corridors and the surrounding coarse backfill could act as preferential pathways for contaminant migration, similar to existing conditions.

Groundwater in the study area may be locally contaminated. The water table in the south portal area is about 6 to 10 feet bgs. The depth to water increases in the north because of the rise in the ground surface elevation. Since the Seattle Municipal Code prohibits the use of groundwater as a source of potable water, risk to humans

through direct consumption is minimal. Therefore, the greatest threat posed by contaminated groundwater is to the receiving surface water bodies: Elliott Bay, Lake Union, and Puget Sound.

Groundwater flow, and therefore groundwater contaminant distribution, could be altered by the presence of the walls supporting the retained cuts, cut-and-cover tunnels, and ground improvement areas. The retaining walls would extend for a distance of about 500 feet south of the south portal and would essentially block the natural direction of groundwater flow, which could result in a localized higher groundwater level as groundwater backs up against the wall. In particular, groundwater backup could occur along the east side of the walls, because groundwater flow is generally toward Elliott Bay. Groundwater backup could also occur along Alaskan Way, where it may be necessary to improve the structure of recent deposits that overly the tunnel. The localized increases in water levels are expected to be within the normal range of water table fluctuation.

A barrier to groundwater flow, such as the tunnel wall or a ground improvement zone, would hinder contaminant migration to the receiving water by increasing the travel distance. Contaminants would take longer to migrate because they would have to move laterally along the barrier wall before a break or window in the wall would allow groundwater movement toward the receiving water. The backup would have essentially no effect on contaminant concentrations or the amount of contaminants that ultimately reach Elliott Bay.

The Bored Tunnel Alternative could be identified as a contributor to contaminant migration because before project construction, only downgradient properties would have been affected. With lateral movement of groundwater, adjacent properties that were previously crossgradient could be affected. In addition, this alternative could be identified as a contributor if the elevation of contaminated groundwater rises and adversely affects a subsurface structure. However, water level increase is expected to be within the normal range of groundwater level fluctuations. Although this would primarily be an impact evaluated in Appendix P, Earth Discipline Report, which discusses groundwater, if the groundwater is contaminated, the water could require treatment before disposal.

5.2.1 Viaduct Removal

The Bored Tunnel Alternative includes relocating the utilities on the existing viaduct and demolishing the existing viaduct. Demolition of the viaduct would have no operational effects related to hazardous materials. If the viaduct is removed, a benefit of the removal would be that soil liquefaction and potential seawall failure would not cause a collapse of the viaduct and an airborne release of hazardous materials.

5.2.2 Battery Street Tunnel Decommissioning

As part of the Bored Tunnel Alternative, the Battery Street Tunnel would be decommissioned. As part of the decommissioning process, the tunnel should be remediated to remove ACM and LBP at concentrations greater than 1.0 mg/m^2. In samples of soot lining the tunnel, contaminant concentrations exceeded the MTCA Method A cleanup levels, and lead concentrations were greater than the dangerous waste criterion. The concentration of cadmium also exceeded the dangerous waste criterion in one sample (Taylor 2007). Another study conducted in 2008 identified ACM, lead, and mercury. The conduit contains asbestos, and the fire doors are presumed to contain asbestos. LBP was identified on painted fire doors, fire cabinets, and the long yellow painted stripe along the barrier (Pacific Rim Environmental 2008). Low levels of mercury were found in lights, and disposal would need to be managed under the universal waste rule (Pacific Rim Environmental 2008).

The tunnel could be filled with debris generated from the viaduct removal. However, a beneficial use determination must be made before the viaduct debris may be used to fill the tunnel. If concrete is pulverized into small fragments before placement as fill, this would increase the total concrete surface area, which could cause an increase in the pH of water that comes in contact with the concrete. Public Health of Seattle and King County, the local agency responsible for overseeing the solid waste handling standards (WAC 173-350), would look to Ecology for beneficial use guidance for the reuse of viaduct debris as fill. A study may be needed to determine whether there are any hazardous materials issues associated with using the debris as inert fill.

5.3 Operational Mitigation

This section discusses the mitigation measures for the operational effects identified in Section 5.2.

Under the Bored Tunnel Alternative, the tunnel roadway would not be exposed; therefore, the impermeable area would be reduced relative to existing conditions. In addition, stormwater that comes in contact with PGIS would comply with the flow control and water quality treatment requirements specified in Seattle's drainage code, or it would be discharged to the sanitary sewer.

The Seattle Fire Department emergency response crews are equipped to handle small spills and fires. If a large release occurs, the national spill hotline can be contacted to mobilize more resources.

To mitigate preferential pathways in utility corridors, CDF or trench dams could be installed at intervals along utility runs where contamination is suspected to prevent the migration of contaminants in shallow groundwater.

Groundwater monitoring devices have been installed in the Program area to evaluate the groundwater levels over time. Groundwater samples have been collected to assess water quality. Additional groundwater monitoring could be conducted if contaminated groundwater is expected.

Groundwater backup would be evaluated for all walls and ground improvement zones longer than about 100 feet where groundwater could build up against the wall. If the magnitude of the groundwater backup would be less than the current measured natural fluctuation of groundwater in the soil, then no mitigation measures would be necessary because the Bored Tunnel Alternative would not substantially alter the groundwater flow. If greater backup is expected, then mitigation measures could consist of providing a path for groundwater through the retaining walls or ground improvement zones. This could be achieved by constructing pipes or drainage trenches that connect the groundwater flow between the west and east sides of the wall. Before pipes or drainage trenches are constructed, groundwater quality could be evaluated and the placement of the pipes or trenches could be modified to reduce the change in groundwater flow if this alternative is expected to exacerbate existing contaminated groundwater conditions.

5.4 Operational Benefits

A potential benefit of the Bored Tunnel Alternative would be the large-scale removal of contaminated soil that may be present along the alignment, particularly at the south and north portals. Although many of the contaminants identified in the vicinity of the south portal (creosote, lubricating oil, heavy oil, and metals) are not highly soluble, the removal of contaminated soil would reduce future groundwater contamination in the area, if present, and could reduce the potential exposure of workers who participate in future excavation projects in the area.

Ground improvements such as soil mixing, jet grouting, and diaphragm walls in the south portal area and at the south end of the bored tunnel are expected to reduce the mobility of contaminants in soil and their potential to migrate with groundwater.

Chapter 6 CONSTRUCTION EFFECTS AND MITIGATION

Construction effects could arise if contaminated soil or groundwater is encountered during the utility relocations or construction of the bored and cut-and-cover tunnels, retained cuts, retaining walls, soil improvement, and foundations of buildings. Construction effects would likely occur where these activities are required on sites that have been identified as potentially contaminated, based on the evaluation presented in Chapter 4. No sites would present a significant unavoidable adverse impact. All of the potential significant adverse impacts could be mitigated. The potential adverse impacts and the measures that could be taken to mitigate the impacts are discussed in this section.

6.1 Construction Effects

Construction activities would result in several types of effects related to hazardous materials:

- Spoils containing contaminated soil and debris would be removed from the subsurface.
- Spoils with an elevated pH, including spoils from the bored tunnel because of additives, and grout and slurry waste because of cement content.
- Contaminated groundwater would be extracted during dewatering that would occur in the vicinity of the retained cuts, cut-and-cover tunnels, and foundations.
- Groundwater pathways could be modified by subsurface construction, resulting in the potential spread of existing contaminants.
- Air quality could be affected by the release of contaminants and dust during construction and handling of contaminated media.

These construction effects are discussed below for each portion of the project area.

Standard impacts that routinely apply to hazardous material in WSDOT construction projects are shown in Attachment I, Exhibit I-1. These impacts relate to contaminated soil and groundwater, USTs, spills, demolition, worker safety, and public health. Standard impacts and mitigation measures typically apply to low or moderate risk sites with straightforward mitigation measures that can be reasonably predicted based on experience.

6.1.1 South Portal Area

The main roadway would begin at-grade near S. Royal Brougham Way and transition into a retained cut. On- and off-ramps would also be constructed in retained cuts on either side of the side-by-side main roadway. The roadway would continue as a cut-and-cover tunnel, becoming a double-level roadway at the south portal of the bored tunnel, near the intersection of Alaskan Way S. and S. King Street. At the south tunnel portal, the retained excavation would be about 70 feet wide and 95 feet deep to accommodate launching of the TBM. The south portal area would also include a tunnel operations building.

Retaining wall types that could be used in the south portal area for shallower excavations include soldier pile and lagging walls, sheet pile walls, cantilever cast-in-place concrete walls, and diaphragm walls. Diaphragm walls would likely be used to support the sides of cuts deeper than about 15 feet bgs, including the cut-and-cover tunnel, the deeper portions of the retained cuts, and the excavation for the tunnel operations building. The advantage of diaphragm walls is that they can be used as temporary excavation support as well as the permanent retaining wall for the final structure. Diaphragm wall types include deep soil mixing walls, slurry walls, secant pile walls, and tangent pile walls. In addition to supporting excavation sidewalls, diaphragm walls are impermeable (prevent the passage of water), thereby reducing groundwater flow into excavations. After construction, areas between or adjacent to the diaphragm walls would be excavated, and the diaphragm wall would serve as the retaining wall for the excavation.

Ground improvement may be performed beneath or around foundations and/or the retained cuts and cut-and-cover tunnels to stabilize soft soils, reduce groundwater inflow, and/or mitigate potential liquefaction. Ground improvement could consist of deep soil mixing, jet grouting, or a less likely method, vibro-replacement (stone columns).

The Bored Tunnel Alternative in the south portal area also includes the construction of new east-west and north-south surface streets over the cut-and-cover portion of the new SR 99 roadway between S. King Street and S. Royal Brougham Way. These streets would be constructed at-grade. Several fills may be constructed to connect the SR 99 roadway to the new mainline elevated structure south of S. Royal Brougham Way and within the cut-and-cover sections above the finished roadway structures.

Contaminated Spoils

Construction methods that would involve direct soil removal in the south portal area include excavation for retained cuts, retaining walls, changes in grade, and utilities. Similarly, the use of drilled shafts for the construction of diaphragm walls would result in large volumes of spoils that would have to be handled and properly

disposed of. Ground improvement techniques used in construction would also generate large volumes of spoils. Jet grouting operations, which inject cement grout to strengthen subsurface soils, typically produce spoil volumes equal to about 50 to 70 percent of the volume of soil treated. This spoil material would consist of a blend of eroded soil and cement grout flushed to the ground surface during grouting. Deep soil mixing, which involves in situ mechanical mixing of soil and cement, would produce spoil volumes equal to about 30 to 50 percent of the volume of soil treated. The spoils from this method would consist of blended soil and cement with the consistency of thick mud; this material would have to be allowed to settle before it could be handled or disposed of.

Jet grouting or soil mixing would displace potentially contaminated soil to the surface. Irrespective of the potential contaminants, special handling would be required because the spoils would consist of commingled cement and soil. The spoils would need to be contained to allow them to stabilize before being transported to a disposal area.

For the south portal area, the estimated volume of material that would be excavated or generated as spoils is 440,000 cy. Site demolition and ground improvement activities would result in additional spoils, but the quantities are unknown. About 50 percent of the excavated material (217,400 cy) could be considered potentially contaminated or require special handling. The estimated volumes of soil that would be excavated are summarized in Exhibit 6-1. These volumes are based on design parameters and are estimated to be within 30 percent of the actual volumes. The quantities are estimates based on the depth of fill, all of which is assumed to be contaminated. As shown in the profile view of the proposed excavation and the major geologic units, the fill layer extends to a depth of approximately 20 to 30 feet bgs (see Exhibit 4-2).

Fill in the south portal area consists of soil and debris from unknown sources. Construction throughout this area could encounter contaminants such as petroleum, metals, and PAHs in the fill soils, as well as creosote-treated timbers and wood debris. Coal from the S. King Street coal pier was also used as fill and is associated with PAHs. As described in Section 4.2, low concentrations of petroleum and other contaminants have been detected in this area; however, contaminant concentrations appear to be less than the dangerous waste levels but sometimes greater than the MTCA Method A cleanup levels. In addition to being contaminated, the fill soil would not be suitable for use as structural fill unless it is screened to remove the wood debris that is comingled with the soil. The soil may be segregated based on the level of contamination and pH of the spoils. Characterization samples of the stockpiles would likely be needed to support waste designation. Depending upon

Exhibit 6-1. Estimate of Total and Potentially Contaminated Excavation Quantities (in Cubic Yards)

Location		Demolition Debris	At-Grade	Excavation	Bored Tunnel	Total Material
Viaduct	Total	107,000	--	--	--	107,000
	Contaminated	107,000	--	--	--	107,000
South portal	Total	--	20,000	420,000	--	440,000
	Contaminated	--	20,000	197,400	--	217,400
Bored tunnel	Total[1]	--	--	--	808,000	808,000
	Contaminated	--	--	--	8,080	8,080
North portal	Total	--	88,000	145,000	--	233,000
	Contaminated	--	24,470	72,500	--	96,970
Dangerous waste from dry-cleaning operations		--	--	1,600	--	
Contained-in waste		--	12,235	34,640	--	
Contaminated soil		--	12,235	36,260	--	
Total excavated		**--**	**108,000**	**565,000**	**808,000**	**1,481,000**
Total demolition and excavated		**107,000**	**108,000**	**565,000**	**808,000**	**1,588,000**
Total excavated material needing special handling and disposal		**--**	**44,470**	**269,900**	**8,080**	**322,450**
Total material needing special handling and disposal (demolition and excavated)		**107,000**	**44,470**	**269,900**	**8,080**	**429,450**
As a percentage of total		100%	41%	48%	1%	27%

Notes:
Contaminated material includes waste material needing special handling and disposal. It includes soil with concentrations of chemicals that warrant restricted disposal, construction debris, and wood waste. Areas of ground improvement have not been identified, except for the wood waste at the south end of the bored tunnel.
Bored tunnel: Contaminated fill and former dry cleaner sites are located in the immediate vicinity of the ends of the tunnel. One hundred feet of tunnel, about 1 percent of the length of the tunnel, is assumed to be contaminated.
Contained-in waste: Based on available data, historical site uses (Vagabond Inn and City maintenance yard), and percentage of soil contaminated with solvents.
Contaminated waste: Remaining quantity, subtracting dangerous/F-listed and contained-in waste from total contaminated.
Dangerous waste: Dangerous waste known at Vagabond Inn. Assume portion (25 percent) of secant pile wall adjacent to property is contaminated. No dangerous waste has been identified for the City maintenance yard.
Demolition debris: Assume entire quantity is contaminated and would require special handling.
North portal: Between Stations 300+00 and 304+40, assume half of the estimated total quantities are contaminated (northbound roadway, closest to Vagabond Inn (Site 60.3-1). Between Stations 304+40 and 310+50, assume half of secant wall is contaminated (closer to former laundry that may have had dry-cleaning operations at current City maintenance yard; Site 50.1-1), and half of total structure excavation is contaminated.
South portal: Fill extends about 25 feet deep within the south portal footprint. Assume all fill is contaminated.
[1]The pH of spoils from the bored tunnel may be greater than 8.5. For disposal at a land reclamation facility, the spoils would have to be amended to reduce the pH.

the level of contamination, clean, low, or above MTCA Method A, the spoils may be transported to a land reclamation facility or a RCRA Subtitle D landfill. Dangerous waste must be disposed of at a RCRA Subtitle C landfill. Soil disposal options are discussed in Section 6.5, Contaminated Media Handling and Disposal Options. All of the material that would be removed for at-grade work is assumed to be contaminated or require special handling. Included in these estimates are all of the pavement, surface structures, and obstructions that would require special handling because of the presence of brick and asphalt mixed with the concrete.

Handling and disposal of spoils from the project could present a significant adverse effect; however, these effects will be mitigated by development and implementation of management plans. Construction effects would also be mitigated by establishing a budget that reflects the costs associated with disposing of contaminated spoils and dewatering water. Early identification of contaminated soil and groundwater, and waste characterization, although increasing up-front costs, may minimize the volume of contaminated spoils. Areas of contamination could be avoided, construction methods could be modified to address contaminated media, and contaminated spoils could be segregated for appropriate disposal. Adequate laydown areas have been identified to allow for sufficient stockpiling of soil and characterization sampling, without affecting the construction schedule.

A maximum of 2,800 cy of soil per day could be excavated in the south portal area. This is the equivalent of between 4,000 and 5,000 tons of soil. Based on engineering estimates, the laydown area(s) should be capable of storing approximately 25,000 cy of spoils, approximately 2 weeks of spoils. This is equivalent to a 250-by-250-foot area that is 11 feet tall. If characterization samples are not required, soil disposal would be more expedient. Either a smaller laydown area would be needed or the storage capacity would increase assuming a multiplier of 1.8 cy per ton. Individual waste disposal companies operating in King County typically have the capacity to accept 4,000 to 5,000 tons of material per day, assuming two shifts of work. If necessary, two or more waste disposal companies could be contracted for spoils disposal. Excavated fill, which is expected to be contaminated, could be hauled by truck to one of several staging areas identified in the south end or hauled directly to the disposal company's intermodal facility. Spoils could be routed to multiple facilities or temporarily stored until the facility's operations could accommodate them. The additional cost for stockpiling is estimated to be between $3.00/cy and $5.00/cy, not including analytical testing, if required. The material would then be transported by rail or barge to a facility permitted to accept the soil. Most of the native soils in the south area and bored tunnel section would likely not require disposal at a facility permitted to accept contaminated soil; however, elevated pH levels associated with glacially overridden soils and spoils from tunneling may need to be neutralized before the spoils can be disposed of at a land reclamation facility. These soils are expected to be otherwise clean, based on sampling that has occurred

to date. Unit costs for disposal for the various classifications of waste are presented in Section 6.6.3. Handling and disposal options are presented in the *Draft Spoils Handling and Disposal Planning Report* (PB 2009b).

South Portal Dewatering and Groundwater Contamination

As discussed in Appendix P, Earth Discipline Report, the water table in the south portal area is located about 6 to 10 feet bgs. Therefore, dewatering would be required during construction of the cut-and-cover tunnels and most of the retained cut sections. Preliminary analyses from the design team indicate that pumping rates along the alignment may range from 100 to 1,000 gallons per minute (approximately 0.2 to 2 cubic feet per second) per 100 feet of open excavation. Dewatering during construction could result in groundwater flow toward the excavated area; therefore, subsurface contaminants, including total petroleum hydrocarbons (TPH), total suspended solids (TSS), and trace organics, could migrate toward the excavation from areas outside the alignment and increase pollutant concentrations in dewatering water (PB 2009b). As a result of dewatering, water table drawdown in soils in the vicinity could result in ground settlement, which could damage sensitive structures and facilities. Dewatering would likely continue until the construction of the tunnel retaining wall is completed, which is estimated to take approximately 9 months. Significant adverse effects could be associated with dewatering in the south area. However, these effects could be mitigated by development and implementation of construction management plans describing the dewatering approach and discharge options. Discharge of dewatering water will have to comply with federal, state, and local regulations, as described in Section 6.5.4, Minimization of Effects.

Two zones of groundwater have been identified: a shallow zone extending from the water table to a depth of about 30 feet, which is the depth of the fill/native soil contact, and a deeper water-bearing zone. The interaction between the two zones would be evaluated before construction and would be summarized in a groundwater conditions report. Better estimates of pumping rates for dewatering the excavation would also be available before construction and summarized in a report.

Diaphragm walls would prevent shallow groundwater from infiltrating the excavation, reducing the volume of shallow groundwater that would be discharged. The volume of shallow water is estimated to be approximately 1.5 million gallons for the whole south portal area, assuming a 30-foot-thick shallow water zone and a soil porosity of approximately 30 percent.

During installation of drilled shafts or cast-in-place piles, shallow groundwater or water used to stabilize the hole during drilling would be displaced to the ground surface. This water may have a pH greater than 10 because of its contact with the grout. Water with a pH greater than 10 would need to be treated before

discharge. At a pH of 12, the liquid would be considered a dangerous waste. Fines (cement) may also be suspended in the water.

If H_2S is encountered, special procedures may be required, including monitoring and mechanical ventilation of excavations. For any dewatering activities that encounter H_2S dissolved in the groundwater, treatment would most likely be required before discharge.

Water that is discharged to the combined sewer would need to be treated and discharged in accordance with the King County Wastewater Discharge Permit or Authorization and with DPD and SPU's Director's Rules for dewatering. Water that would be reinjected to mitigate settlement of nearby structures would meet Washington's Water Quality Standards for Groundwater (WAC 173-200). The project would likely be considered a large volume discharger, because it would likely produce more than 25,000 gallons per day during the wet season (November through April). Volume for construction site dewatering would be determined once the construction methods and sequencing have been determined. The limits are site-specific and have not been determined at this stage of the design. If the volume of water exceeds King County's or Seattle's sewer capacity, it would be temporarily stored on site, reinjected, or transported off site for disposal. Handling and disposal of water generated during dewatering is addressed in Appendix O, Surface Water Discipline Report.

Groundwater Flow

Dewatering would be required for the construction of the cut-and-cover tunnels, most of the retained cut sections, and excavations for the tunnel operations building. This would alter the groundwater flow and the distribution and contaminant concentrations in contaminated groundwater plumes.

Ground improvement extending to below the water table is expected to be necessary in a block area in the south end. Diaphragm walls for the cut-and-cover tunnel and most of the retained cuts in the south portal area would also extend below the water table. The ground improvement and diaphragm walls for the cut-and-cover tunnel would create a more extensive barrier to groundwater flow than the barrier that currently exists, resulting in an alteration of groundwater flow paths.

Ground freezing is another method of ground improvement that would be a barrier to groundwater flow into an excavation, in much the same manner as a diaphragm wall. This method may require installing three or more rows of freeze pipes spaced from 3 to 5 feet apart to achieve blocks of frozen soil. The refrigeration coolant is circulated through the pipes. Groundwater movement and salinity can hamper freezing efforts, requiring longer periods of time or lower temperatures to achieve an adequate diameter of frozen ground and continuity

between freeze pipes. It is important to maintain a consistent line and grade to freeze blocks of ground.

Ground freezing is a temporary measure to alter (cut off) groundwater flow and provide support for an excavation. Although technically feasible, ground freezing in the south portal area by itself would not satisfy the long-term structural requirements. Additional permanent structural support and waterproofing for the operations building and the cut-and-cover tunnel would still be necessary. A potential impact of ground freezing would be heave and permanent deformation locally around the frozen soil zone. Additional potential impacts would include disturbance at the ground surface due to extensive networks of circulation pipes and refrigeration equipment, as well as potential chemical release, depending on the method of refrigeration that is selected. These impacts could be mitigated during design with probable associated cost implications.

For both ground freezing and diaphragm walls, dewatering would be required to lower the groundwater table within the excavation until the permanent structure is completed. Reinjection of deep groundwater to mitigate potential settlement of nearby buildings would also create a hydraulic barrier that would reduce potential changes in groundwater flow patterns due to dewatering.

Installation of temporary or permanent barriers to groundwater flow could result in crossgradient migration of contaminated groundwater, potentially contaminating areas adjacent to the constructed, less permeable zone.

Air Quality

Air quality could be adversely affected by contaminated soil. Surface material and near surface soil may be dry, and dust could be generated during excavation and handling activities. Dust from contaminated stockpiled soil could also be released into the air. However, most of the excavated material is expected to be moist to wet, reducing the potential for dust during handling and from stockpiles. In addition, gasoline and gasoline-related VOCs such as benzene could be released. ACM and LBP could be released during building demolition.

6.1.2 Bored Tunnel

The bored tunnel alignment would extend from near S. King Street at the south end, generally along Alaskan Way, west of the existing viaduct. North of S. Washington Street, the tunnel would extend north until it would be located beneath First Avenue. The tunnel would continue along First Avenue until about Stewart Street, where it would trend north again until it ends near the intersection of Sixth Avenue N. and Thomas Street. The bored tunnel would be approximately 1.7 miles long and 54 feet in diameter (outside edge of the liner).

At the south portal, the tunnel invert would be about 75 feet bgs. The maximum depth of the tunnel invert (about 270 feet bgs) would be located near Virginia Street. At the north portal, the tunnel invert would be about 90 feet bgs. The roadway in the bored tunnel would be a double-level configuration, with the southbound lanes on the upper level and the northbound lanes on the lower level.

The bored tunnel would be constructed using a TBM. Two types of TBMs are being considered: an earth pressure balance (EPB) machine and a slurry pressure balance (SPB) machine. Typically SPB TBMs are more suitable for granular soils (e.g., sand and gravel), and EPB TBMs are more suitable for fine-grained clay and silt soils. Both types of soils are present along the proposed bored tunnel alignment.

For the EPB TBM, the excavated material exiting through the screw conveyor would generally consist of wet, cohesive mud with a toothpaste-like consistency. This excavated material would then be transported via conveyors or muck cars to the starting point of the tunnel for transfer into trucks, railcars, or barges for off-site disposal. The SPB TBM uses slurry to pressurize the face during the excavation and transport of the cuttings. The slurry and excavated material would be very wet and would be transported through pipes to a slurry separation plant located on the ground surface at the starting point of the tunnel. The slurry separation plant would likely be located on WSDOT property west of First Avenue S., in the south portal area. A slurry separation plant typically consists of an arrangement of conveyors, pumps, centrifuges, filters, and sumps. The plant would process the spoils exiting the tunnel to separate the slurry from the excavated soil, allowing the slurry to be recycled and used to further excavate the tunnel. After separation, the remaining wet soil spoils could be stockpiled and/or loaded into trucks, railcars, or barges for off-site disposal.

Ground improvement may be performed along the tunnel alignment to improve soil behavior and mitigate potential ground loss. Ground improvement along the bored tunnel is expected to consist of jet grouting or compensation grouting. It may be performed above the tunnel launching and receiving areas as well as between S. King Street and S. Jackson Street, where the recent deposits of soil consist of loose fill with localized areas containing wood debris. Compensation grouting, performed through the tunnel liner or from the ground surface, would mitigate ground loss during tunneling, or beneath structures where settlement is expected or detected during construction of the bored tunnel. Grout is injected into the ground beneath the structure foundation, forming a grout bulb. Spoils are generated from advancing the grout hole.

Another potential ground improvement method is ground freezing. As described for groundwater flow in the south portal area, this method may require installing

three or more rows of freeze pipes spaced from 3 to 5 feet apart to achieve blocks of frozen soil.

This method could be used to form a stiffened arch around the crown of the tunnel and would likely yield similar results as the jet grout arch. Ground freezing could likely be used to improve the strength and behavior of the soils in the tunnel crown with more certainty than jet grouting. Another advantage to ground freezing is its ability to be implemented horizontally from an access shaft, reducing total drilled footage and the associated cost. Ground freezing could also be implemented from the ground surface. Additionally, ground freezing is not subject to blind spots or reduction in the diameter of improved soil in the same manner as jet grouting. Depending on which areas and depths are subject to ground freezing, contaminated soil could be removed during the installation of the freeze pipes.

Contaminated Spoils

The bored tunnel would advance through native soil. Along Alaskan Way S., localized contamination of native soil may be associated with treated piles. Ground improvement techniques that access subsurface soils from the ground surface would advance through contaminated fill soils, particularly at the south end of the tunnel, south of Marion Street. Spoils from compensation grouting accomplished through the tunnel liner are unlikely to be contaminated because the grouting occurs at depth, and spoils are brought through preestablished portals in the tunnel liner; however, the pH of the spoils may be elevated. The areas requiring ground improvement have not been delineated; therefore, spoil volumes from ground improvement have not been estimated.

The estimated volume of material that would be excavated is 808,000 cy, with 1 percent of this volume identified as contaminated. The estimated volumes of soil that would be removed during construction are summarized in Exhibit 6-1. Assuming an advance rate of 30 feet per day, approximately 3,900 to 6,600 tons of soil would be generated each day. Due to the depth of the bored tunnel and because it will be advanced through native soil, it is reasonable to assume that a high percentage of the spoils would be less contaminated than those from the south and north portal areas. Along the waterfront, native soil may have been contaminated by creosote-treated piles. Elevated metals concentrations may be encountered, generally less than MTCA Method A levels, with possible isolated occurrences of organic contaminants. Glacially deposited soil may have elevated levels of pH (above 8.5), based on experience from a tunnel advanced in east Seattle. In addition, construction additives mixed with soil may elevate the pH of the spoils.

The spoils would be handled using methods similar to those employed for the south portal, with the possible addition of a slurry treatment plant. Handling and

disposal of spoils from the bored tunnel portion of the project could present a significant adverse effect; however, potential effects from spoils management will be mitigated, with development and implementation of construction plans that address contaminated media and pollution prevention, logistical planning, and the establishment of a budget that reflects the costs for managing and disposing of contaminated media.

Contaminated Groundwater

The depth to groundwater and the quality of groundwater in the southern part of the bored tunnel alignment are similar to conditions in the south portal area. As the elevation of the ground surface continues to increase, the depth to groundwater increases to approximately 80 feet near the north end of the tunnel alignment. Both types of TBMs keep pressures relatively equal inside the tunnel and in the surrounding soil to minimize the potential for soil loss and sinkholes. Dewatering would not be required except in the rare circumstance of a major boring machine failure in an area of high groundwater pressure. Under these circumstances, water that is discharged to the combined sewer would need to be treated and disposed of in accordance with the King County Wastewater Discharge Permit or Authorization and in accordance with SPU and DPD requirements. If the water exceeds the contaminant criteria, it would be treated before it is discharged. Significant adverse effects from dewatering are not expected, unless the boring machine malfunctions.

Groundwater Flow

Localized areas of ground improvement could alter groundwater flow. Groundwater backup along the bored tunnel north of Yesler Way is not expected. The lower aquifers that intersect the 54-foot-high tunnel horizon are widespread, interconnected, and highly pervious, allowing water to flow around the tunnel.

Air Quality

There is a low potential for contaminated soil to adversely affect air quality during construction of the bored tunnel. The soil would be removed from the tunnel as slurry. The slurry would be contained, and spoils would be stockpiled for off-site disposal. Because the material would be moist to wet, little dust is expected from stockpiles. Soil removed for installation of drilled shafts would also be moist to wet because these borings would extend past the water table. Gasoline and gasoline-related VOCs such as benzene have not been identified in the soil that would be removed in this section.

6.1.3 North Portal Area

At the north portal of the tunnel, near the intersection of Sixth Avenue N. and Thomas Street, the double-level roadway would exit the tunnel and extend north

into a cut-and-cover tunnel for the first 450 feet as it unbraids and the excavation becomes shallower. At the north end of the cut-and-cover section, the northbound and southbound roadways would be side by side and about 35 feet and 20 feet bgs, respectively. The excavation would be about 150 feet wide. From this point northward, two separate excavations may be performed to construct the side-by-side retained cut roadways. The retained cut roadways would continue north until they reach existing grade near Broad Street, which would be filled in as part of the Bored Tunnel Alternative. At the tunnel portal near Thomas Street, the retained excavation would be about 70 feet wide and 90 feet deep to receive the TBM at the completion of tunnel boring. Along the cut-and-cover section in the north portal area, the retained excavation would be filled in after the roadway structure is constructed. The surface streets above the SR 99 roadway area would then be connected at John, Thomas, and Harrison Streets.

Two configurations for Sixth Avenue N. and the southbound on-ramp are being considered:

- Curved Sixth Avenue N. option – proposes a new roadway that would extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets. The new roadway would have a signalized intersection at Republican Street.
- Straight Sixth Avenue N. option – proposes a new roadway that would extend Sixth Avenue N. from Harrison Street to Mercer Street in a typical grid formation. The new roadway would have signalized intersections at Republican and Mercer Streets.

The existing retained cut along Mercer Street would be widened to accommodate two additional lanes of traffic. Construction of this connection and the roadway widening would require demolition of portions of the existing retaining walls at Mercer and Broad Streets. The retained cut roadway along Mercer Street from Fifth Avenue N. to Dexter Avenue N. would be widened from four lanes to six lanes, requiring construction of new retaining walls for the widened roadway. The north portal area would also include a tunnel operations building.

Contaminated Spoils

Contaminated spoils would likely be encountered in the north portal area. Five classifications of soil would likely be excavated in this area:

- Soil acceptable at a land reclamation facility permitted to accept low levels of contaminants and pH-affected soil
- Soil containing contaminant concentrations exceeding MTCA Method A cleanup levels.
- Dangerous waste, associated with former dry cleaners.

- Contained-in waste (waste from dry cleaners with a solvent concentration less than the dangerous waste concentration). This site-specific designation is provided by Ecology.
- Clean soil (no detected contaminants).

During construction, soil containing contaminants below MTCA may be difficult to segregate from soil with higher concentrations of contaminants, particularly petroleum. Similar to the south portal, soil would be transported to the staging area(s). Confirmation sampling of the stockpiles would likely be needed to support soil characterization. Depending upon the level of contamination, clean, low, or above MTCA Method A, the spoils may be transported to a land reclamation facility or a RCRA Subtitle D landfill. Dangerous waste must be disposed of at a RCRA Subtitle C landfill. Soil contaminated with dry-cleaning solvents would require special handling and disposal. Soil disposal options are discussed in Section 6.5.5, Contaminated Media Handling and Disposal Options.

Characteristic dangerous waste for elevated levels of metals could be present. These soils would have metal concentrations greater than the characteristic (TCLP criteria) levels for dangerous waste. Elevated concentrations of metals have not been encountered at the north portal.

Solvent-contaminated soil from a dry-cleaning operation has been detected at the Vagabond Inn site (Site 60.3-1), the parcel adjacent to the proposed location for the north tunnel operations building. A laundry that may have had dry-cleaning operations (currently City maintenance yard) was located in the proposed retained cut section of the alignment, one block north of the Vagabond Inn site. Gas stations and auto repair shops operated adjacent to the proposed alignment and may have released petroleum products.

The estimated volume of material to be excavated for the north portal area is 233,000 cy. Approximately 96,970 cy, of which 24,470 cy are at-grade spoils, These would require special handling because of contamination. Assuming the excavated soil is assigned to the most restrictive category (with no overlap); the following quantities are estimated for each soil classification:

- Soil contaminated at levels less than dangerous waste criteria , excluding contained-in waste: 36,260 cy
- Dangerous waste associated with dry-cleaning operations: 1,600 cy
- Contained-in waste: 34,640 cy
- Clean soil: 130,245 cy

The quantities of dangerous waste and contained-in waste are based on available data. Additional investigations are anticipated, and data from the investigations would be incorporated into the design. Ecology must issue a contained-in

designation for qualifying soils. The estimated volumes of soil that would be removed during construction and the assumptions used for the estimates are summarized in Exhibit 6-1. Similar to the south portal area, handling and disposal of spoils from the north portal area would present a significant adverse effect. A maximum of 2,800 cy of soil per day could be excavated in the north portal area. This is the equivalent of 5,040 tons of soil, assuming a multiplier of 1.8 cy per ton. A waste disposal company operating in the area has estimated that it can accept 4,000 to 5,000 tons of material per day, assuming two shifts of work. If necessary, two or more waste handlers could be contracted for spoils disposal. Excavated soil, would be hauled by truck to staging areas identified in the south portal area or directly to the spoils loading area. Spoils could be routed to multiple facilities or stockpiled until the facility's operations could accommodate them. The material would then be transported by rail or barge to a facility that is permitted to accept the material. Contaminants have been encountered in both fill and native soils and are associated with localized land uses, such as a service station or dry cleaner.

If contaminant concentrations exceed dangerous waste criteria, the material would require disposal at a RCRA Subtitle C landfill. Handling, storage, and transport measures would need to comply with RCRA. Contained-in designated soil can be taken to Subtitle D landfill. Requirements for a contained-in designation are discussed in Section 6.5.5 Contaminated Media Handling and Disposal Options.

If the disposal company requires additional testing of excavated soil, then the schedule would slide and costs would increase. Additional soil handling may be required to segregate clean, possibly contaminated, and contaminated soil. With expedited analysis of the soil, the project could be delayed from a few days to a few weeks, depending on the volume of soil, the number of samples, and the disposal company review and acceptance of analytical data. Costs for analytical testing are shown in Section 6.6.1. Costs associated with stockpiling soil could range from $3.00/cy to $5.00/cy, depending on how far the soil has to be transported and the logistics of the stockpile site. If no predesignation can be accomplished and all soil has to be stockpiled, the project could incur significant delays and costs associated with the additional handling and testing. Unit costs for disposal for the various classifications of waste are presented in Section 6.6.3. Handling and disposal options are presented in the *Draft Spoil Handling and Disposal Planning Report* (PB 2009b).

Contaminated Groundwater

Groundwater in the north portal area is perched. The regional groundwater table is approximately 70 to 80 feet bgs. Localized areas of contamination have been identified. Tetrachloroethylene has been detected in perched groundwater in the

vicinity of Aurora Avenue and Republican Street, where the ramps are approximately 5 to 10 feet bgs. Groundwater is approximately 6 feet bgs, as measured in monitoring well AB-4. It is perched on silty to clay fill with scattered layers of sand. At a nearby Geoprobe® location, perched groundwater has been measured at about 9 feet bgs; it is perched on a peat layer. Depth to water in a well at Harrison Street and the west side of SR 99 has been measured at 15 feet bgs; it is perched on peat and underlain by clay to 33 feet bgs. The lenses of water-bearing sand are not laterally continuous and are underlain by fine-grained soil. Monitoring wells are slow to recover. Dewatering in these circumstances would likely be accomplished with the use of a sump pump in the excavation.

Dry-cleaning contaminants have been detected in groundwater at a depth of approximately 60 feet bgs on the adjacent property east of the proposed location for the tunnel operations building at the north portal. It is unclear whether this water is perched or is regional groundwater. The western extent of the tetrachloroethylene is unknown. The excavation for the tunnel operations building ranges from about 50 feet bgs at the north end of the block to 80 feet bgs mid-block and south. Dewatering would likely be necessary for the deeper part of the excavation. Water removed during dewatering could be contaminated with tetrachloroethylene.

If tetrachloroethylene and other dry-cleaning contamination is found at properties with former dry-cleaning operations, any solvent-contaminated groundwater removed from the area would be considered a dangerous waste, because it was contaminated by a dry-cleaning operation. The water would have to be treated, most likely by passing it through a granular activated carbon (GAC) filter, before disposal in the combined sewer system or sent off site for treatment as dangerous waste. The waste handling requirements also extend to solvent-contaminated spoils from adjacent properties that are believed to be adversely affected by the dry-cleaning operation.

Petroleum contamination is also likely at the north portal. Gas stations and auto repair business were formerly located along Aurora Avenue. Depending on the concentrations of petroleum and petroleum-related VOCs in the groundwater, the water may need to be treated before discharge.

Water that is discharged to the combined sewer would need to be treated and disposed of in accordance with the King County Wastewater Discharge Permit or Authorization and DPD and SPU requirements. Water exceeding the water quality criteria would be treated on site before it is discharged, or it would be transported off site for treatment and disposal. Discharge rates and volume are project specific and are established once construction methods and sequencing have been determined. If the volume of water exceeds King County's or SPU's combined sewer capacity, it would be temporarily stored on site or transported

off site for disposal. On-site storage of large volumes of water would present a problem because of the few staging areas located in the north end.

Groundwater Flow

Substantial dewatering is not expected to be necessary for the proposed excavations in the north portal area because the water table is located more than about 70 feet bgs. Perched groundwater occurs in sand lenses underlain by silty to clay fill and/or peat and fine-grained fill. Perched seepage zones may exist above the regional water table; however, this seepage can typically be controlled by sumps and pumps in the excavations. The regional groundwater flow is toward Lake Union. Depending on the location of the dewatering well(s) and the pumping rate, the cone of depression could extend to the adjacent property. Contaminated groundwater could be encountered and drawn into areas that were previously not contaminated, and discharge from dewatering operations could contain hazardous materials.

Significant adverse effects associated with dewatering efforts in the north area are not expected. Because of a stepped foundation, only a portion of the tunnel operations building would extend 10 to 20 feet into the regional groundwater. Construction techniques that limit dewatering could be implemented for this area.

Air Quality

Air quality at the north portal area could be affected by dust from contaminated stockpiled soil. In addition, dry-cleaning solvents may be present in soil excavated for construction of the north tunnel operations building. These solvents could volatilize during excavation and affect the environment, workers, and the public. To minimize potential exposure, Ecology does not permit contained-in soil stockpiling at the site unless it is conducted in accordance with the dangerous waste rules (WAC 173-303-200). Gasoline-contaminated soil may also be encountered during the removal of soils from former gas station sites.

6.1.4 Viaduct Removal

Demolition of the existing viaduct would likely be performed using hoe-rams and other vibratory equipment. The viaduct bents would be removed to approximately 5 feet bgs and in some locations deeper to accommodate future underground utilities. Utilities currently attached or suspended on the viaduct structure would need to be relocated, which would require some excavation. The location or depth of the excavations has not yet been determined, but the utilities would be located adjacent to the existing structure and could be buried to depths up to 4 or 6 feet, and possibly more in a few cases, depending on the utility type.

Some contaminated soils and groundwater have been documented in the vicinity of the viaduct. WSDOT is the lead agency responsible for management of contaminated soils and groundwater for the viaduct removal. The 2006 Supplemental Draft EIS documents potential contaminated sites in the vicinity of the viaduct.

6.1.5 Battery Street Tunnel Decommissioning

The Battery Street Tunnel would be decommissioned as part of the Bored Tunnel Alternative. As part of the decommissioning process, the tunnel should be remediated to remove ACM and LBP. In samples of soot collected from the tunnel lining, concentrations of cadmium, lead, cPAHs, and oil-range hydrocarbons exceeded the MTCA Method A cleanup levels for unrestricted land use. Arsenic also exceeded the MTCA Method A cleanup level in a few of the samples. Testing by TCLP indicated that lead concentrations exceeded the dangerous waste threshold in five of the six samples, and cadmium exceeded the threshold in one sample (Taylor 2007). These materials could become airborne. Any hazardous materials present in the tunnel would need to be removed before decommissioning. An estimated 107,000 cy of debris is expected from the demolition of the viaduct. One likely decommissioning option includes partially filling the tunnel with the concrete debris recycled from the viaduct demolition. The remainder of the empty space in the tunnel would then be filled with CDF to provide a continuous backfill.

The concrete to be used to fill the Battery Street Tunnel is likely to be left in the form of rubble; however, if a portion of the concrete fill is pulverized before placement, the surface area of the fill material would increase; consequently, any water that came into contact with the concrete could have an elevated pH. Before disposal, this use of the existing viaduct concrete must be approved as a beneficial use in accordance with the Solid Waste Handling Standards (WAC 173-350). Public Health of Seattle and King County oversees compliance with this regulation and would issue the required permit.

6.2 Applicable Federal, State, and Local Regulations

Applicable federal and state regulations and policies concerning hazardous materials, potential hazardous waste, and associated liability issues are described in Attachment H. Local regulations are discussed in this section.

Public Health of Seattle and King County is the local regulating agency that oversees compliance with the Solid Waste Handling Standards (WAC 173-350). King County also evaluates Cedar Hills Regional Landfill, the King County landfill, solid waste transfer stations, and stockpiles for compliance. A permit would be required for sites within the county where stockpiles remain more than

90 days. The local permitting process requires an environmental protection plan that describes how the material will be handled and what precautions will be taken to prevent the dispersal of material. Handling procedures for contaminated material should be tailored to the type, level, and media. The plan would be reviewed and accepted before King County would issue a permit. King County would also be the entity that issues a permit for beneficial use of demolition material. Such beneficial use material cannot present a threat to human health or the environment.

The City also has statues that pertain to hazardous materials and wastes. These requirements, listed below, take precedence over all other laws for governing business and operations in Seattle, where the requirements are at least as stringent as the state or federal requirements.

Seattle Municipal Code, Title 10 – Health and Safety. This code provides the enforcement authority as it relates to the regulation and control of sanitation and disease and other measure to protect the health and safety of the community. The City may investigate any permit holders for compliance.

Seattle Municipal Code, Title 15 – Street and Sidewalk Use includes provisions that relate to use, maintenance, and construction of streets and sidewalks. This code addresses dust suppression requirements during construction and demolition. It also requires the timely removal of excavated soil from streets and sidewalks.

Seattle Municipal Code, Chapter 22.800 – Stormwater, Grading, and Drainage Control Code establishes the City's authority to regulate stormwater within the city limits. The City has published a four-volume manual that provides guidance for site activities that could affect stormwater. The manual also outlines mitigation that could be applicable to protect stormwater quality. Code interpretation is presented in the Seattle Municipal Code in DPD and SPU Joint Director's Rulings. **SMC 22.800** (Drainage Code) and a related code**, SMC 21.16** (Side Sewer Code), regulate the discharge of stormwater and groundwater from dewatering activities to the sewer system. Code interpretation for Side Sewer Permit for Temporary Dewatering is presented in DPD's and SPU's Joint Ruling DPD Director's Rule 3-2004 and SPU Rule 02-04.

Seattle Municipal Code, Title 25 – Environmental Protection and Historic Preservation adopts the uniform requirements of WAC 197-11 for compliance with the Washington State Environmental Policy Act (SEPA) and to establish local procedures and policies where permitted. In particular, environmental health requires assessment for potential exposure to toxic chemicals and mitigation planning. The code also has additional requirements if the site is under an order, agreed order, or decree from Ecology.

Puget Sound Clean Air Agency (PSCAA). Regulations regarding discharge to air (including fugitive dust, asbestos, and hazardous chemicals) would be enforced at the state and local municipality levels through PSCAA.

6.3 Liabilities Associated With Property Acquisition

In acquiring a contaminated property, the agencies could become liable for site cleanup under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for non-petroleum-related contaminants and under state law for any type of contaminant. The standard impact and mitigation for liability for a contaminated site is presented in Attachment I under Acquisition – Cleanup Liability.

Properties that could be acquired and properties on which temporary and permanent tiebacks would be installed are listed in Exhibit 6-2. Properties that have been identified for temporary construction easements, with some also being considered for subsurface parcel acquisition, are listed in Exhibit 6-3. Compensation grouting to improve soil quality and mitigate potential settlement of the building may be conducted at parcels listed in Exhibit 6-3. The potential for encountering contaminated soil is much lower at these parcels because of the depth of the tunnel and the type of construction. Only parcels on which the crown of the tunnel is less than 100 feet bgs have been identified as validated sites because soil at these sites may be contaminated (solvents) and compensation grouting could occur from the surface. Other properties of concern that would not be acquired but may adversely affect the project at a moderate level are listed in Exhibit 6-4.

Under the Bored Tunnel Alternative, all or portions of 11 parcels, including an optional parcel, would be acquired. Easements would be obtained for four parcels on which temporary or permanent tiebacks would be installed. Subsurface property rights would also be acquired for parcels overlying the bored tunnel; compensation grouting may occur at some of these sites under construction easements. The partial acquisitions would consist of narrow strips through the middle of the block bounded by S. Atlantic Street, S. Royal Brougham Way, First Avenue S., and Alaskan Way S.; at the northeastern corner of the block bounded by Mercer Street and Aurora Avenue; and on the east side of Aurora Avenue at the corner with Republican Street. Other acquisition parcels include a half block on the east side of Sixth Avenue N. north of Thomas Street, on the east side of Sixth Avenue N. north of Harrison Street, and along the west side of First Avenue S. between S. Royal Brougham Way and S. Dearborn Street. These parcels contain 17 potentially contaminated sites (including sites that would be needed if the Curved Sixth Avenue option is selected), primarily associated with former railroad operations, metal works, a junkyard, gas stations, and dry cleaners. One additional site is within the Alaskan Way S. right-of-way (Site 360.1-13).

Exhibit 6-2. Properties of Concern That Would Be Acquired

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
South Portal									
7666206966	**Parking Lot of Pyramid Alehouse**	**380.3-1**	Former cleaning compounds company 95 S. Royal Brougham Way	Adjacent east	Phase I ESA Focused Phase II ESA	Petroleum, metals, solvents, and PAHs (if burned material, coal, or heavy oil is encountered). Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Partial acquisition of site's western portion.	**Moderate**	Could be complex if solvents present
7666206966	**Parking Lot of Pyramid Alehouse**	**380.2-1**	Former fuel company 1207 Utah Avenue S.	Adjacent east	Phase I ESA Focused Phase II ESA	Petroleum, metals, and PAHs (if burned material, coal, or heavy oil is encountered). Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Partial acquisition of site's western portion.	**Moderate**	Straightforward
[7666207006]/ 7666207012/ 7666207025	**Terminal Warehouse Use**	**380.2-2**	Former iron works/foundry 1237 Utah Avenue S.	Adjacent east	Phase I ESA Focused Phase II ESA ACM and LBP surveys of building (building occupies Sites 380.2-2, 380.2-3, 380.2-4)	Metals, solvents, and PAHs (if burned material, coal, or heavy oil is encountered). Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Partial acquisition of site's western portion.	**Moderate**	Could be complex if solvents present
[7666207006]/ 7666207012/ 7666207025	**Terminal Warehouse Use**	**380.2-3**	Former junk company 1247 Utah Avenue S.	Adjacent east	Phase I ESA Focused Phase II ESA	Metals, petroleum, and PCBs. Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Partial acquisition of site's western portion.	**Moderate**	Complex
[7666207006]/ 7666207012	**Terminal Warehouse Use**	**380.2-4**	Former can company 1259 Utah Avenue S.	Adjacent east	Phase I ESA Focused Phase II ESA	Petroleum associated with a former UST and metals. Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Partial acquisition of site's western portion.	**Moderate**	Straightforward

Exhibit 6-2. Properties of Concern That Would Be Acquired (continued)

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
7666206941/ 7666206945		**360.15-1**	Former sheet metal works and freight depot 90 S. Dearborn Street	East of alignment. **Site has already been acquired for the project.**	Focused Phase II ESA	Ecology CSCSL and Brownfield site. Petroleum contamination may remain at the site. No documentation of additional investigation performed to delineate the contamination and determine whether groundwater has been affected. Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	The south tunnel operations building would occupy the parcels. Excavation could extend to 80 feet bgs.	**Moderate**	Straightforward; recommend remediation in conjunction with planned construction.
7666207697	**Terminal 46**	**360.1-1**	Former plating works, boiler works, brass foundry, tin shop, blacksmith, machine shops/gas and oil 501–505 Alaskan Way S.	Adjacent west.	Focused Phase II ESA Environmental sampling in conjunction with geotechnical design.	Potential contaminants in soil and groundwater include solvents, metals, gasoline, and petroleum.	Temporary tiebacks would be installed.	**Moderate**	Potentially complex; recommend remediation in conjunction with planned construction
North Portal									
1991200800 and may affect 199120815	**Empty Lot and Seattle Pacific Hotel**	**60.3-1**	Vagabond Inn-former laundry 327–329 Aurora Avenue N.	Adjacent east	Contaminant delineation.	Ecology CSCSL site. Tetrachloroethylene from a dry-cleaning operation has been detected at dangerous waste levels in the eastern part of the site. Tetrachloroethylene breakdown compounds (solvents) and gasoline have also been detected in site soils. Solvents have been detected in groundwater. Existing data from previous investigations should be evaluated to determine whether contaminant delineation is sufficient to predesignate the soil removed for tiebacks at site and adjacent parcel south of the site.	The site and vacant parcel south of the site would have temporary tiebacks installed.	**High**	Complex

Exhibit 6-2. Properties of Concern That Would Be Acquired (continued)

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
1991200845	**Office**	**60.3-1 (cont.)**	Located adjacent west to Site 60.3-1	Adjacent east	Contaminant delineation related to adjacent property. Phase I ESA, ACM and LBP surveys of building on parcel.	Existing data from previous investigations at Site 60.3-1 should be evaluated to determine if contamination extends on to the parcel located adjacent (west) of Site 60.3-1.	North tunnel operations building would be constructed at parcel.		
1991200405	**Seattle City Light Substation**	**60.2-1**	Public utility 319 Sixth Avenue N.	Adjacent west	Focused Phase II ESA. Environmental sampling in conjunction with geotechnical design.	Petroleum and PCBs.	Temporary tieback.	**Moderate**	Special handling of contaminated soil removed for tieback
1988201285	**Hostess**	**50.2-4**	Interstate Brands Corp. Hostess 434 Aurora Avenue N.	Adjacent east	Environmental sampling in conjunction with geotechnical design.	Petroleum and related compounds. The site has received a determination of NFA; concentrations of diesel and Bunker C oil were below MTCA Method A; however spoils could contain petroleum.	Permanent tieback.	**Low**	Special handling of contaminated soil removed for tieback

Exhibit 6-2. Properties of Concern That Would Be Acquired (continued)

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
1988201090	**City of Seattle Maintenance Yard**	**50.1-1**	Former laundry; possible dry-cleaning operation 606 Harrison Street	In project alignment	Phase I and Phase II ESA. Possibly a Phase III ESA to delineate the types and extent of contamination and identify feasible remediation approaches and costs. LBP survey of shed.	Solvents may be present in soil and perched groundwater. Perched groundwater has been encountered in a nearby boring at a depth of 7 feet bgs. The investigation should occur in phases, with a Phase II ESA to determine whether contamination is present. If contamination is present, additional borings or probes should be advanced to delineate the contamination and evaluate remediation options and costs.	This entire block would be acquired. Excavation is expected for the site.	**High**	Complex
	City of Seattle Maintenance Yard	**50.1-2**	Former laundry dye supply and furniture repair business 600 Harrison Street	In project alignment	Phase I and Phase II ESA	Evaluate site for solvent contamination. Potential for soil and groundwater contamination. Perched groundwater has been encountered in a nearby boring at a depth of 23 feet bgs.	The site would be acquired, and retained cuts for ramps are planned.	**High**	Complex
	City of Seattle Maintenance Yard	**50.1-3**	Former auto repair 410 Sixth Avenue N.	In project alignment	Phase I and Phase II ESA	Evaluate site for petroleum contamination. Potential for soil and groundwater contamination. Perched groundwater has been encountered in a nearby boring at a depth of 23 feet bgs.	The site would be acquired, and retained cuts for ramps are planned.	**Moderate**	Straightforward
1988201155	**Gates Foundation Campus**	**40.1-1**	Former machine shop 650 Broad Street	Adjacent west	Phase I and Phase II ESA	Evaluate site for metals and solvents contamination. Potential for soil and groundwater contamination. Perched groundwater has been encountered in a nearby boring at a depth of 7 feet bgs.	The site would be acquired for the Curved Sixth Avenue option.	**Moderate** for the Curved Sixth Avenue option. **Low** if the Curved Sixth Avenue option is not selected.	Could be complex if solvents are encountered

Exhibit 6-2. Properties of Concern That Would Be Acquired (continued)

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
	Gates Foundation Campus	**40.1-3**	Former auto repair 604 Republican Street	Adjacent west	Phase I and Phase II ESA	Evaluate site for petroleum contamination. Potential for soil and groundwater contamination. Perched groundwater has been encountered in a nearby boring at a depth of 7 feet bgs.	The site would be acquired for the Curved Sixth Avenue option.	**Moderate** for the Curved Sixth Avenue option. **Low** if the Curved Sixth Avenue option is not selected.	Straightforward
1988201155 (cont.)	**Gates Foundation Campus**	**40.1-4**	Former paint removing company 526 Sixth Avenue N.	Adjacent west	Phase I and Phase II ESA. ACM and LBP surveys not necessary (building constructed in 1994).	Evaluate site for solvents and metals contamination. Potential for soil and groundwater contamination. Perched groundwater has been encountered in a nearby boring at a depth of 7 feet bgs.	At least part of the site would be acquired for the Curved Sixth Avenue option.	**High** for the Curved Sixth Avenue option. **Low** if the Curved Sixth Avenue option is not selected.	Complex
	Gates Foundation Campus	**40.1-5**	Seattle City Seattle Center (former paint company) 601 Mercer Street/520 Fifth Avenue N.	Adjacent north and beneath for either option (Curved or Straight Sixth Avenue options)	Environmental sampling in conjunction with geotechnical design.	Potential contaminants include solvents and metals.	The northern strip of the site would be acquired for the Curved Sixth Avenue option.	**Moderate** for the Curved Sixth Avenue option. **Low** if the Curved Sixth Avenue option is not selected.	Complex
1988201175	**Vacant Parcel with Billboard**	**40.1-2**	Former gas station 624 Republican Street	In project alignment	Phase I ESA Phase II ESA. Geophysical survey.	Evaluate site for diesel, oil, and gasoline contamination. Potential for soil and groundwater contamination. Perched groundwater has been encountered in a nearby boring at a depth of 7 feet bgs.	A 1,000-square-foot triangular parcel in the southeast area of the former gas station site would be acquired.	**Moderate**	Straightforward

Exhibit 6-2. Properties of Concern That Would Be Acquired (continued)

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
Other Properties of Concern									
7666206950	**MSI Railroad**	**370.1-2**	Railroad terminal 801 First Avenue S.	Beneath and adjacent east. **The site has already been acquired.**	No additional investigation appears to be warranted.	Phase II explorations were previously conducted for the project. Isolated instances of solvents and lead have been detected, but concentrations have not exceeded MTCA Method A cleanup levels. Based on the former railroad use and presence of fill, there is potential for petroleum, PAHs, metals, and solvents.	New cross streets would be constructed across the site.	**Low**	Straightforward
7666206955	**Terminal Warehouse Use**	**370.1-1**	Former gas station 1041/1121 First Avenue S.	Beneath and adjacent east. **The site has already been acquired.**	No additional investigation appears to be warranted. ACM and LBP surveys of building.	Evaluate site for diesel, oil and gasoline contamination. Geophysical survey to determine whether USTs are present. Potential soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs. Evaluate whether ABM or LBP is present in the building constructed in 1939.	New cross streets would be constructed across the site.	**Low**	Straightforward Potential ACM and LBP abatement.
	Alaskan Way S. right-of-way	**360.1-13**	West side of Alaskan Way S. right-of-way, north of S. Dearborn Street	Site is in right-of-way	Continue environmental sampling in conjunction with geotechnical design.	Petroleum, including gas and oil, cPAHs, and heavy metals, exceed MTCA cleanup levels. Lead encountered at 1,800 mg/kg; elevated concentration but not identified as a dangerous waste. Metal concentration in groundwater also exceeds MTCA Method A groundwater criteria. Groundwater is approximately 6 to 10 feet bgs.	Transition between cut-and-cover tunnel and at-grade road. Tiebacks would be installed in the area.	**Moderate**	Special handling of contaminated soil. Elevated concentrations of lead; potential for dangerous waste based on TCLP testing of soil for lead.
19912600600		**Block 80.4**		Adjacent west	None	No specific site use was identified that may have led to the presence of subsurface contamination of the block to be acquired for the project. The potential exists for contamination to have migrated to the site from other adjacent properties described elsewhere in this document. The parcel has a building that will not be acquired.	Temporary construction easement	**Low**	Straightforward

Exhibit 6-2. Properties of Concern That Would Be Acquired (continued)

Parcel No.	Present Use	Site No.	Site Name & Address	Site Location Relative to the Study Area	Recommended Type of Investigation	Potential Contaminants	Planned Construction	Impact	Remediation
		Block 70.4		Adjacent east	None	No specific site use was identified that may have led to the presence of subsurface contamination of the block to be acquired for the project. The potential exists for contamination to have migrated to the site from other adjacent properties described elsewhere in this document. The parcel has a building that will not be acquired.	Permanent tieback	**Low**	Straightforward Special handling if contaminated soil is removed for tieback.
1988201155	**Gates Foundation Campus**	**Block 40.1**		Adjacent west	ACM and LBP surveys of building	No specific site use was identified that may have led to the presence of subsurface contamination of the portion of the block to be acquired for the project. The potential exists for contamination to have migrated to the site from other adjacent properties described elsewhere in this document.	The northeastern corner of the block would be acquired. A building may be acquired for the Curved Sixth Avenue option.	**Low**	Potential ACM and LBP abatement.
1988201250	**School of Visual Concepts**	**Block 40.2**		East of alignment	None	No historical operations that used hazardous materials.	Permanent tieback	**Low**	

Notes:

Parcel enclosed in brackets […..] is part of the site but would not be acquired; investigation should NOT include this parcel.
ACM= asbestos-containing materials
bgs = below ground surface
cPAH = carcinogenic polycyclic aromatic hydrocarbons
CSCSL = Confirmed and Suspected Contaminated Sites List
cy = cubic yards
Ecology = Washington State Department of Ecology
ESA = Environmental Site Assessment
LBP = lead-based paint
LUST = leaking underground storage tank
mg/kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NFA = No Further Action
PAH = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
UST = underground storage tank

Exhibit 6-3. Temporary Construction Easements

Site No.	Parcel No./ Building I.D. [1]	Present Use	Right-of-Way Required	Building Area Required
290.2-4	766620 2575	Parking	Special consideration for subsurface parcel acquisition and temporary construction easement	
290.2-5	766620 2570/ T252	Western Building	Special consideration for subsurface parcel acquisition and temporary construction easement	Yes
290.2-1, -2, -3	766620 2565/ T251	Polson Building	Special consideration for subsurface parcel acquisition and temporary construction easement	Yes
280.2-3	766620 2560/ A161	Parking	Special consideration for subsurface parcel acquisition and temporary construction easement	
280.2-2	766620 2545/ A159	Commuter Center Building	Special consideration for subsurface parcel acquisition and temporary construction easement	
280.3-1 through 280.3-4	766620 2540	Parking	Special consideration for subsurface parcel acquisition and temporary construction easement	
Block 270.3 (no sites)	766620 2530/ T243	Office	Temporary construction easement	
260.3-1	766620 2515/ T234	Office	Temporary construction easement	
260.4-3	1974600 035/ T237	Retail/Service	Temporary construction easement	
260.4-1, -2	1974600 025/ T235 & T236	Retail/Service	Temporary construction easement	
250.4-4, -5, -6	9197200 000/ T231	Multifamily	Temporary construction easement	
250.4-1, -2, -3	1697500 000/ T230	Mixed Use	Temporary construction easement	
240.3-3, -4, -5	1976200 076/ T222 & T223	Mixed Use	Temporary construction easement	
230.3-8, -9, -10	1976200 075/ T216	Mixed Use	Temporary construction easement	
140.8-1, -2	0697000 064/T77	Office	Temporary construction easement	
130.8-1, -2	0697000 025/ A110 & A167	Multifamily	Temporary construction easement	
Block 80.5 (not a site)	1991200 600/ A166	Office	Temporary construction easement	

Note:

1. Building I.D. number is from *SR 99 Bored Tunnel Alternative – Draft Assessment of Settlement Impacts to Buildings* (PB 2010).

Exhibit 6-4. Properties of Concern That Would Not Be Acquired (Moderate Potential Impact)

Site No.	Site Name & Address	Site Location Relative to the Project Area	Parcel No.	Type of Investigation[1]	Potential Contaminants	Planned Construction	Impact	Remediation
Tunnel Segment								
360.1-1	Former plating works, boiler works, brass foundry, tin shop, blacksmith, machine shops/gasoline and oil 501–505 Alaskan Way S.	Adjacent west	7666207697	Borings	Solvents, metals, gasoline, and petroleum (diesel and/or oil).	The soil adjacent to the property would be excavated for the cut-and-cover tunnel.	**Moderate**	Special handling of contaminated soil if contaminants are detected. Groundwater removed for construction may require pretreatment to remove suspended solids and organic compounds (activated carbon filter) before it can be discharged to the sanitary sewer.
360.1-2	WSDOT S. King Street and Alaskan Way S. and former copper works and machine shop 429 Alaskan Way S.	Adjacent west	7666207695	Borings	Identified cPAHS in right-of-way for tunnel borings. Concentrations are greater than MTCA Method A cleanup levels, but well below dangerous waste concentrations. Based on site historical land use solvents, metals, petroleum, and cPAHs.	The soil adjacent to the property would be excavated for the cut-and-cover tunnel.	**Moderate**	Special handling of contaminated soil. Groundwater removed for construction may require pretreatment to remove suspended solids and organic compounds (activated carbon filter) before it can be discharged to the sanitary sewer.
320.1-1	Former cleaners and dyers 67 Yesler Way	Adjacent east	7666202594 and 5247800005	Deep boring	Analyze soil in the bored tunnel interval for solvents. Potential for soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Tunnel would be constructed adjacent, and tunnel crown is less than 100 feet bgs.	**Moderate**	Special handling of contaminated soil if solvents are detected.
320.1-2	Former lithographer 75 Yesler Way	Adjacent east	5247800005	Deep boring	Analyze soil in the bored tunnel interval for solvents. Potential for soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Tunnel would be constructed adjacent, and tunnel crown is less than 100 feet bgs.	**Moderate**	Special handling of contaminated soil if solvents are detected.

Exhibit 6-4. Properties of Concern That Would Not Be Acquired (Moderate Potential Impact) (continued)

Site No.	Site Name & Address	Site Location Relative to the Project Area	Parcel No.	Type of Investigation [1]	Potential Contaminants	Planned Construction	Impact	Remediation
320.1-3	Former machine shop and metal stamping 112 Alaskan Way S.	Adjacent east	5247800025	Deep boring	Analyze soil in the bored tunnel interval for solvents. Potential for soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Tunnel would be constructed adjacent, and tunnel crown is less than 100 feet bgs.	**Moderate**	Special handling of contaminated soil if solvents are detected.
290.2-3	Former printers, publishers, and marine gasoline and diesel company 71–79 Columbia Street	Adjacent east	7666202565	Deep boring	Analyze soil in the bored tunnel interval for solvents. Potential for soil and groundwater contamination. Groundwater is approximately 6 to 10 feet bgs.	Tunnel would be constructed adjacent, and tunnel crown is less than 100 feet bgs.	**Moderate**	Special handling of contaminated soil if solvents are detected.
140.8-2	Newspaper 501 Wall Street	Adjacent west, and tunnel is beneath site	0697000064	Deep boring	Analyze soil in the bored tunnel interval for solvents. Potential for soil and groundwater contamination. Groundwater may be perched.	Tunnel would be constructed adjacent, and tunnel crown is less than 100 feet bgs.	**Moderate**	Special handling of contaminated soil.
130.8-1	Grosvenor House Vine Street and former dry cleaner, printer, and auto repair businesses 505 Vine Street (EDR Map No. 69)	Tunnel is beneath site	0697000025	Deep boring	Analyze soil in the bored tunnel interval for solvents. Potential for soil and groundwater contamination. Groundwater may be perched. Petroleum contamination could be present in shallower soils and groundwater.	Tunnel would be constructed beneath the site, and the tunnel crown is less than 100 feet bgs. Compensation grouting may be performed.	**Moderate**	Special handling if solvent contaminated soil encountered

Notes:

bgs = below ground surface
cPAH = carcinogenic polycyclic aromatic hydrocarbon
Ecology = Washington State Department of Ecology
EDR = Environmental Data Resources, Inc.
ESA = Environmental Site Assessment
ICR = Washington Site Register of Independent Cleanup Reports
LUST = leaking underground storage tank
MTCA = Model Toxics Control Act
UST = underground storage tank
WSDOT = Washington State Department of Transportation

1. Deep borings to be accomplished during Phase 2 Geotechnical Investigation that supports project design. Boring locations are contingent on access and may be possible only at intersections or side streets perpendicular to First Avenue.

Six buildings would be acquired, and an additional one would be acquired if the Curved Sixth Avenue option is implemented. The six buildings include two warehouses, three office buildings, and a temporary structure in the City maintenance yard. If the Curved Sixth Avenue option is implemented, a metal training facility building would also be acquired.

WSDOT has already acquired five parcels, including three parcels on the block bounded by S. Royal Brougham Way, S. Dearborn Street, First Avenue S., and Alaskan Way S. This block encompasses the former Gerry Sportswear property and the WOSCA property, Sites 370.1-1 and 370.1-2, respectively. The two parcels directly north of the WOSCA property (Site 360.15-1) have also been acquired. A Phase I ESA was conducted for Site 360.15-1, and Phase I and II ESAs were conducted for Sites 370.1-1 (Gerry Sportswear property) and 370.1-2 (WOSCA property).

The southern portion of the study area has been filled, and railroads have operated continuously in the area. The fill was placed around treated and untreated timber piles that supported former railroad tracks and an elevated road. Although no specific sites have been identified on some of the blocks, historical railroad activities that typically result in petroleum (lubricating oil and diesel), PAHs, and metals contamination in near-surface soils and ballast occurred throughout the study area. Fill in the area is also frequently associated with metals and petroleum contamination. Treated piles and railroad ties would likely be encountered during construction of the Bored Tunnel Alternative.

6.3.1 Staging Areas

Numerous potential staging areas have been identified for the Bored Tunnel Alternative (refer to Appendix B, Alternatives Description and Construction Methods Discipline Report for a description of these sites and their potential uses). Many are located in the industrial areas along the Duwamish River and the waterfront, south of downtown, although there are also several potential sites in the north portal area. Many of the sites are terminals owned by the Port of Seattle, which has a vested interest in this project; the use of these terminals is being evaluated. The method of transport for spoils has not been identified, but the options include rail, barge, and trucking. Management of stockpiled soil would comply with the requirements of the Solid Waste Handling Standards (WAC 173-350). Public Health of Seattle and King County locally enforces compliance with this regulation. Spoils handling procedures would be addressed in construction management plans developed for the project, as described in Section 6.5.4, Minimization of Effects, and Appendix O, Surface Water Discipline Report.

6.3.2 Sites with a High Potential Impact

Three sites have been designated as high-impact sites based on their historical land use and proximity to the project area. Another site (Site 40.1-4) that would be part of the Straight Sixth Avenue option in the north is considered to have a low impact; however, if the Curved Sixth Avenue option is implemented, it would be acquired and then could have a high impact on the project. All of the sites with a high potential impact are located in the north portal area and would potentially be acquired or have tiebacks installed at the site.

Two of the four sites were laundry/dry cleaners (Sites 50.1-1 and 60.3-1), one site was a former paint removing company (Site 40.1-4), and one site (Site 50.1-2) supplied dry-cleaning products and laundry dyes. Solvent contamination from the dry cleaner has been documented at Site 60.3-1, identified by Ecology as the Vagabond Inn site. A dry cleaner (and a gas station) operated on the site from 1946 to 1957 or 1958, according to information provided by the property owner's environmental consultant. A three-story hotel, constructed in 1961, occupies the site.

Although Site 60.3-1 would not be acquired, a temporary easement for installation of tiebacks would be necessary for this site and the parcel south of the site. Construction of the north tunnel operations building adjacent to (west of) the site would require excavation to a depth of approximately 80 feet bgs. Ecology's file for the Vagabond Inn shows that during a 2001 investigation, solvents were detected in every soil sample collected between the depths of 10 and 60 feet bgs. Solvents were also detected in a groundwater sample collected at a depth of 60 feet bgs. Additional investigations conducted by the owner's consultant confirmed the earlier findings and indicated that the highest concentrations of tetrachloroethylene were confined to the parking lot adjacent to Aurora Avenue and were contained in a layer of blue clay at a depth of 10 to 20 feet bgs. Soil contamination exceeding the MTCA Method A cleanup levels extends to a depth of at least 50 feet in the center of the site. Contamination has also been encountered at the south end of the site. The northern extent of the contamination appears to be within the parcel boundary. Solvent contamination from the Vagabond Inn may extend into the adjacent parcels west and south, affecting soil and groundwater that would be removed for construction of the north tunnel operations building.

Existing data from previous investigations should be evaluated to determine whether the contaminant delineation is sufficient to predesignate soil that would be removed from the site as spoils from tiebacks. If not, additional subsurface investigation should be conducted to characterize and delineate solvent contamination at the western and southern boundaries of the site. A tieback easement would also be acquired for the parcel south of the site. If the data indicate that contaminants have migrated off the site, explorations should be

performed on the parcel south of the site in the area that would be affected by the tiebacks. Additional investigations would be necessary to determine whether the soil and groundwater that would be removed for the north tunnel operations building (west of the site) could be contaminated. Some dewatering would likely be necessary during the construction of the building. Remediation and disposal options for the contaminated soil should be evaluated. Solvent mitigation measures that could be used to manage the contaminated soil are discussed in Section 6.5.5.

Although the Vagabond Inn (Site 60.3-1) would not be acquired, a temporary easement would be required. Soil and groundwater at the Vagabond Inn site and the adjacent property where the north tunnel operations building would be constructed could be contaminated. WSDOT could become liable if contaminated soil and/or groundwater removed from either site are mishandled. If the property has already been contaminated by the adjacent former dry cleaner, WSDOT would need to avoid liability for the cleanup of the north tunnel operations building property. WSDOT could also become liable if dewatering alters the existing groundwater plume and makes existing conditions worse. New areas on the Vagabond Inn site could become contaminated and/or the contamination could be pulled onto the north tunnel operations building property.

A laundry operated from 1944 through at least 1960 at Site 50.1-1. Dry-cleaning operations may also have occurred at the site. A laundry dye supply company and a furniture repair business operated at Site 50.1-2. Both of these sites are considered a potential high impact. An auto repair facility operated at Site 50.1-3; therefore, it is considered a moderate impact because the expected contamination is likely petroleum. All of these sites are located on the block immediately west of Aurora Avenue and just south of Republican Street. The entire block currently owned by City maintenance department should be investigated. Currently the only structure on the block is a shed used by the maintenance department. Two borings (AB-3 and AB-4) were drilled in the Republican Street right-of-way, on the east and west side of Aurora Avenue, respectively, as part of the project. In boring AB-3, tetrachloroethylene was detected in three samples collected at 5, 10, and 20 feet bgs, at concentrations of 0.0013, 0.001, and 0.0014 mg/kg, respectively. In boring AB-4, tetrachloroethylene was detected at 0.0011 mg/kg in a sample collected at 2.5 feet bgs. These concentrations are an order of magnitude less than the MTCA Method A cleanup level of 0.05 mg/kg. However, because of the proximity of the borings to the site and the lack of other nearby solvent sources, it is possible that Site 50.1-1, at the City maintenance yard, is the source of the tetrachloroethylene encountered in the right-of-way.

Investigations at Sites 50.1-1, 50.1-2, and 50.1-3 are needed to determine whether contamination is present and to delineate the extent of the contamination. Depending on the complexity of the subsurface conditions and remediation options that could be implemented, additional investigations may be necessary, as described in Section 6.5.2. Solvent mitigation measures that could be used to manage the contaminated soil are discussed in Section 6.5.5.

WSDOT needs to avoid potential liability for site cleanup if contaminants are found on the property. WSDOT could be liable if soil and groundwater that was removed from the City maintenance yard is mishandled.

Construction is unlikely to make existing in situ conditions worse. The deepest excavation would be above the regional water table, so dewatering of this water-bearing unit would not be required. Dewatering of perched water may alter groundwater flow patterns; however, perched water zones do not appear to be laterally extensive.

Site 40.1-4 could be acquired if the Curved Sixth Avenue option is selected for implementation. It is part of a larger parcel owned by the Gates Foundation. The site was a paint removal company from 1938 until at least 1960, and the operations may have involved the use of solvents. Heavy metals also occur frequently in paint and may be a contaminant at the site. The site is currently vacant land. If solvents are present in site soils, additional characterization would be necessary, similar to that for the sites described above. However, these solvents would not be the same solvents associated with a dry cleaner, and soil excavated from the site would be evaluated as characteristic dangerous waste. Solvent mitigation measures that could be used to manage the contaminated soil are discussed in Section 6.5.5.

WSDOT would need to avoid liability for property cleanup, if contaminants are found on this portion of the parcel. Excavation may occur along Mercer Street, so WSDOT could become liable if contaminated soil is mishandled.

6.4 Worker Safety and Public Health and Safety Concerns

Issues related to worker safety and public health and safety pertain to potential exposures to pollutants, hazardous materials, and wastes encountered or generated during construction activities. Physical hazards associated with construction activities are not addressed. Standard impacts and mitigation are discussed in Attachment I, under Construction Impacts, Worker Safety, and Public Health Concerns.

LBP has been found in the Battery Street Tunnel and may also be present in other parts of the viaduct. Under WAC 296-155-17607, an employer must ensure that no employee is exposed to lead at concentrations exceeding the permissible

exposure limit of 50 micrograms per cubic meter. The employer can meet that requirement (assuming lead is present in some elements of the viaduct) by conducting an initial exposure assessment, or if the employer has completed a certain number of roughly equivalent projects in the past year, use the data to show that the initial exposure assessments used for those other projects would be applicable to the current project and use the same level of personal protective equipment.

The requirements of WAC 296-62-077 specify that building owners must identify and dispose of ACM that may be encountered during demolition or renovation activities. This requirement is also in the PSCAA Regulation III, Section 4.02, Asbestos Survey Requirements.

The AHERA regulation (40 CFR 763) is the primary governing regulation for performing asbestos surveys. AHERA defines suspect ACM and specifies the minimum number of samples to be collected and analyzed from a suspect material. AHERA was originally enacted for school buildings, but since 1994, it has been applied to public and commercial buildings by the Asbestos School Hazard Abatement Reauthorization Act. The Occupational Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) worker protection regulations, specifically 29 CFR 1926.1101(k) and WAC 296-62-077, have also incorporated AHERA for demolition and renovation projects.

Other chemical hazards would be addressed in a site-specific health and safety plan that identifies potential chemical hazards for the various work activities. The plan identifies appropriate monitoring and threshold values that would trigger additional protective actions, including an increase in the level of personal protective equipment, monitoring, engineering controls, and changes in work flow.

In areas of known contamination, site workers would need to have Hazardous Waste Operation and Emergency Response training (40-hour HAZWOPER Certification [29 CFR and WAC 296-62 Part P]), which is required for individuals involved in cleanup of uncontrolled hazardous waste sites. It is designed for workers engaged in hazardous substance removal or other activities that expose or potentially expose them to hazardous substance and health hazards. An annual 8-hour refresher course is also required to stay current.

In addition to standard impacts, a dry cleaner site (Site 60.3-1) at the north portal presents some unique concerns related to worker safety and public health and safety. Dust may be generated during excavation, and if this occurs, the tetrachloroethylene and breakdown products could volatilize.

The soil would need to be transported through the city to a disposal site permitted to accept the material. Ecology and Public Health of Seattle and King County would regulate the handling and disposal of the contaminated material. Preparation of a CMMP would be required to address these issues before any excavation. Ecology would review the CMMP, as it pertains to contained-in waste.

6.5 Construction Mitigation

This section discusses mitigation for the construction effects related to hazardous materials and handling and disposal options for hazardous materials. The Bored Tunnel Alternative has been designed to avoid contamination where possible and to minimize handling and disposal activities to the extent feasible where contaminated material cannot be avoided. Timely identification of the contaminants is critical to minimizing or avoiding potential impacts.

Mitigation measures that would be required as part of the construction planning include development of a temporary erosion and sediment control plan; a spill prevention, control, and countermeasures plan; a CMMP that addresses handling and disposal of known and unanticipated contamination; a fugitive dust control plan for demolition activities; and a water quality monitoring plan. Development and implementation of these plans would be required by WSDOT Standard Specifications and necessary regulatory permits, including the National Pollutant Discharge Elimination System (NPDES) stormwater permit. These mitigation measures as well as other standard mitigation measures are described in Attachment I.

6.5.1 Data Gaps and Unknowns

The sources of information that were used to generate the histories of properties within the study area included general information from readily available sources. There may have been uses at individual sites that could have resulted in contamination that were not revealed by the available information.

It is assumed that the risk of contamination from businesses that use, store, or dispose of hazardous materials increases with the length of time the businesses were in operation. The length of time particular businesses were in operation was not necessarily revealed by the available data, limiting the ability to ascertain this risk.

6.5.2 Recommendations for Further Investigations

This section outlines the approach for mitigating potential risks associated with hazardous material sites and provides recommendations for specific activities that should be undertaken. Investigation should be conducted for sites that would be acquired or that have a significant potential to affect the project.

Site Reconnaissance Recommendations

A full-access site reconnaissance is recommended for all properties to be acquired or where a temporary or permanent easement would be obtained for the Bored Tunnel Alternative. Twenty-one sites and parts of three parcels with no recognized environmental conditions are identified in Exhibit 6-2. The reconnaissance should be conducted by an experienced environmental professional and, wherever possible, include interview(s) with persons knowledgeable about present and past operations at the site.

Phase I ESA Recommendations

Phase I ESAs should be conducted for properties that would be acquired as part of due-diligence requirements and WSDOT guidance. Additional RECs could be identified. Phase I ESAs should be conducted for eight parcels, which include 13 sites.

Phase II ESA Recommendations

Phase II ESAs should be conducted for properties that would be acquired or for which WSDOT would obtain a temporary or permanent easement on which there is either a risk of contamination from past site operations or on which contamination is known to exist. Where acquisitions would be for only portions of a given parcel, focused Phase II ESAs are recommended for only the portions of the parcels that would be affected by the project. In addition, site investigations should target potential contaminants associated with historical land use for that portion of the parcel.

Furthermore, borings with environmental sampling are recommended (within the WSDOT right-of-way) for properties located adjacent to the project footprint in the south and north portal areas on which contaminants may be encountered during construction activities, including excavation, ground improvement, installation of drilled shafts, and dewatering. Sampling for VOCs is also recommended for sites where the crown of the tunnel is less than 100 feet bgs. Potentially contaminated adjacent properties that pose a high enough risk to warrant sampling include sites where it is known or suspected that contamination extends into the right-of-way and any sites where the most likely potential contaminants are chlorinated solvents. Such contaminants have a tendency to be highly mobile and may present a hazard to activities on other properties.

Explorations to obtain soil and groundwater samples could be conducted with direct-push-type equipment, such as a Geoprobe® machine. Drilling would be necessary where obstacles prevent Geoprobe® advancement or where the subsurface interval of interest is greater than 30 feet bgs.

Fifteen Phase II ESAs are recommended for the project based on the results of database reviews and the historical land uses. In addition, a subsurface

investigation to determine the southern and western extent of existing contamination may be necessary at the Vagabond Inn site. Recommendations for specific sites are summarized in Exhibit 6-2, which includes the location, map reference number, and primary contaminant(s) of these sites. Phase II ESAs have not been recommended to characterize fill and general railroad activities; however, site characterization for properties to be acquired or where temporary or permanent easements would be obtained should address these historical land uses. Phase II ESAs have already been conducted at the WOSCA property (Sites 370.1-1 and 370.1-2). Data generated from explorations (deep borings) for engineering design could provide sufficient data in other portions of the project footprint. In addition, environmental data collected from geotechnical borings drilled in areas of tiebacks may be sufficient to characterize material that would be removed during construction. The data from all of these explorations are not available but will be included in an environmental considerations report.

Additional Investigations

Site characterization or more extensive investigations may be necessary to collect subsurface data. Phase III ESAs may be necessary for sites that would be acquired, particularly if the Phase II ESAs indicate the presence of contamination on the site. Phase III investigations may involve additional sampling, monitoring, fate and transport studies, and other modeling to evaluate how and where contaminants have moved, and feasibility studies for remediation or remedial plans. The information may be used to evaluate cleanup approaches and develop preliminary cost estimates for remediation.

For the Vagabond Inn site (Site 60.3-1), a former dry-cleaning operation, extensive sampling has been completed by the property owner. Existing data from previous investigations should be evaluated to determine whether the contaminant delineation is sufficient to predesignate the soil that would be removed during installation of tiebacks at the site. If the data are not adequate, additional investigations may be necessary at the Vagabond Inn site. The investigation would be used to delineate the western and southern extent of contamination, determining the lateral and vertical limits of contained-in and clean soil. Based on data collected by the owner's environmental consultant, dangerous waste concentrations of dry-cleaning solvents appear to be located on the eastern half of the parcel. Predesignation of solvent-contaminated soil on and potentially off the site may be required by Ecology before a contained-in designation could be obtained for F-listed contaminated soil. Remediation of this site would not be the responsibility of the project. If solvent contamination is confirmed at the former dry cleaner site located one block north (the current City maintenance yard), then a similar process would be required there before

excavation. The lateral and vertical extents of contamination and the concentrations of the solvents would need to be determined.

Asbestos-Containing Materials and Lead-Based Paint Survey Recommendations

Surveys for ACM and LBP would be required for buildings to be acquired. Seven buildings are on properties that would be acquired, including a building that would be acquired if the Curved Sixth Avenue option is selected. According to the tax assessor records, all the buildings were constructed between 1910 and 1961, with the exception of the building that would be acquired for the Curved Sixth Avenue option, because it was constructed in 1994. Because of the age of the six buildings, there is the potential for ACM and LBP to be present, and surveys are recommended for them.

ACM, LBP, and lead-containing soot have already been identified in the Battery Street Tunnel (Pacific Rim Environmental 2008; Taylor 2007). Other sections of the viaduct may need to be surveyed before demolition.

Geophysical Surveys

Applicable geophysical methods for locating USTs include GPR, electromagnetic methods, metal detection, and magnetometry. GPR uses high-frequency electromagnetic waves to obtain subsurface information. The waves are deflected by objects, such as tanks and pipes. However, because of debris, including rebar in concrete that can interfere with the signal and wet clay soils that can absorb the wave, the depth of penetration is typically limited to between 3 and 15 feet bgs. Often other subsurface debris creates anomalies that mask the presence of tanks.

In this application, electromagnetic methods refer to subsurface conductivities by low-frequency electromagnetic induction. A transmitter coil radiates an electromagnetic field, creating a secondary electromagnetic field that is received by a receiver coil. The voltage measured by the receiver coil can be related to subsurface conditions. The limitations of this method are similar to those of GPR; other buried metal objects can interfere with the signal, but also objects above the ground surface, such as overhead power lines, fences, vehicles, and buildings, can interfere with the measurements. The difference between the conductivity of the UST and that of the surrounding fill material is typically enough for detection.

Metal detectors can locate buried metal objects. There are two types of metal detection: frequency domain and time domain. Frequency domain detection is applicable for identifying shallow buried metal objects, such as pipes. Time domain detection can identify objects up to 15 feet bgs. Metal detectors are similar to electromagnetic methods, but they are altered to locate metal objects. When the subsurface current is measured at a specific level, the metal has been identified by meter reading and/or with a sound. Because of the size of a tank, it can be detected at a depth of up to 20 feet bgs. Smaller metal objects have to be

much closer to the surface to be identified. This method is also sensitive to interferences from other metal objects such as vehicles, buildings (with rebar), and buried pipes.

Magnetometers work by measuring the earth's total magnetic field at a particular location. Buried ferrous materials distort the magnetic field, creating a magnetic anomaly. However, because of much interference at urban sites, by material such as concrete with rebar, utilities, and vehicles, this method is not widely used for UST identification.

Former locations of gas stations that are recommended for geophysical surveys are identified in Exhibit 6-2. Although these surveys are not always conclusive, it would be a first step in identifying the USTs. Current property owners of these sites should be contacted for properties that would be acquired. They may have knowledge or documentation of tank status and locations. In the south end, three sites may have USTs. Temporary tiebacks would be installed at these sites. The width of the temporary construction easement may influence the determination of whether a geophysical survey is warranted. One site at the north end identified as a former gas station would be acquired. Part of the original site was acquired for the construction of Broad Street. A portion of the parcel remains.

Additional Investigation Costs

Additional investigations to determine whether contaminants or other hazardous materials are present at a site are standard mitigation measures. Typical costs and time for completion are summarized below:

Phase I ESA	$3,000–$8,000	4–8 weeks
Phase II ESA	$15,000–$30,000	8–12 weeks
Phase III ESA	25,000–$100,000	12–16 weeks
Asbestos survey	$3,000–$10,000	2–4 weeks
Lead survey	$1,000–$2,000	2–4 weeks
Geophysical survey	$500–$3,000	2–4 weeks

6.5.3 Avoidance of Effects

In addition to avoiding the acquisition of contaminated properties, there are various means of reducing potential liability, including but not limited to the following:

- Leasing rather than purchasing property.
- Obtaining a surface easement rather than purchasing property.
- Creating an indemnification agreement and/or prospective purchaser agreement with the current property owner.

- Valuing property as clean and placing funds in escrow until cleanup is completed by the owner.

For the four properties that have been identified as potentially having a high impact on the project (Sites 60.3-1, 50.1-1, 50.1-2, and 50.1-3), specific mitigation measures have been identified.

If contamination extends to the property on which the north tunnel operations building would be constructed (Site 60.3-1), WSDOT may choose to create an indemnification agreement and/or prospective purchase agreement with the current property owner to limit WSDOT's potential exposure to site cleanup. Generally, it is the current property owner's responsibility to negotiate with the owners of the Vagabond Inn site. However, given the proposed construction schedule and scope of the project, WSDOT would likely have an active role in the negotiations. WSDOT could choose to purchase the property as clean and place funds in escrow until cleanup is completed by the owner. This option is less likely if the soil at depth is contaminated. Because the soil would be excavated, it would likely be more cost-effective and timely to treat or remediate the soil above ground. If the excavated soil is contaminated, it may be disposed of as described in Section 6.5.5. Obtaining a surface easement or leasing the property is not a viable option, because substantial portions of this block would be excavated for the north tunnel operations building.

The edges of the groundwater plume on Sites 60.3-1 would need to be established and the information would need to be considered in the development of construction methods and dewatering.

For Sites 50.1-1 and 50.1-2, WSDOT may choose to create an indemnification agreement and/or prospective purchase agreement with the current property owner (the City) to limit WSDOT's potential exposure to site cleanup. Site 50.1-3 although posing a potential moderate impact on the project, is also located on the City maintenance yard property and would likely be addressed with the other sites. WSDOT could choose to purchase the property as clean and place funds in escrow until cleanup is completed by the owner. However, because the City is also one of the proponents of this project, it would become an interagency negotiation. Similar to the north tunnel operations building, because a substantial quantity of soil at depth would be excavated, cleaning up the site before construction would not be practical. It would likely be more cost-effective and timely to treat or remediate the excavated soil at the ground surface, rather than attempt in situ remediation. Obtaining a surface easement or leasing the property is not a viable option, because substantial portions of this block would be excavated for the ramps.

Site 40.1-4, the former paint removal company, is part of the larger Gates Foundation property. Depending on the location of the contamination, it may be

possible to obtain a surface easement rather than purchasing the property. If purchased, WSDOT could create an indemnification agreement and/or prospective purchase agreement with the current property owner to limit WSDOT's potential exposure to site cleanup. WSDOT could also purchase the property as if it were clean, and place the funds in escrow until cleanup is completed by the owner.

6.5.4 Minimization of Effects

Phase II ESAs should be performed in areas where excavation or drilling is expected so that a plan for contaminant management during construction can be developed. To the extent feasible, contaminated areas identified during the Phase II explorations should be avoided. Where construction in a contaminated location cannot be avoided, construction methods could be adjusted to minimize the amount of contamination that may be encountered.

Contaminated Spoils

Contamination would likely be encountered during earthwork within the right-of-way at the portals. Soil contaminated with petroleum, primarily oil-range, and creosote-contaminated soil, as well as creosote-treated timber, would likely be encountered at the south portal; wood waste within the bored tunnel alignment would require special handling; and gasoline and solvents would likely be encountered at the north portal. Exhibit 6-1 summarizes the estimated volumes of soil that would be removed, including the estimated volumes of material that are potentially contaminated. If there is sufficient space to stockpile soil and it is financially beneficial, the contractor may segregate excavated clean soil, soil contaminated at low levels, and soil that is contaminated at levels exceeding the MTCA cleanup levels but not considered dangerous waste. Characterization sampling of the stockpiles would likely be needed to support the waste designation. If characterization samples are not required, soil disposal would be more expedient. Either a smaller laydown area would be needed or the storage capacity would increase. If few characterization samples are collected, it may be difficult to differentiate the different waste disposal categories and may result in a more conservative disposal designation. The soil handling and disposal costs would be less; but the disposal costs would likely be higher, assuming disposal costs at a RCRA Subtitle D landfill would be greater than fees charged by land reclamation facilities.

Four land reclamation facilities have been identified that accept low-level contaminated soil with a pH of less than 8.5. The limits are based on each facility's permit, as described in the *Draft Spoils Handling and Disposal Planning Report* (PB 2009b). Two RCRA Subtitle D landfills accept all levels of

contaminated soil and pH, as long as it is not considered a dangerous waste. Dangerous waste must be disposed of at a RCRA Subtitle C landfill.

Based on engineering estimates, the staging area(s) should be capable of storing approximately 25,000 cy of spoils, approximately 2 weeks of spoils. This is equivalent to a 250-by-250-foot area that is 11 feet tall. This is a conservative estimate based on the expected construction schedule. A slurry treatment plant may also be required for the spoils generated during the tunnel boring. Adequate space for stockpiling is necessary so that the excavation can proceed on schedule. Remediation of any petroleum contamination and abatement of ACM and/or LBP encountered are expected to be reasonably predictable. Remediation of other potential contaminants that may be encountered, such as halogenated solvents and other solvents, metals, PCBs, creosote, formaldehyde, VOCs, SVOCs, and PAHs, is not considered reasonably predictable.

Soil removed from the drilled shafts could be contaminated. The amount of contamination removed could be reduced by alternative support structures that do not result in waste soil, such as driven piles or stone columns. Both of these methods displace soil laterally. However, they may have limited application. Driven piles cannot be installed near buildings because of the vibration. The installation of stone columns may cause vibrations that could damage adjacent buildings and induce overall ground settlement, and it would require overhead clearance. Large amounts of water mixed with eroded soil could be displaced to the surface during the installation of stone columns if a wet method is used.

The slurry used in diaphragm wall construction may become contaminated. To reduce the potential for slurry contamination, the contaminated portion of the hole could be cased, to a maximum practicable depth of about 50 feet. If the slurry becomes contaminated, it could be reused within the contaminated zone on the property (if the concentrations are less than the MTCA Method A cleanup level). The volume of contaminated slurry generated could be minimized by constant reuse through the contaminated zone. At the end of the contaminated area, the contaminated slurry should be disposed of appropriately to minimize cross-contamination along the diaphragm wall. If the contaminated slurry is not reused, it would be disposed of at a facility that can accept contaminated slurry.

Ground freezing could also be used to improve tunneling behavior of in situ soils and reduce adverse effects on the existing viaduct. It would be an alternative to jet grouting. It also could be used during excavation in the south portal area and would temporarily alter groundwater flow. However, permanent watertight barriers would still be necessary in the south portal area for the tunnel operations building and the cut-and-cover tunnel. Ground freezing is typically accomplished by recirculating refrigerant fluid through a closed-loop system of casings and header pipes that includes a heat exchanger/cooling plant, or by

pumping expendable refrigerants into the casings, such as liquid nitrogen or carbon dioxide. Freezing systems must be properly designed to match the soil and groundwater conditions.

A CMMP would need to be developed for the soil and groundwater removed during project construction. A site-specific CMMP could also be required if solvents from the dry-cleaning operations are present in areas where soil and groundwater would be removed. Handling of soil and groundwater affected by these two sites would be regulated by Ecology. Once site characterization is completed, it may take 1 to 3 months to obtain a contained-in designation from Ecology. Public Health of Seattle and King County issues permits for stockpiles within the county and would have to approve any plans for these sites.

Excavation could be required in potentially contaminated areas. A stockpile area could be designated for temporary storage of soils until the characterization results are available. If soils encountered during project construction are expected to be a dangerous waste (i.e., contaminant concentrations exceed the state criteria for disposal at a RCRA Subtitle D landfill), an identification number could be obtained and planning for soil handling and disposal could be completed before construction. This would reduce soil handling time, because soils could be loaded onto trucks during initial excavation and hauled to treatment or disposal facilities. The disposal facility may also require additional testing of the stockpile before accepting the material.

Contaminated Groundwater

Dewatering would be necessary during construction of the cut-and-cover tunnel retaining walls and deep excavations for the tunnel operations buildings Groundwater is 6 to10 feet bgs in the south area necessitating extensive dewatering efforts. Groundwater in the north end of the project area is perched, and the regional groundwater is 70 to 80 feet bgs. Large-scale dewatering is not expected in the north area. Dewatering water would be handled and discharged to meet applicable local, state, and federal requirements, including permits. Dewatering discharge to the combined sewer will be required to meet King County, SPU, and DPD permit requirements for discharge. Reinjection of dewatering water to groundwater may be performed to mitigate the potential effects of dewatering. Reinjected water will comply with Washington's Water Quality Standards for Groundwater.

Effects from construction dewatering would be mitigated by implementation of the stormwater pollution prevention plan; the temporary erosion and sediment control plan; and the spill prevention, control, and countermeasures plan (discussed in the Appendix O, Surface Water Discipline Report). Measures described in these plans should include treatment of water generated by dewatering of shallow groundwater areas before discharge. Groundwater that is

removed from deeper soil units is less likely to contain contaminants. Water quality treatment for shallow dewatering could consist of storing the water to allow particles to settle, or adding chemical flocculants (chemicals that promote flocculation by causing colloids and other suspended particles in liquids to clump together into a mass, called a *floc*) to reduce suspended particles before the water is discharged from the project area. Any water meeting contaminated thresholds would have to be either treated to acceptable standards of the King County Wastewater Discharge Permit or Authorization, and SPU and DPD requirements, before discharge to the combined sewer system or disposed of off-site at approved hazardous waste facility.

In addition, given the rates of pumping for dewatering water in some areas, detention of this water may be necessary before discharge to either the storm drainage system or the combined sewer system to meet the requirements of the King County Wastewater Discharge Permit or Authorization and to avoid overwhelming these conveyance systems. Depending on the volumes and timing, if discharging dewatering flows to the stormwater or combined sewer system would not be feasible, off-site disposal would be required.

Temporary storage area and possible areas for water treatment would be identified as part of the dewatering plan. The size and configuration of the areas would also be determined.

Specific construction methods may be necessary to prevent cross-contamination and to minimize the migration of hazardous materials or contaminated media during construction. In areas of known groundwater contamination, special drilling methods would be used to reduce the potential for vertical migration of contaminants during installation of the drilled shafts and dewatering wells. Each saturated zone would be cased to prevent groundwater from entering the borehole and flowing down the open shaft. Dewatering wells should be designed to minimize drawdown and the area of influence to reduce the potential for mobilizing contaminants that may be present in the groundwater.

Lateral support would be required for the cut-and-cover tunnel. Although soldier piles with tiebacks and/or soil nails could be used, this would extend the project boundaries beyond the tunnel footprint. Alternative lateral support approaches, such as drilled shafts, would provide waterproof support systems that would eliminate or reduce the production of contaminated groundwater.

Solvent-contaminated groundwater at the north portal would need to be contained and treated before discharge. The water could be placed in Baker tanks and passed through an activated carbon filter to remove organic contaminants. Testing after treatment would be necessary to confirm that the solvents have been removed from the water.

H_2S has been encountered within the project area. Appropriate H_2S treatment options would depend on the concentration of H_2S. Trace amounts of H_2S (up to a few tenths of a milligram per liter) can be filtered such that the H_2S is adsorbed onto the carbon surface before discharge. In this method, the filter must be replaced when exhausted and cannot be recharged.

For H_2S at concentrations less than 2 mg/L, aeration (adding air to the water) is an appropriate treatment method. However, in any aeration system, the water must be protected from bacterial contamination and freezing, and there are large space requirements. Another limitation of this method is that the aeration process produces a strong, potentially unpleasant H_2S odor near the aerator. Furthermore, this process, by itself, may not always reduce the H_2S to the required levels. However, the addition of a carbon filter may remove some of the remaining trace amounts of H_2S.

For H_2S at concentrations of 1 to 10 mg/L, the use of an iron-removal filter containing manganese greensand is appropriate. Manganese dioxide oxidizes H_2S, and the oxidized particles are then filtered out in the lower part of the bed. Manganese greensand filters must be recharged with a solution of potassium permanganate when the manganese greensand is depleted. Water with a pH less than 6.7 may need to be treated with an acid water neutralizer before this process will be effective.

For H_2S at concentrations greater than 6 mg/L, the most common treatment method is constant chlorination using an automatic chemical feed pump. The recommended dosage is 2 mg/L chlorine for each mg/L of H_2S. The chlorine should be added ahead of the mixing tank, and sufficient storage must be provided to maintain 20 minutes of contact time between the water and the chemical.

Groundwater Flow

Dewatering would be necessary during construction of the cut-and-cover tunnels, retaining walls, and deep excavations for the tunnel operations buildings. To the extent feasible, the dewatering systems required for construction should be designed to minimize drawdown of the water table. This would reduce the volume of groundwater requiring treatment and disposal. It would also reduce the potential for mobilization and spreading of groundwater contaminants toward the project area.

Because of concerns about ground settlement, water would need to be reinjected close to where it is removed. Placement of the pumping wells and the reinjection points can be evaluated to minimize gradients near areas of groundwater contamination. In addition, the reinjection wells can be placed to create a hydraulic barrier for contaminated groundwater.

Jet grouting and deep soil mixing could be accomplished so as to allow permeable zones for groundwater to flow through the area after ground improvements are completed. Although flow paths would be altered, this approach would avoid a large-scale groundwater diversion and would reduce the potential for contamination of crossgradient properties.

Mitigation for groundwater backup is described in Section 5.3. Placement of pipes or drainage trenches would take into account the characteristics of contaminant plumes so as not to make the existing conditions worse.

Airborne Contaminants

VOCs, including compounds from creosote-treated timbers, gasoline-contaminated soil, and dry-cleaning operations, could become airborne during construction. Air monitoring can be performed, if conditions warrant it, and BMPs and/or engineering controls would be used so that VOC emissions are less than the relevant criteria, including those of Washington State Department of Labor and Industries and PSCAA. Engineering controls such as fans and blowers could be used to dissipate volatile contaminants. More elaborate engineering controls, such as soil wetting or air filtration, may also be necessary.

6.5.5 Contaminated Media Handling and Disposal Options

Because known or potentially contaminated sites have been identified in or near the study area, soil and/or groundwater contamination would likely be encountered during construction. Potential contaminants include petroleum hydrocarbons, metals, PCBs, VOCs, and SVOCs.

Mitigation Options for Petroleum Contamination

Petroleum-contaminated soil and groundwater associated with gas stations, auto repair shops, and heating oil tanks may be encountered in the study area. Mitigation options for petroleum contamination differ depending on the contaminated media. Mitigation options for petroleum-contaminated soil and groundwater are discussed below.

Soil. Petroleum-contaminated soils can be evaluated relative to current MTCA Method A cleanup levels or to MTCA Method B risk-based TPH criteria. Method A cleanup levels are conservative and are not risk-based. Soil cleanup actions using Method A cleanup levels would likely result in more soil having to be remediated than would be required under Method B. Method A would be easier to implement and would allow more rapid determination of remediation requirements than Method B. However, Method B cleanup levels are more flexible and would allow more petroleum-contaminated soil to remain on site or be used as road fill material in the study area.

Petroleum-contaminated soils encountered unexpectedly would require stockpiling and testing to assess the regulatory classification of the soil and the most cost-effective remediation strategy. Management options for petroleum-contaminated soils include the following:

- Soils containing petroleum contamination at concentrations less than the MCTA Method A cleanup levels are not restricted in use and could be used similarly to uncontaminated soils (including as backfill); however, Ecology has recommendations for the reuse of contaminated soil. Soil removed from the south end of the project area would generally not be suitable as fill for the project because of the wood debris that is comingled with the soil. In addition to reuse, soil reclamation facilities accept lightly contaminated material that complies with the facilities' permit requirements, which may be lower than the MTCA cleanup levels.
- Soils containing petroleum contamination at concentrations greater than the MTCA Method A cleanup levels but less than the Method B cleanup levels could be placed under roadways, if the fill capacity is adequate and the soils meet the geotechnical fill requirements.
- Soils contaminated with petroleum hydrocarbons at concentrations that exceed the Method B cleanup levels and soils in excess of the quantity required for fill could be transported to a thermal treatment facility. Alternatively, the soils could be disposed of at a landfill permitted to accept such contaminated soils.

On-site treatment of petroleum is not a viable option. The soil contains many other contaminants, such as PAHs, and metals that would not be treated by either land-farming or on-site thermal desorption. The range of petroleum compounds that have been encountered in the southern area is primarily in the heavy end, which is more difficult to remediate. Thermal desorption and land-farming are not efficient at treating this range of petroleum compounds; low levels would still likely be detectable. The high wood content also hinders remediation approaches. In addition, large volumes of spoils are expected, and there may be insufficient space to efficiently remediate the soil.

Groundwater. If contaminated groundwater is identified, approaches may be available to minimize the volume of water produced during construction, as described Section 6.5.4.

For contaminated groundwater generated during construction, containerization and characterization would be required to determine the approach to treatment. All dewatering water would conform to applicable federal, state, and local regulations. Groundwater that contains contaminants only at concentrations less than the MTCA Method A cleanup levels and that conforms with the criteria

defined in WAC 173-201A, Water Quality Standards for Surface Waters in the State of Washington, could be discharged directly or indirectly to the ground surface or surface water.

Groundwater containing contaminants at concentrations greater than the MTCA Method A cleanup levels could also be treated to meet the requirements for local discharge, depending on the contaminants and their concentrations. Local discharge after treatment could include (1) reinjection into the aquifer, (2) discharge to surface water, (3) discharge to a publicly owned treatment works (POTW), or (4) off-site disposal at a private TSD facility. Dewatering water that is reinjected would conform to Washington's Water Quality Standards for Groundwater. Discharge directly or indirectly to surface water would require conformance with the criteria defined in WAC 173-201A and permitting by Ecology. Discharge to a local sanitary sewer or a TSD facility would require approval from the facility and would likely require treatment before being discharged to a POTW. Water that is discharged to the combined sewer would need to be treated and disposed of in accordance with the King County Wastewater Discharge Permit or Authorization and in accordance with SPU and DPD requirements.

Mitigation Options for Metals, VOCs, and SVOCs

Metals, VOCs, and SVOCs associated with lumber yards, gas stations, auto repair shops, laundries/dry cleaners, dyers, rug cleaners, paint manufacturers, metal manufacturers, junkyards, printers, photo developers, and contaminated fill material may be encountered during project construction. Mitigation options for these contaminants differ depending on the contaminated media; mitigation for soil and groundwater containing these contaminants is discussed below.

Soil. If soil contamination is encountered during construction, excavated soil would require stockpiling and testing to determine its regulatory classification and the most cost-effective management strategies. Concentrations of metals, VOCs, and SVOCs can be evaluated relative to MTCA Method A or B cleanup levels and the dangerous waste rules to assess whether the soils would be of concern. MTCA Method A or B cleanup levels and dangerous waste levels could be used to determine disposal strategies where small amounts of contaminated soils are present, where soils need to be removed and disposed of quickly, and where soils can be easily used as subgrade road material.

Soils exceeding the TCLP criteria or other dangerous waste criteria would need to be handled as Washington State dangerous waste (WAC 173-303). Generators of dangerous waste are required to obtain an identification (ID) number for each site (location). The ID numbers can be obtained after the soils have been determined to be dangerous waste. ID numbers can be obtained by completing Ecology's Form 2. If preconstruction explorations are used to determine where dangerous

waste will be encountered, an ID number can be obtained and planning for soil handling and disposal can be accomplished before construction. This would reduce soil handling time and the potential for exposure or release to the environment, because such soils could then be loaded directly onto trucks during excavation and hauled to appropriate treatment or disposal facilities.

Contaminated soil that is removed from a property (as waste) and is known to be from a dry cleaner is regulated under the dangerous waste rules (WAC 173-303), which incorporate the requirements of RCRA. Ecology allows for disposal of soil contaminated with low concentrations of dry-cleaning solvents at a RCRA Subtitle D landfill if the soil has been classified as contained-in waste. Ecology may require from 1 to 3 months reviewing the data and issuing a contain-in designation.

A contained-in designation means that tetrachloroethylene is present (contained) in the waste at a low enough concentration that it cannot leach or does not have the potential to leach from the soil at a leachate concentration greater than 0.7 mg/L. Site characterization to determine the lateral and vertical limits and contaminant concentrations as well as the level of contamination is necessary to address Ecology's criteria for a contained-in designation. A written request for the designation must be made to Ecology Northwest Regional Office Hazardous Waste Toxics Reduction Program. Included in the request is an estimate of the volume of contaminated soil for which a determination is sought, representative analytical data obtained during the site characterization, and a diagram showing the location of the soil. A plan that describes the intended handling and transportation methods and identifies the final disposal site must be included with the request.

Special handling requirements are mandated if Ecology grants a contained-in designation. Permits would be required; therefore, the Seattle Solid Waste Division and Public Health of Seattle and King County would also be involved in the approval process. Ecology may require direct hauling to a landfill if a temporary staging area or transfer station is not able to segregate this material and maintain the special handling requirements imposed by Ecology.

Once Ecology is satisfied, it would provide a contained-in letter, which would allow soil disposal at a RCRA Subtitle D landfill. The cost for disposal at a Subtitle D landfill is substantially less than the cost for disposal at a Subtitle C landfill (see Section 6.6.2). Ecology coordination and permitting should be performed before design and excavation.

Handling options for contaminated soils include the following:

- Soils with concentrations that do not exceed the Method A cleanup levels could be placed under roadways if the fill capacity is adequate, the soils

are not designated as dangerous waste, and they meet the geotechnical fill requirements.

- Depending on the type of contaminant and its concentration and the pH level of the soil, soils must be transported to either a land reclamation facility, landfill or treatment facility if they have concentrations that (1) are less than the Method A cleanup levels but greater than the requirements for use as clean fill or (2) exceed the Method A cleanup levels but do not exceed the dangerous waste criteria.
- Soils designated as dangerous waste must be transported to a RCRA Subtitle C hazardous waste landfill or incinerator.
- Soils designated as contained-in waste by Ecology can be transported to a RCRA Subtitle D landfill for disposal. Otherwise, the soil must be transported to a RCRA Subtitle C hazardous waste landfill.

Groundwater. If contaminated groundwater is identified, approaches may be available to minimize the volume of water produced during construction, as described in Section 6.5.4.

For contaminated groundwater generated during construction dewatering, containerization and characterization would be required to determine the approach to treatment. If the contaminant concentrations are less than the dangerous waste criteria, the groundwater could be treated to meet the requirements for local discharge. Local disposal could include (1) discharge to the ground surface or reinjection to groundwater; (2) discharge to surface water; (3) discharge to a POTW; or (4) off-site disposal at a private TSD facility. Discharge of contaminated water to the ground surface or reinjection to groundwater would require conformance with Washington's Water Quality Standards for Groundwater (WAC 173-200). Discharge to the combined sewer system would meet the requirements of the King County Wastewater Discharge Permit or Authorization and DPD and SPU discharge requirements.

Groundwater contaminated with spent dry-cleaning solvents is characterized as F002 waste. It can be treated using GAC filters. Once the water is treated so that no detectable solvents remain, it would no longer carry a waste code and could be disposed of in the sanitary sewer or the storm sewer. However, it should be noted that disposal in a storm sewer would require an NPDES permit that would likely take at least 6 months to obtain. The spent GAC would require disposal as an F-listed dangerous waste.

Contaminated Building Debris

For structures that would be demolished, a verification of the presence of ACM and LBP and an estimation of the quantities of each material in and on the

structure to be demolished would need to be completed before demolition. This would be accomplished as a predemolition building survey conducted by an AHERA-certified building inspector. Demolition and disposal of these materials requires special handling. If ACM is identified, mitigation would consist of removing these materials in compliance with WISHA requirements before building demolition and disposing of them in an approved facility.

No mitigation options are available for the disposal of ACM. Such materials would need to be removed from any buildings slated for destruction before demolition activities occur and disposed of in a lined landfill. A comprehensive building survey and sampling program before demolition would help limit the amount of material that would need to be removed and placed in the landfill, thereby minimizing costs.

The dangerous waste criterion for lead, measured by the TCLP, is 5.0 mg/L. The TCLP test must be run "on a representative sample of the waste." If painted materials are treated as a separate waste, it is possible that these materials, containing high concentrations of LBP, would exceed the dangerous waste criterion. However, when these materials are combined with other building debris to create a representative sample of the building debris to be removed, it is likely that the combined waste stream would not fail the TCLP test and would not require designation as a dangerous waste. Building debris that fails the TCLP test is regulated as dangerous waste and must be transported to a hazardous waste landfill or incinerator.

6.6 Preliminary Cleanup Cost Estimate

Handling and disposal of contaminated soil and groundwater could pose a significant adverse impact on the project. An estimated 20 percent of the excavated soil would require special handling or would have disposal restrictions that make it a problem waste. Similarly, groundwater in the north and south portal areas may be contaminated. Dewatering in these areas would require additional evaluation, and the collected water would possibly require treatment before it could be discharged. Construction effects from contaminated media could be mitigated by developing a construction budget that includes the increased costs for managing and disposing of contaminated spoils and water. Early identification of contaminated soil and groundwater, and waste characterization, although increasing up-front costs, may minimize the volume of contaminated spoils. Areas of contamination could be avoided, construction methods could be modified to address contaminated media, and contaminated spoils could be segregated for appropriate disposal.

Estimated costs to identify, plan, and implement management of contaminated media are presented below. These costs are associated with construction of the

project, including elements such as relocation of utilities that may be implemented by other agencies.

6.6.1 Analytical Testing Costs

The following costs are for testing soil and/or groundwater samples for potential contaminants (see Exhibit 6-5). Typical turn-around time for results from local laboratories is 2 weeks. For same day turn-around (if feasible), the costs are usually double the costs for the standard 2-week turn-around. A surcharge of between 100 and 75 percent of the standard charge is applied for a 1-day turnaround. Costs for soil and groundwater testing are similar except for total metals analysis. Samples may be analyzed for one or any combination of the analytical tests.

Exhibit 6-5. Analytical Testing Costs

	Standard Cost per Sample	Cost for One-Day Turn-Around (With 100% Surcharge)
Diesel- and heavy-oil-range hydrocarbons	$75	$150
Gasoline-range hydrocarbons	$70	$140
Volatile organic compounds	$170	$340
PAHs	$190	$380
Eight RCRA metals (soil)	$105	$210
Eight RCRA metals (water)	$130	$260
TCLP for metals	$170	$340
PCBs	$90	$180

Note:
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
RCRA =Resource Conservation and Recovery Act
TCLP = Toxicity Characteristics Leaching Procedure

6.6.2 Underground Storage Tank Removal/Closure Costs

The following costs are for tank removal and disposal only and do not include the cost of overexcavation or trucking of soil to the selected disposal/treatment facility, if required:

Household heating oil tank	$3,000 per tank
Service station tank	$5,000 to $10,000 per tank
Product/sludge disposal	$2 to $4 per gallon
UST site assessment (no known release)	$3,000 to $7,500 per site

A site assessment is not required for unregistered household heating oil tanks where no release has occurred.

6.6.3 Soil Disposal and Treatment Costs

The following costs are for soil disposal only and do not include the cost of excavation or trucking to the selected disposal/treatment facility:

Petroleum-contaminated soils:

Thermal treatment	$30 to $35 per ton
Landfill disposal	$20 to $30 per ton

Soils contaminated with halogenated solvents, EPA priority pollutants, and/or corrosive waste:

Landfill disposal of non-dangerous waste	$30 per ton
Landfill disposal of dangerous waste	$180 per ton
Incineration of dangerous waste	$600 per ton

On-site treatment is not practical for contaminated soil removed at the south end of the project area. Soil would require treatment for petroleum hydrocarbons, mostly oil range, which is difficult to remove from soil with high levels of organics, and in areas with heavy metals.

6.6.4 Groundwater Treatment and/or Disposal Costs

The following costs for groundwater treatment and/or disposal options include permitting for local discharge and/or off-site treatment and disposal:

Permitting for local discharge:	$2,500 to $10,000, depending on type and level of contaminants present
Off-site treatment and disposal:	$0.25 to $2 per gallon, depending on type and level of contaminants present
On-site treatment and disposal:	$0.005 to $0.25 per gallon, depending on type and level of contaminants present

6.6.5 Contaminated Building Debris Costs

The cost estimates provided in this section are unit cost estimates, because the volume of potential ACM and/or contaminated soil that could be encountered during project construction is unknown at this time. The cost estimate for a predemolition building survey is $1,500 to $6,000 per residential structure, depending on the size of structure and the number of structures involved.

The following is a sample list of ACM that could be found in the various buildings and their associated removal/disposal costs. Estimated costs for

preparing abatement specifications and for providing abatement oversight are also included.

Ceiling tiles	$2 to $3 per square foot
Textured ceiling (popcorn)	$5 to $7 per square foot
Fire doors	$50 to $75 per door
Sheet flooring	$3 to $5 per square foot
Floor tiles (9- or 12-inch)	$1 to $2 per square foot
Mastic (floor tile or sheet flooring)	$2 to $4 per square foot
Wallboard, tape, and mud	$2 to $4 per square foot
Roofing (built-up)	$1 to $2 per square foot
Roof patching	$1 to $2 per square foot
PSCAA permit	$25 to $2,000, depending on the project size and number of structures involved
Preparation of abatement specifications	$5,000 to $15,000
Abatement oversight	$500 or 10 percent of total abatement costs, whichever is greater

Chapter 7 CUMULATIVE EFFECTS

Cumulative effects are effects on the environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. Hazardous materials are not in and of themselves a resource that would normally be evaluated for cumulative effects. Hazardous materials, however, could affect resources including air and water. However, a cumulative effects discussion is included here to provide a summary of the resources that could be affected by hazardous materials. The detailed analysis of cumulative effect is presented in Attachment J.

7.1 Trends Leading to Present Conditions

The Program area is significantly modified relative to the pre-European development, primarily through large earth-moving projects and dense urban development. The large earth-moving projects involved filling the tidelands near the south portal area for railroad and manufacturing and industrial development. In the north portal area, in the early twentieth century, the Denny Hill Regrade project sloughed off the soils on top of the steep Denny Hill down into Elliott Bay. This area is still referred to as the Denny Regrade.

Wastes were often buried in the various fill areas, and they may contain residual contamination from the original borrow site. Over the past 100 years, the erection of industrial, commercial, and residential buildings and the development of roads have also contributed to soil and groundwater contamination. Starting in the 1970s, environmental regulations required the proper handling and disposal of wastes in accordance with various federal, state, and county regulations. Additionally, laws required the cleanup of known sites of contamination. This has led to an improvement in environmental quality for land, water, and air resources.

7.2 Effects From Other Roadway Elements of the Program

Other elements of the Program include the road improvements discussed below.

7.2.1 Alaskan Way Surface Street Improvements – S. King to Pike Streets

The Alaskan Way surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), transitioning to four lanes between Marion and Pike Streets. Generally the new Alaskan Way surface street would be located on the east side of the right-of-way where the viaduct is located today. The new street would include new sidewalks, bicycle lanes, parking and loading zones, and signalized pedestrian crossings at cross streets.

Surface contamination would likely be present, since all of the removed material would be fill. The roadway intersections with the downtown Seattle street grid would be signalized, which would require installation of signal poles supported by drilled shafts. Standard construction effects and mitigation would occur as described in Attachment I.

7.2.2 Elliott/Western Connector – Pike Street to Battery Street

The new roadway connecting Alaskan Way to Elliott and Western Avenues (in the area between Pike and Battery Streets) would be four lanes wide and would provide a grade-separated crossing of the BNSF mainline railroad tracks. The new roadway would include bicycle and pedestrian facilities. The Lenora Street pedestrian bridge would become an at-grade pedestrian crossing of this new connector arterial, whereas today it is a grade-separated crossing.

Deep foundations, likely consisting of drilled shafts, would be used to support the elevated structure. Construction would generate pH-affected spoils that would require disposal at a facility permitted to accept the spoils. The volume of material that would be generated is small compared with that generated by other construction projects.

7.2.3 Mercer West Project –Fifth Avenue N. to Elliott Avenue

Mercer Street would be restriped and signalized between Fifth Avenue N. and Second Avenue W. to create a two-way street with turn pockets. These improvements also include the restriping and resignalization necessary to convert Roy Street to two-way operations from Fifth Avenue N. to Queen Anne Avenue N.

Because these improvements are limited to striping and signalization, no impacts related to hazardous materials would be associated with this work.

7.3 Effects From Non-Roadway Elements of the Program

7.3.1 Elliott Bay Seawall Project

The Elliott Bay Seawall needs to be replaced to protect the shoreline along Elliott Bay, including Alaskan Way. It is at risk of failure due to seismic and storm events. The seawall currently extends from S. Washington Street in the south to Bay Street in the north, a distance of about 8,000 feet. The Elliott Bay Seawall Project limits extend from S. Washington Street in the south to Pine Street in the north (also known as the central seawall).

Different concepts have been advanced for replacement of the seawall, including anchored soil improvements and braced secant pile walls. These activities would tend to immobilize contaminants that are locally associated with creosote-treated

timbers located west of the seawall. Soil improvement would also alter groundwater flow patterns.

In-water work would likely disturb sediment in Elliott Bay. Several chemicals of concern have also been identified in sediments along the waterfront. Chemicals that have been found to exceed regulatory cleanup criteria include mercury, silver, lead, zinc, copper, PCBs, and PAHs. The exceedances occurred in the upper 6 to 10 feet of the sediment layer. Overall, mercury may be the most widespread chemical of concern in both surface sediments (0 to 18 inches bgs) and subsurface sediments (greater than 18 inches bgs) in the Seattle waterfront area. Shallow sediment that may be removed would have to be disposed of in an off-site upland location. Sediment could also be resuspended, adversely affecting water quality.

7.3.2 Alaskan Way Promenade/Public Space

A new expanded waterfront promenade and public space would be provided to the west of the new Alaskan Way surface street between S. King Street and Pike Street. Between Marion and Pike Streets this space would be approximately 70 to 80 feet wide. This public space will be designed at a later date. Access to the piers would be provided by service driveways. Other potential open space sites include a triangular space north of Pike Street and east of Alaskan Way, and parcels created by the removal of the viaduct between Lenora and Battery Streets.

Shallow soils in this area are likely contaminated and would require proper handling and disposal, as described in Section 6.5.5. Likely contaminants include petroleum hydrocarbons, PAHs, and metals.

Assuming that a portion of the promenade would be open green space, the amount of PGIS would decrease relative to existing conditions, and this would benefit the environment. Also, if construction involves excavation, contaminated soil would be removed and properly disposed of, resulting in less soil contamination along the waterfront.

7.3.3 First Avenue Streetcar Evaluation

The First Avenue streetcar is currently planned to run between S. Jackson Street and Republican Street along First Avenue and would include an extension to the South Lake Union streetcar line. The maintenance base would likely be either at the extension of the South Lake Union line or at a new maintenance base that would be built as part of the First Hill streetcar line.

Depending on the type of streetcar, there could be minimal localized contamination from operation of the streetcar.

7.3.4 Transit Enhancements

A variety of transit enhancements would be provided to support planned transportation improvements associated with the Program and accommodate future demand. This includes (1) the Delridge RapidRide line, (2) additional service hours on the West Seattle and Ballard RapidRide lines, (3) peak-hour express routes added to South Lake Union and Uptown, (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes, (5) transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue, and (6) simplification of the electric trolley system. RapidRide transit along the Aurora Avenue corridor would also be provided.

No effects related to hazardous materials are expected to result from the enhanced transit service.

7.4 Cumulative Effects of the Project and Other Program Elements

While not a cumulative effect, a potential beneficial cumulative effect of the Program is that there would be fewer contaminated sites in the Program area due to cleanup activities associated with the construction of these projects. In addition, there would likely be a decrease in contaminated surface water, because new construction would include stormwater flow control and water quality treatment measures in compliance with Seattle's drainage code.

Reduced availability of sites for handling and disposing of contaminated material could be a cumulative effect of the Program elements that are constructed within the same timeframe as the Bored Tunnel Alternative. Available capacity could be reduced, and contaminated materials may need to be transported greater distances.

7.5 Cumulative Effects of the Project, Other Program Elements, and Other Actions

Cumulative effects of other past, present, and reasonably foreseeable future projects combined with the effects of the Program may add to the effects related to hazardous materials discussed in this discipline report. The following projects have been completed or are anticipated in or near the Program area:

- Sound Transit University Link Light Rail Project
- Sound Transit North Link Light Rail
- Sound Transit East Link Light Rail
- Sound Transit Phases 1 and 2
- S. Spokane Street Viaduct Widening

- S. Holgate Street to S. King Street Viaduct Replacement Project
- SR 519 Intermodal Access Project, Phase 2 (completed in spring 2010)
- SR 520 Bridge Replacement and HOV Program
- I-5 Improvements
- South Lake Union Redevelopment

Potential spills or releases of contaminated materials to the environment could occur with any construction project. This could adversely affect the environment and worker and public health.

A potential benefit of all of the major construction projects is that there may be fewer contaminated sites in the area due to cleanup activities associated with the construction of these projects. In addition, there would likely be a decrease in contaminated surface water, because new construction would include stormwater flow control and water quality treatment measures in compliance with Seattle's drainage code.

Reduced availability of sites for handling and disposing of contaminated material could be a cumulative effect of the Program elements and other projects that may be constructed within the same general timeframe as the Bored Tunnel Alternative. Available capacity may be reduced, and contaminated materials may need to be transported greater distances.

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ATTACHMENT A

EDR Study Area Report

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Attachment A provides the EDR Study Area Report used for the analysis discussed in the body of the discipline report. This attachment is too large (either in length or file size) to include in the document, but is available upon request.

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ATTACHMENT B

Sites Excluded Based on Screening Criteria

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ATTACHMENT B
SITES EXCLUDED BASED ON SCREENING CRITERIA

Exhibit B-1. Resource Conservation and Recovery Act (RCRA) Small- and Large-Quantity and Conditionally Exempt Generator Sites

EDR Map	EDR Map Number	Name	Address	Conditionally Exempt	Small Quantity Generator	Large Quantity Generator	Identified on Multiple Regulatory Lists
8	5	Maryatt Industries	771 Valley Street			X	X
17	5	Quik Sign Inc	601 Dexter Avenue N.		X		
17	5	Utilities Inc	605 Dexter Avenue N.		X		
26	5	Iris Holding LLC	520 Fifth Avenue N.			X	
27	5	Carl Zapffe Inc	513 Dexter Avenue N.	X			
36	5	Display Products	401 Eighth Avenue N.	X			
41	5	KING TV	333 Dexter Avenue N.	X			X
51	5	Bernard Import Bodyworks	223 Eighth Avenue N.	X			
53	5	Hauge & Hassain Inc.	207 Sixth Avenue N.		X		
57	5	Fat City Inc. Auto Repair	508 Denny Way	X			
57	5	Prime Cyte Inc	130 Fifth Avenue N.	X			
82	5	Frederick Cadillac	2301 Sixth Avenue	X			X
87	5-8	Lifespan Biosciences	2401 Fourth Avenue 12th Floor	X			
101	8	Wilson Engraving Co Inc	314 Bell Street	X			
107	8	Holman Body and Fender	2324 Second Avenue	X			X
116	8	Cinerama	2100 Fourth Avenue	X			
126	8	Consolidated Press Printing Co	2228 First Avenue	X			
127	8	Gem East Corp	2124 Second Avenue	X			
156	8	Payless 2932	1401 Second Avenue		X		
157	8	Seattle City Jones Bldg	1331 Third Avenue	X			X
166	8	Bayer Healthcare Pharmaceuticals Seattle	51 University Street			X	

Exhibit B-1. Resource Conservation and Recovery Act (RCRA) Small- and Large-Quantity Generator Sites (continued)

EDR Map	EDR Map Number	Name	Address	Conditionally Exempt	Small Quantity Generator	Large Quantity Generator	Identified on Multiple Regulatory Lists
166	8	Nikko Media Ctr	1305 First Avenue	X			
172	8	Ps Industries Inc	1100 Second Avenue, Suite B1	X			
172	8	Washington Mutual Bank	1101 Second Avenue	X			
179	8	Nikko Media Center LLC	88 Spring Street	X			
182	8	Alexis Hotel	1007 First Avenue		X		
182	8	1000 First Avenue Properties LLC	1000 First Avenue	X			
226	8-11	Bridge Warehouse	401 Alaskan Way S.			X	
236	11	Biocoll Labs	562 First Avenue S., Suite 600	X			
236	11	MSI Provident LLC	568 First Avenue S.	X			
247	11	Palmer Building The	1000 First Avenue S.		X		
254	11	Stevedoring SVCS of America Term 37 Port	1201 Alaskan Way S.	X			X

Exhibit B-2. Emergency Response Notification System (ERNS) Sites

Map ID Number	Focus Map Number	Business Address
120	8	2121 Third Avenue
132	8	Third Avenue and Virginia Street

Exhibit B-3. Registered USTs Removed

EDR Site No.	EDR Focus Map No.	Name	Address	Install Date	Site Description	Identified on Other Regulatory Lists (ERNS and RCRIS)	Site Identified on Multiple Release Lists (LUST, VCP, CSCSL, ICR)
10	5	ABC TOWING -- RYDER TRUCK	707 TAYLOR	12/31/1964	2 tanks, removed 1993		YES
20	5	PCY CORP	601 6TH AVE N	1/1/1900	1 tank, removed 7/14/1998		YES
41	5	KING TV	333 DEXTER AVE N	11/7/1980	1 tank, removed 9/20/1999	YES	
69	5	Grosvenor House Vine Street	505 Vine Street	12/31/1964	3 tanks, removed 1996 or earlier		NO*
70	5	PRECISION TUNE 7TH AVE SEATTLE	2331 7TH AVE	9/1/1982	1 tank, removed 8/26/1996		NO
82	5	FREDERICK CADILLAC	2301 6TH AVE	1/1/1976	1 tank, removed 3/2/1999	YES	
87	5-8	PARSON SEATRUST PARTNERSHIP	2500 4TH AVE	12/31/1964, 1	4 tanks, removed 8/26/1996		YES
91	5-8	PHOM PROPERTY	2301 4TH AVE	1/1/1900	3 tanks, removed 6/19/2001		YES
93	8	NEUFFER CONSTRUCTION CO.	5TH / BLANCHARD	1/1/1900	4 tanks, removed 7/16/2001		YES
107	8	HOLMAN BODY AND FENDER	2324 2ND AVE	1/1/1694	1 tank, removed 8/26/1996		YES
120	8	REXLAND CO INC	2126 3RD AVENUE	12/31/1928	1 tank, removed 12/9/1997		YES
137	8	AUTOPARK USA, INC	1915 2ND AVE	1/1/1964	2 tanks, removed 5/15/2000		YES
139	8	One Pacific Tower W Construction Site	1st Ave/Virginia Ave		4 gasoline USTs removed in 1994.		YES
156	8	SECOND AND UNION PARKADE	1400 2ND AVE	1/1/1969	2 tanks, removed 8/26/1996		YES
158	8	HELIPARKER GARAGE	95 UNION ST	1/1/2001	4 tanks, removed 4/26/2006		YES
173	8	EXPEDITORS INTERNATIONAL	1015 3RD AVE	3/1/1987, 1/1/1970	3/16/1998		NO
189	8	NORTHWEST BUILDING CORPORATION	801 2ND AVE	12/31/1964	2 tanks, removed 8/26/1996		NO
210	8	BUTLER GARAGE	114 JAMES ST.	1/1/1900, 1/1/1964	7/21/2004		YES
211	8	ACE NOVELTY SEATTLE	621-625 WESTERN AVE	12/31/1964	2 tanks, removed 8/26/1996		NO
212	8	YESLER WAY GARAGE	2ND AVE / YESLER WAY	1/1/0001	1 tank, removed 9/30/2002		NO
244	11	Union Pacific RR 1st Ave Seattle	801 1st Avenue S.	12/31/1964	1 tank, removed 1993		YES
247	11	KINGDOME STATION	1046 1ST AVE S	(2), 6/20/1973	4 tanks, removed 6/26/2000		YES
252	11	SERVICE STATION 1ST AVE	1200 1ST AVE S	(1)	1/1/2001 (1)		NO
257	11	FORTUNE	84 S ATLANTIC	12/31/1964	1 tank, removed 8/26/1996		NO

Notes:

Tanks that have been removed (this table) have not been assigned a site number for the UST study or as a Documented and Potential Contaminant Release location.

If the UST site had a release, the site would have been identified on one of the following regulatory databases: Confirmed or Suspected Contaminant Release Site = CSCSL; Hazardous Sites List = HSL; Leaking Underground Storage Tank (LUST), Voluntary Cleanup Program (VCP), or Independent Cleanup Report (ICR). The site was evaluated further.

* One site that does not appear on other lists was considered further because of historical site use other than the presence of USTs.

Ten unique sites were excluded because the UST has been removed and the site does not appear on another regulatory list indicating a release.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
20.0	20.0-2	707 Taylor Ave.	ABC Towing - Ryder Truck (Intermark Queen Anne Property)	Former Chevron station; two USTs removed 1993, PCS excavated; PCS remains at east and south extents of excavation (toward Taylor Ave. and Roy St., respectively) in zone approx. 6 to 13 feet below ground surface (bgs).	gasoline, BTEX	10-5	LUST	Site is approximately 300 feet north and likely crossgradient of project area (Mercer Street); no excavation planned in site vicinity.
20.01	20.01-5	720 Taylor Avenue N.	Plaid Pantry No. 309	Plaid Pantries Store #309: Gasoline leaked from three USTs. Vapor extraction system installed. Volatiles no longer detected in groundwater at 6 to 13 feet below ground surface. Received NFA in 2001. No additional information was available in 2009.	gasoline	10-5	VCP, CSCSL-NFA	Site is approximately 500 feet north and likely crossgradient of project area (Mercer Street); no excavation planned in site vicinity; site is reportedly cleaned up.
20.20	20.2-1-3	771 Valley Street	Maryatt Industries	Maryatt Industries: Reported in 1992, no recent data. Dry-cleaning solvents (PCE, TCE, and vinyl chloride), gasoline, and BTEX detected in groundwater. The highest concentration of PCE was 0.8 mg/L, and the highest concentration of vinyl chloride was 0.1 mg/L. Planned to continue monitoring. Depth to groundwater is 7 to 17 feet. Groundwater gradient was towards the west (Dexter). No additional information was available in 2009.	solvents, gasoline	8-5	CSCSL, ICR	Site is approximately 100 to 200 feet north and likely crossgradient of project area (Broad Street); no excavation planned in site vicinity.
80.5	80.5-2	600 Denny Way	Japanese Auto Clinic	Gas station was present from at least 1961 to 1989. USTs removed, petroleum-contaminated soil was excavated and treated on site via air stripping, and reused as backfill. Groundwater not encountered. No additional information was available in 2009.	gasoline, petroleum	62-5	LUST, ICR	Site is adjacent to the project (tunnel) where the tunnel crown is approximately 85 feet bgs. Site has documented contamination whose status is unknown. It is unlikely that soil excavated from tunnel zone would be contaminated with petroleum products. In addition, if petroleum was present it would likely have been removed during construction of the multi-story building under construction in 2009.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
120.6	120.6-1	2619 5th Avenue	Edwards on 5th Building	Database listing indicates that petroleum products are present in soil from a tank release; site is awaiting a site hazard assessment.	petroleum	66-5	CSCSL, ICR	Site has documented contamination whose status is unknown. It is unlikely that soil excavated from tunnel zone would be contaminated with petroleum products. In addition, if petroleum was present it would likely have been removed during construction of the multi-story building under construction in 2009.
120.6	120.60-4	2602 4th Avenue	Stonecliff Apartments	Ecology received interim cleanup reports in May and June 1993 regarding cleanup of petroleum products in soil from a tank.	petroleum	81-5	ICR	Site is approximately 450 feet west of project area (tunnel); no excavation planned in site vicinity; tunnel crown is approximately 100 feet bgs.
130.7	130.7-1	2500 Fourth Avenue	Parson Seatrust Partnership	Former Selig Property/Keylock Parking Lot: NFA issued January 1999. Removed UST and excavated petroleum-contaminated soil for off-site disposal.	gasoline	87-5,8	CSCSL-NFA	Site is approximately 250 feet west of project area (tunnel); tunnel crown is greater than 100 feet bgs; no excavation planned in site vicinity; site is reportedly cleaned up.
130.8	130.8-2	500 Wall St.	Archstone Belltown	circa 1949, 18-story apartment building has 10,000-gallon Bunker C UST inside building in a concrete vault; UST closed in place March 2007; a soil sample 12.5 feet bgs collected December 2006 had TPH-O of 38,000 mg/kg; sample was collected beneath the floor of a former paint room. Additional sampling using limited access drill rig (auger) was accomplished in early 2007. Petroleum was not detected in any of the six borings drilled in the vincinity of the tank. One groundwater sample from a different location did not have contamination greater than MTCA-A (TPH and PAHs). This may be water trapped between floor slabs for the two buildings. No additional information was available in 2010.	petroleum, cPAHs	73-5	CSCSL, VCP, Spills	Site is adjacent to or beneath the project (tunnel). A subsurface easement would be acquired for the parcel number. The tunnel crown is approximately 95 feet bgs in the site vicinity. The site has documented petroleum contamination, but the type of contaminants are not highly mobile.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
140.7	140.7-2	2400 Fourth Avenue	Fountain Court Apartments	Fountain Court Apartments: Removed four USTs when developing site as apartments. Excavated soil to below MTCA cleanup levels. Received NFA on 4/2/01. No additional information was available in 2009.	solvents, gasoline	87-5,8	VCP, CSCSL-NFA	The tunnel crown is approximately 95 feet bgs in the site vicinity. The site has documented petroleum contamination, but the type of contaminants are not highly mobile.
150.5	150.5-3	2324 Second Avenue	Holman Body & Fender	Holman Body and Fender/Former Master Auto Service Co.: gasoline UST removed, approximately 50 to 70 tons of gasoline contaminted soil was removed and disposed off-site in 1995. No apparent groundwater impact; some soil contamination remains on site. Former UST was adjacent to Second Avenue. No additional information was available in 2009.	petroleum	107-8	LUST, ICR	Site is approximately 400 feet west of project area (tunnel) and approximately 30 feet southeast of Battery Street tunnel decommissioning; no excavation planned in site vicinity; tunnel crown is greater than 100 feet bgs in site area.
150.6	150.6-2	2301 Fourth Avenue	Phom Property	Phom Property: Former gas station; tanks apparently removed, soil borings advanced to investigate remaining conditions, gas/BTEX present above MTCA Method A. Also heating oil tank below floor of building. No further info in file (2009).	gasoline	91-5	LUST, ICR	Project area (tunnel) is below the site; no excavation planned in site vicinity; tunnel crown is greater than 100 feet bgs in site area.
150.7	150.7-2	2334 Fourth Avenue	Seattle Fire Station 2	Seattle Fire Station 2: Two USTs removed, diesel-range TPH remains above MTCA Method A in soil, groundwater not encountered. No further info in file. No additional information was available in 2009.	petroleum	91-5,8	LUST, ICR	Project area (tunnel) is below site; site is adjacent to Battery Street tunnel decommissioning; no excavation planned in site vicinity; contaminants are not highly mobile; tunnel crown is greater than 100 feet bgs in site area.
160.6	160.6-1	306 Blanchard Street	Cornelius Apartments	Cornelius Apartments: According to EDR (2009) - Petroleum products present in soil from heating fuel tank; interim cleanup report filed in 1993. Ecology file not available for review in 2004 or 2009.	petroleum	113-8	ICR	Site is adjacent to east side of project area (tunnel); contaminants are not highly mobile; tunnel crown is approximately 160 feet bgs in site area.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
160.8	160.8-1	Fifth Avenue and Blanchard Street	Neuffer Construction Company	Neuffer Construction Co.: Eight abandoned USTs encountered during construction, all petroleum-contaminated soil removed, perched groundwater was pumped from excavation and did not return. No additional information was available in 2009.	petroleum	93-8	LUST, ICR	Site is approximately 500 feet east of project area (tunnel); contaminants reportedly cleaned up; tunnel crown is greater than 100 feet bgs in site area.
170.3	170.3-4	2114 Western Avenue	Elliott Bay Bicycles	Repair garage built in 1902. EDR: petroleum products confirmed in soil and suspected in groundwater. Site has been ranked (5, lowest priority), and is awaiting remedial action.	petroleum	140-8	CSCSL, HSL	Site is approximately 500 feet west of project area (tunnel), and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 180 feet bgs in site area.
170.7	170.7-3	2101 5th Ave.	Sterling Realty Organization Co. Property	Former Chevron service station; potential USTs present; 4 MWs installed in 1997; PCS encountered 4 to 7.5 feet bgs; groundwater contaminated with TPH-D,G and benzene; RI conducted in 2006 found 2 abandoned USTs; PCS present in southeastern site area (2-15 ft. bgs); TPH-D and benzene detected in groundwater greater than MTCA-A. Perched groundwater flow direction to the east, depth 2 to 10 ft. bgs.	gasoline, petroleum, benzene	103-8	LUST, VCP, CSCSL	Site is approximately 600 feet east of project area (tunnel), and downgradient based on perched groundwater flow direction at site; no excavation planned in site vicinity; tunnel crown is approximately 150 feet bgs in site area.
180.3	180.3-3	2001 First Avenue	Intrawest	Intrawest/Former Reliable Tailors and Cleaners: Abandoned Bunker C UST encountered during building demolition; affected soil overexcavated and disposed; groundwater not encountered. This Ecology file review is from 2004. The file could not be located in 2009.	solvents, metals, petroleum	139-8	ICR	Site is approximately 150 feet west of project area (tunnel) and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 200 feet bgs in site area.
180.4	180.4-3	First Avenue and Virginia Avenue	One Pacific Tower West Construction Site	One Pacific Tower West Construction Site: Four gasoline USTs removed in 1994. Removed petroleum-contaminated soil. Samples at limits of excavation were below MTCA Method A standards. Site redeveloped. No additional information was available in 2009.	gasoline	139-8	LUST, ICR	Project area (tunnel) is below the site; site is reportedly cleaned up; tunnel crown is approximately 200 feet bgs in site area.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
180.5	180.5-2, 180.5-3, 180.5-4	211 Lenora Street	Second & Lenora Project	2 USTs removed in 1998 (heating oil and Bunker C?); approximately 285 tons PCS removed; confirmational samples indicated PCS effectively removed.	petroleum	127-8	ICR	Site is adjacent to the east side of project area (tunnel); contaminants are not highly mobile; site is reportedly cleaned up; tunnel crown is approximately 180 feet bgs in site area.
180.6	180.6-6	2025 4th Ave.	Minit Lube #1113	Waste oil UST closed in place in 1996; 3 MWs installed in 2007; contaminants not detected in soil samples at greater than MTCA-A; groundwater samples collected between 2007 and 2009: most recent two sampling events, all constituents less than MTCA-A; earlier detections of TPH-D and lead exceeded cleanup standards.	petroleum, lead	121-8	ICR, LUST, CSCSL, VCP	Site is approximately 450 feet east of project area (tunnel); no excavation planned in site vicinity; tunnel crown is approximately 180 feet bgs in site area.
190.4	190.4-3	1915 Second Avenue	Autopark USA, Inc.	Auto Park Garage/Second Avenue Garage: USTs were removed in 2000. Gasoline-contaminated soil remains under the sidewalk along Second Avenue. Received NFA in 2000. Not practical to remove soil. Additional information was found in the 2009 Ecology file review. A Phase II Environmental site assessment was conducted in 2005. Three areas of petroleum impacted soil were encountered; 1)the former UST area (along Second Avenue); 2) the southwest are; and 3) the northern area. Gasoline exceeding the MTCA cleanup level of 30 mg/kg (benzene was also detected) were encountered in all three areas. The maximum concentration encountered at a depth of 16 feet was 3,900 mg/kg gasoline (approximately 100 feet west of Second Avenue and 100 feet north of Steward Avenue). Groundwater was not encountered. They propose to excavate the soil (2006); however, no documentation regarding cleanup was found in the Ecology file (as of 2009).	gasoline	137-8	LUST, CSCSL, VCP	Site is adjacent to the east side of the project area (tunnel); tunnel crown is approximately 180 feet bgs in site area.
190.4	190.4-7	116 Stewart	St. Regis Hotel	EDR: Petroleum products confirmed in soil and groundwater; site status: awaiting site hazard assessment.	petroleum	145-8	CSCSL	Site is approximately 100 feet east of the project area (tunnel); tunnel crown is approximately 180 feet bgs in site area.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
190.5	190.5-4	1929 3rd Ave.	Barg French Cleaners	Soil vapor extraction wells installed in 2000; specific flow direction for the perched water table not well defined; estimated regional groundwater flow direction toward the southwest.	PCE	135-8	CSCSL	Site is approximately 350 feet east of project area (tunnel); no excavation planned in site vicinity; tunnel crown is approximately 200 feet bgs in site area.
210.5	210.5-3	1521 2nd Ave.	1521 2nd Ave. Property	Former Green Tortoise Hostel and Hanford Bldg.; PAHs in fill material; 3,000 cy excavated and disposed. NFA granted with no restrictions.	petroleum, PAHs	149-8	CSCSL-NFA	Site is approximately 150 feet east of project area (tunnel); site is reportedly cleaned up; no excavation planned in site vicinity; tunnel crown is approximately 180 feet bgs in site area.
220.5	220.5-1	1400 2nd Ave.	Parkade (Aampco Parking Garage)	Former gas station; two USTs closed in place in 1994; PCS not found at tanks, but was detected in fill elsewhere at 5 ft. bgs; 2 cy removed.	petroleum, BTEX	156-8	ICR, LUST	Site is approximately 350 feet east of project area (tunnel); no excavation planned in site vicinity; tunnel crown is approximately 145 feet bgs in site area.
230.2	230.2-1	1319 Western Avenue	Puget Sound Power & Light	Puget Sound Power & Light: Bunker C by viaduct footing to a depth of 17 to 19 feet below ground surface in soil and groundwater.	petroleum, PAHs, metals, PCBs	166-8	CSCSL, LUST, ICR	Site is approximately 350 feet west of project area (tunnel) and likely downgradient; contaminants not highly mobile; no excavation planned in site vicinity; tunnel crown is approximately 130 feet bgs in site area.
230.3	230.3-1	1312 Western Ave.	Seattle City Light/Union Substation	Transformer oil spill in 1996; Ecology notified. No information in file re: sampling or regulatory actions taken (2009).	petroleum, PCBs	166-8	ICR	Site is approximately 150 feet west of project area (tunnel) and likely downgradient; contaminants are not highly mobile; no excavation planned in site vicinity; tunnel crown is approximately 160 feet bgs in site area.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
230.3	230.3-2	95 Union Street	Heliparker Garage	EDR: Ecology granted NFA on 6/14/2006.		158-8	CSCSL-NFA, VCP	Site is adjacent to the west side project area (tunnel) and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 160 feet bgs in site area.
230.5	230.5-7	1331 3rd Ave.	Aampco/Jones Bldg. Parking	2 USTs removed in 1996; third one may have been removed previously; PCS removed from UST locations and a floor drain; confirmational samples indicate remaining soil meets MTCA-A.	petroleum	157-8	LUST, ICR	Site is approximately 450 feet east of project area (tunnel); no excavation planned in site vicinity; contaminants have reportedly been cleaned up; tunnel crown is approximately 145 feet bgs in site area.
240.2	240.2-2	1201 Western Ave.	Harbor Steps Development	Based on a 2009 review of Ecology file former occupants included a metal plating company and a service garage; USTs removed in 1990; soil with petroleum and metals contamination excavated in 1993 and 1995, disposed off-site; confirmational samples meet regulatory criteria; groundwater occurs 7 to 11 feet bgs; samples from monitoring wells indicate groundwater not impacted.	metals, petroleum	174-8	ICR	Site is approximately 300 feet west of project area (tunnel) and likely downgradient; site reportedly cleaned up; no excavation planned in site vicinity; tunnel crown is approximately 100 feet bgs in site area.
260.2	260.2-1	1011 Western Avenue	Waterfront Place	Waterfront Place: Arsenic, chromium, lead, mercury, and TPH present in site soil and groundwater. Although total metals exceed MTCA Method A, dissolved metals do not. NFA issued April 2000. No additional information was available in 2009.	metals	185-8	VCP, ICR, CSCSL-NFA	Site is approximately 150 feet west of project area (tunnel) and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 90 feet bgs in site area.
270.2	270.2-2	911 Western	Maritime Building	Maritime - EDR 2009 -Cleaned up under prior authority. NFA Date 9/13/1995. No file available at Ecology. A cleaner operated in the building, as well as a printing operation, and engine company.	unknown	192-8	CSCSL-NFA	Site is approximately 50 feet west of project area (tunnel) and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 90 feet bgs in site area.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
280.2	280.2-2	801-809 Western Avenue	Mitchell & Shelly/Commuter Centre Parking	Commuter Center ParkingMitchell & Shelley: Listed as a medium quantity generator, no description of waste provided. 809 Western - five USTs (possibly from former gas station) removed, ~20 yards affected soil removed and disposed off-site. Some PCS remains near footing from waste oil tank. No additional information was available in 2009.	gasoline	199-8	LUST, ICR	Site is adjacent to west side of project area (tunnel) and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 100 feet bgs in site area.
280.2	280.2-4	815 Western Avenue	Turner & Pease Co./Commuter Center Parking Facility	Turner & Pease Co./Commuter Center Parking Facility: 815 Western - two USTs discovered, both appear to be heating oil tanks. First tank removed, second tank is on adjoining property and not removed. Affected soil removed and disposed. Small pocket of PCS remains near adjacent UST. Site reported "cleaned up" by consultant. No additional information was available in 2009.	petroleum	199-8	LUST, ICR	Site is adjacent to west side of project area (tunnel) and likely downgradient; no excavation planned in site vicinity; tunnel crown is approximately 100 feet bgs in site area.
290.3	290.3-6	700 Post Avenue	Seattle Steam Co. Post Avenue	Seattle Steam Co. Post Avenue: 55,000-gallon Bunker C UST for emergency use, TPH in soil and groundwater at site. The potential for contaminants to migrate off the site was not evaluated, but it is possible. The site has been ranked as having the lowest assessed risk to human health and environment (WARM BIN #5). It's status is "awaiting remedial action."	PCBs, petroleum	207-8	CSCSL	Site is approximately 150 feet east of project area (tunnel); contaminants are not highly mobile; no excavation planned in site vicinity; tunnel crown is approximately 90 feet bgs in site area.
300.1	300.1-6	607 Second Avenue, 114 James Street	Butler Garage	Butler Garage: Gasoline-contaminated soil excavated. Contaminated soil and groundwater remain at the site by the perimeter of the building and downgradient (alley). Pump and treat system for remediating groundwater operating (2001). Site is undergoing groundwater remediation (potassium permanganate injections) 2004-2008 (annually). In 2009, gasoline range petroleum hydrocarbons were detected in two of the four monitoring wells (120 and 3,900 ug/L, above the MTCA cleanup level of 800 ug/L). Benzene was also detected at 9 and 15 ug/L, above the MTCA cleanup level of 5 ug/L. Semi-annual groundwater monitoring is being conducted (2009).	gasoline	210-8	LUST, ICR	Site is approximately 700 feet east of project area (tunnel); no excavation planned in site vicinity. The bored tunnel is downgradient, but the crown of the tunnel is approximately 75 feet bgs and the gasoline contamination, which is lighter than water would likely only impact shallow downgradient groundwater.

Exhibit B-4. Excluded Listed Sites with Documented, Suspected, or Potential Releases

Block	Site No./ Exhibit E-1	Address	Site/Business Name	Ecology File Summary	Known or Suspected Contaminants	EDR Map No. and Focus Map No.	List	Rationale for Exclusion
370.2	370.2-6	820-824 1st Avenue South	Squire Shop Warehouse - Former	Reported petroleum release from heating fuel tank in 1993. Ecology received interim cleanup report. No Ecology file in 2004 or 2009. Potential contaminants in soil and groundwater include metals and petroleum.	petroleum and metals	244-11	ICR	Site is approximately 300 feet east of the project area (south portal). Site has documented contamination whose status is unknown, but remediation would not be the responsibility of the project.
370.2	370.2-19	1046 First Avenue S.	Kohl & Kohl/Kingdome Station (2009)	Three USTs removed in 2005; four older USTs were removed in 1995; petroleum contamination found in 2005 consistent with known previous contamination; approximately 9,800 tons of PCS removed; groundwater 12.5 feet bgs; sheet pile shoring (groundwater barrier) installed around site; PCS remains under south and west sidewalks; TPH-G in samples from monitoring well in west sidewalk is periodically above cleanup criteria (based on most recent quarterly samples Sept. 2008 and Jan. 2009; report date 3/31/2009).	gasoline, benzene	247-11	LUST, CSCSL, VCP	Site is approximately 100 feet east of project area (surface streets); no excavation planned in site vicinity.
380.1	380.1-4	1201 Alaskan Way, changed address from 1255 Railroad Avenue S.	Terminal 37	Terminal 37: Ecology notified in 1995 of petroleum release when four tanks removed. Gasoline contamination encountered. Waste oil remains beneath the office trailer. Benzene is present in groundwater above MTCA (59 ppb). Groundwater flows to the northwest. In 2003, a 9,500 gallon two- compartment UST that had contained gasoline and diesel, was removed. The tank was associated with the fuel dispensing facility located in the fenced parking area south of the Terminal 37 entrance. Gasoline was detected in a single confirmation sample collected at the bottom of the excavation (43 mg/kg), below the MTCA cleanup level. No other petroleum hydrocarbons were detected in the 5 confirmation samples (based on 2009 and 2010 record review of Ecology file).	gasoline	254-11	LUST, ICR	Site is approximately 500 feet south of project area (surface streets) and likely crossgradient; no excavation planned in site vicinity.

Notes: * N=Sites north of ~mid-block 160.7; E and W are sites south from that point and located either east or west of project alignment.

Acronyms: Confirmed and Suspected Contaminated Sites List = CSCSL; Hazardous Sites List = HSL; Independent Cleanup Report = ICR; Leaking Underground Storage Tank = LUST; No further Action = NFA; Voluntary Cleanup Program = VCP; EDR = Environmental Data Resources Inc.

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
20.01	711 6th Avenue North	Residential	Residential	2-story 4 apartments, built 1923, stove; 1-story shed in rear, built 1915, unheated	not reviewed, not adjacent
20.01	715 6th Avenue North	Residential	Residential	1-story, built 1902, stove	not reviewed, not adjacent
20.01	571 Valley Street	Residential	Residential	2-story 4 Apartments., built 1926, hot water/oil burner	not reviewed, not adjacent
20.01	565 Valley Street	Residential	Residential	1-story, built 1908, hot air furnace/oil burner	not reviewed, not adjacent
20.01	559 Valley Street	Residential	Residential	2-story 2 family, built 1900, stove	not reviewed, not adjacent
20.01	718 Taylor Avenue North	Residential	Residential	1-story, built 1900, stove	not reviewed, not adjacent
20.01	560 Roy Street	Residential/ Commercial	Residential, commercial	1-story, built 1909, stove	not reviewed, not adjacent
20.05	608 Roy Street	Residential	Residential	2-story, 4 apartments, built 1910, stove	1-story warehouse, built 1982, space heaters
20.05	707 & 711 Aurora Avenue North	Residential	Residential	2 homes, each is 2-story, built 1900, stove	vacant land
20.05	713 Aurora Avenue North	Residential	Residential	1-story, built 1900, stove	vacant land
20.05	719 Aurora Avenue North	Residential	Residential	1-story, built 1902, stove; new 2-story motel in 1953, gas heat	2-story commercial building, built 1953, electric heat, used as restaurant
20.05	615-617 Valley Street	Residential	Residential	2-story 4 apartments, built 1909, stove, remodeled 1968, gas heat	2-story apartment building, built 1909, forced air heat
20.05	603, 607, & 611 Valley Street	Residential	Residential	3 homes (2-story 2 family, built 1900, furnace/stoker; 1-story, built 1909, stove; & 1-story, built 1909, stove); new 2-story office building in 1969-70, electric heat	2-story office building, built 1969
20.05	712 6th Avenue North	Residential	Residential	1-story, built 1923, oil burner, moved 1931	parking lot
20.1	702 Aurora Avenue	restaurant	Restaurant	1-story restaurant, built 1932, oil burner	(Lots 1, 2, 7, & 8) 6-story office building, built 1984, heat pump

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
30	SE corner of Roy Street and 5th Avenue North	Offices and garage	Offices and garage	1-story office building with garage, built 1923, oil burner	4-story condominium building, constructed 2006, electric heat
30.01	609 6th Avenue North	Residential	Residential	1-story, built 1900, stove	1-story storage warehouse building, built 1981, space heaters
30.01	611 6th Avenue North	Residential	Residential	1-story, built 1923, stove	1-story storage warehouse building, built 1981, space heaters
30.01	557 Roy Street	Commercial	Office buildings	2- 1-story buildings, store (West) & offices (East), built 1952-53, hot water/oil burner in each building	4 buildings: northwest, southwest, southeast, northeast, all 2-story office buildings, built 1952, hot water heat
40.2	521 Dexter Avenue	Peoples National Bank, Seattle Seaman's Center	Bank	Built in 1946-48, listed single-story bank, with oil burner	1-story building, built 1948, hot water heat
40.2	501 Dexter Avenue	--	Office	Built in 1952, listed as single-story office with oil burner.	2-story office building, built 1952, hot water heat
40.2	700 Republican Street	--	Office	Built in 1920, listed as a four-story office building with stove.	4-story office building, built 1920, electric heat
40.3	513 8th Avenue North	--	Furniture warehouse	2-story furniture warehouse, built 1926, stove heat	Commercial parking lot
50.05	580 Broad Street	Moore & Moore, Inc.	Office	2-story office, oil burner, built 1956, torn down 1963	no building records
50.2	434 Aurora Avenue	Bakery, Hostess Cake Kitchen, Continental Baking Company	Bakery factory	Built in 1915, remodeled 1941, listed as two-story factory building/bakery with oil burner.	2-story bakery, built 1900, hot water heat
50.2	411 Dexter Avenue	--	Residential	Built in 1890, listed as two-story single family dwelling with stove	no building records
50.2	408 Aurora Avenue	--	Office and warehouse	Built in 1924, listed as single-story office and warehouse with oil burner	One 2-story office building, built 1924, heat pump

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
50.3	433 – 8th Avenue North	Apparel, Inc., Pacific Trail Sports Center, City Electric & Fixtures, Rich Lumber Co.	Sporting goods, clothing, electric and fixtures warehouse	Built in 1946, listed as single-story warehouse and offices with oil burner	not reviewed, not adjacent
50.3	416 Dexter Avenue	Shields-Harper	Warehouse	Built in 1946, listed as single-story warehouse with oil burner	not reviewed, not adjacent
60.3	311 Aurora Avenue North	Residential/Commercial	Residential, restaurant	1-story/attic, built 1905, stove; replaced 1962 – black top paving only	1-story restaurant building, built 1964, heat pump
60.3	307-3071/2 Aurora Avenue North	Residential/Commercial	Residential, store	2-story 2 family building, built 1900, stove; remodeled 1946 as store & apartments; replaced 1962 – black top paving only	1-story restaurant building, built 1964, heat pump
60.3	6101/2 Thomas Street	Residential	Residential	2-story 2 family, built 1900, stove	(Lots 7-12) 3-story office building, built 1957, HVAC
60.3	602 Thomas Street	Residential	Residential	2-story 4 family, built 1900, stove	(Lots 7-12) 3-story office building, built 1957, HVAC
60.3	318 6th Avenue North	Residential	Residential	1-story, built 1900, stove	(Lots 7-12) 3-story office building, built 1957, HVAC
60.3	306-322 6th Avenue North	Commercial	Office building	3-story office building, built 1957, hot water heat/oil burner	(Lots 7-12) 3-story office building, built 1957, HVAC
60.4	334 Aurora Avenue North	Aurora building Co.	Television station and offices	1-story store, built 1947-48, pipe steam heat/oil burner; 1960-63, remodeled as television station & offices	(Entire block) 4-story building, built 1947, heat pump; used as radio and TV studio
60.4	320 Aurora Avenue North	King Radio & Television	Television studio	television studio, hot water heat/oil burner	(Entire block) 4-story building, built 1947, heat pump; used as radio and TV studio
60.4	330 Aurora Avenue North	Harry H. Baron, Inc.	Store	1-story store, built 1947-48, hot water heat/oil burner	no building records
60.5	329 8th Avenue North	Residential / Commercial	Parking lot, residence	1-story/attic, built 1900, stove, heater/oil; parking lot, 1965	commercial parking lot for King County Library
60.5	327 8th Avenue North	Residential / Commercial	Residence, parking lot	1-story, built 1900, stove converted to oil burner; parking lot, 1965	commercial parking lot for King County Library

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
60.5	325 8th Avenue North	Residential / Commercial	Residence, parking lot	2-story 2 family, built 1900, stove/oil; parking lot, 1965	commercial parking lot for King County Library
60.5	319 8th Avenue North	Residential / Commercial	Residence, parking lot	1-story/attic, built 1900, stove, heater/oil; parking lot, 1965	commercial parking lot for King County Library
60.5	317 8th Avenue North	Residential / Commercial	Residence, parking lot	1-story/attic, built 1900, stove heater/oil; parking lot, 1965	commercial parking lot for King County Library
60.5	315 8th Avenue North	Residential / Commercial	Residence, parking lot	11/2-story 3 family, built 1900, stove; ; parking lot, 1965	commercial parking lot for King County Library
60.5	309 8th Avenue North	Commercial	Warehouse	1-story warehouse, built 1949, oil burner	2 buildings: 1-story warehouse building, built 1949, space heaters; and a 1-story garage building, built 1991, no heat
60.5	768-770 Thomas Street	Residential / Commercial	Apartments	2-story 4 apartments, built 1906, stoves	commercial parking lot for King County Library
60.5	324 Dexter Avenue	Residential / Commercial	Residence, parking lot	1-story/attic, built 1890, stove, heater/oil; replaced 1963 by parking lot	commercial parking lot for King Broadcasting
60.5	759 Harrison Street	Residential / Commercial	Residence, parking lot	1-story/attic, built 1914, stove	commercial parking lot for King Broadcasting
70.3	213-221 6th Avenue North	Residential / Commercial	Residence, office building	2-story 2 family, built 1900, stove; replaced by parking lot, constructed 1958; replaced by 2-story restaurant & office building built 1962, hot water convection heat/fuel not specified, remodel 1965 – offices only	2-story office building, built 1962, hot water heat
70.4	233-235 Aurora Avenue North	Commercial	Apartment and store	3-story apartment & store building, built 1892, stove	5-story motel building, built 1959, hot water heat
70.4	213-235 Aurora Avenue North	Tropics Motor Hotel	Motel	4-story motel, built 1958-59, hot water heat/oil burner	5-story motel building, built 1959, hot water heat
70.4	200 6th Avenue North	Commercial	Parking lot and office	Parking lot & 1-story office, built 1952, stove; 1957 records noted "office gone"	4-story motel, built 1959, electric heat
70.4	605 Thomas Street	Commercial	Office, motel	1-story office building, built 1950-51, hot water heat/oil burner; remodeled as motel, hot water/suspended gas heat	1-story office building, built 1951, hot water heat

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
70.4	609 Thomas Street	Commercial	Apartments	2-story 4 family, built 1925, steam then hot water heat/oil burner	2-story apartment building, built 1925, hot water heat
70.5	225 Dexter Avenue North	Commercial	Apartments	2-story apartment building (16 apartments), built 1946, hot water heat/oil burner	(Lots 2 – 5) 7-story hotel, built 2000, HVAC
70.5	211 Dexter Avenue North	Commercial	Motel	2-story 2 family, built 1895, stove; replaced by 2-story/basement motel building (café in basement), built 1955, hot water heat/oil burner	(Lots 2 – 5) 7-story hotel, built 2000, HVAC
70.5	203 Dexter Avenue North	Pitney-Bowes	Shop, light manufacturing	1-story shop building, built 1952/oil burner	1-story building, built 1952, forced air heat, light manufacturing usage.
70.5	228 Aurora Avenue North	Commercial	Motel	2-story motel building, built 1949-50, hot water heat/oil burner	(Lots 7 – 11) 3 buildings: 1-story motel, built 1947, hot water heat; 2-story motel, built 1955, hot water heat; 6-story hotel, built 1997, HVAC.
70.6	766 John Street	Denny Park Lutheran Church	Church	2-story church, built 1939, oil burner	one two-story church and Sunday school, built 1939, hot water heat
70.6	206 Dexter Avenue	Seattle Salvage Co. (house wrecking and building materials)	Salvage co., house wrecking and building materials	1-story office, built 1922, stove heat, torn down 1943	1-story youth shelter, church annex, built 1949, space heaters
70.6	756 John Street	Denny Park Lutheran Church	Church	1-story Sunday School, built 1949, stove heat	1-story youth shelter, church annex, built 1949, space heaters
70.6	223 8th Avenue North	Korry Manufacturing Co., West Coast Heating & Plumbing Co.	manufacturing co., heating and plumbing	2-story warehouse built 1947, oil burner, oil storage added in 1958	2-story repair garage building, built 1953, hot water heat
80.4	564 Denny Way	Seattle First National Bank	Bank	1-story bank building, built 1950, hot water heat/oil burner	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
80.4	552 Denny Way	Joint Council of Teamsters Local #28	Office building	2-story office building, built 1932, steam heat/oil burner	not reviewed, not adjacent
80.4	553 John Street	Joint Council of Teamsters Local #28	Office building	2-story office building, built 1954-55, remodel/addition 1957, hot water heat/oil burner	not reviewed, not adjacent
80.5	112-34 6th Avenue North	Northwestern Life Insurance Co.	Office building, life insurance	3-story office building, built 1951-52, oil burner heat, 1-4,000 gallon tank	3-story office building, built 1952, hot water heat
80.6	714 Denny Way	Odman's Fine Food	Restaurant	various 1-story restaurants, oil burner heat, built 1933	1-story restaurant, forced air heat
80.6	120 Aurora Avenue	Retail	Retail store	1-story retail with oil heat, built 1945, moved 1954	(Lots 7 – 11) parking lot
80.7	118 Dexter Avenue	Denny Park/City of Seattle Park Dept.	Administration building	1-story administration building, built 1947-48, oil burner heat	not reviewed, not adjacent
	500-22 Wall Street	Grosvenor Apartments	Apartments	18-story apartments, built 1949-50, 3 oil burners	not reviewed, not adjacent
130.8	2501 6th Avenue	Used Car lot	Used car lot	1-story office, used car lot/auto loans, stove heat, built 1932 demolished ~1949	not reviewed, not adjacent
130.9	2400 Block Alaskan Way	Galbraith & Co. Hay & Grain, Building Material	Building material warehouse	1-story warehouse (retail) with stove heat, built 1917; lot 4 has 1-story truck garage owned by same company (appears to be storage of trucks only, not repair)	Port of Seattle office building, 5-stories, built 2000, complete HVAC heat, all lots on N/1/2 of block: 1-8, N of Battery
140.6	315 Wall Street	Retail	Retail	2-story retail, built 1924, stove heat	lots 3-8: 12-story office building, built 1978, heat pump
140.6	2417 4th Avenue	Wall Street Motors (used car sales?)	Auto business	1-story office, built 1946, stove heat	lots 3-8: 12-story office building, built 1978, heat pump
140.6	2405 4th Avenue	Apartments	Apartments	3-story apartments, built in 1921, oil burner heat	lots 3-8: 12-story office building, built 1978, heat pump

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
140.7	2401-11 5th Avenue	Greene-Winkler Co. China, Silverware, Glassware, Housewares	Houseware warehouse	2-story warehouse, built 1919, oil burner heat	Fountain Court apartments (all lots): 6 stories, built 1998, electric heat
140.7	2300 Elliott Avenue	Brodie's Inc.	Warehouse and store	2-story warehouse & store, creosoted pile foundation, oil burner heat, built in 1953-54	One 6-story apartment building, built 1990, forced air unit
150.5	207 Battery Street	Residence	Residence, office car lot	1-family dwelling, 1-story, noted at "office car lot", stove heat, built 1900, torn down 1946	1-story open office, built 1950, space heaters
150.5	2333 3rd Avenue	White & Bollard	Office, residence	1-story office, built 1951, oil burner heat; 1900 (223 & 215 Battery Street): 1-family dwelling, 2 stories, stove heat, torn down 1949	lots 7-8: 1-story open office, built 1951, radiant hot water heat
150.5	2323 3rd Avenue	Pittsburgh Testing Laboratory	Testing laboratory	1-story factory, built 1947, oil burner heat, suspect business	The Bookbenders: 1-story retail, built 1947, radiant hot water heat
150.6	304-08 Bell Street	--	Apartments	3-story apartments, built 1916, oil burner heat	The Adams apartment: 3 stories, built 1916, hot water heat
150.6	2324 3rd Avenue	--	Residence	1-story, 1-family dwelling with oil burner heat, built 1890, torn down 1959	Two mixed use retail buildings, one built 1935, the other built 1924, both hot water heat
150.6	2330 3rd Avenue	--	Warehouse	1-story warehouse, stove heat, built 1918	2-story office building, built 1918, heat pump
150.6	315-23 Battery Street	--	Apartment and parking lot	2-story apartment, stove heat, built 1900	parking lot
150.6	2325-27 4th Avenue	Mobile Elevator Co.	Office building	1-story, 3-office building with oil burner heat, built 1946	1-story restaurant, built 1946, forced air unit; 1-story office, built 1938, forced air unit
150.6	2321 4th Avenue	Fleming Apartments	Apartments	3-story apartments, built 1918, oil burner heat	Fleming Apartments: 3 stories, built 1918, hot water heat

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
150.6	2315 4th Avenue	--	Café	1-story café, oil burner heat, built 1923	1-story tavern and office, built 1923, space heaters
150.7	2312-16 4th Avenue	--	Retail	1-story retail, stove heat, built 1923, torn down 1959	1-story retail, built 1923, forced air unit heat
150.7	416 Bell Street	Montgomery Elevator Co. (welding, etc.)	Elevator co. and garage	1-story garage built 1923, stove heat	vacant land
150.8	2326 5th Avenue	--	Office	1-story office, stove heat, built 1948, torn down 1953	all lots: Frederick Cadillac auto showroom, 1 story, built 1978, space heaters
150.8	2318 5th Avenue	--	Office and used car lot	1-story office and used car lot, stove heat, built 1949	same as above
150.8	2301 6th Avenue	Bechtel Motor Co. Used Cars	Office and used car lot	1-story office and used car lot, stove heat, built 1947-8	same as above
150.9	2306-16 6th Avenue	--	Retail and offices	2-story retail and offices, oil burner heat, built 1956	Antioch University: 2-story office/retail, built 1950, forced air unit
150.9	2320-34 6th Avenue	Farmers Insurance Group	Office	2-story office, oil burner heat, built 1950-51, 1-6,000 gallon fuel tank	Antioch University: 2-story office/retail, built 1950, forced air unit
	2326 6th Avenue (Polk)				
160.4	2235 2nd Avenue	adjacent to Tander(m)ist	Retail and apartment	retail and rooms with stove heat, built 1884, 2 stories	not reviewed, not adjacent
160.4	2219 2nd Avenue	Layco Ross & Co.	Factory and office	1-story factory and office (type of factory unknown), built 1949, oil burner heat	not reviewed, not adjacent
160.4	2207-11 2nd Avenue	Bakery, Mayflower Apartments	Bakery and apartments	2-story apartments, oil burner heat, built 1910	not reviewed, not adjacent
160.4	2205 2nd Avenue	The Humphrey Apartments	Apartments	6-story apartment house, oil burner heat, built 1923	not reviewed, not adjacent
160.4	2225-29 2nd Avenue	grocery store	Apartments and retail	2-story retail and rooms, stove heat, built 1901, torn down 1969	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
160.4	2218 1st Avenue	O. Mattson's Music Store (other half for rent – print shop ~1972)	Print shop and music store	1-story retail with stove heat, built 1920	not reviewed, not adjacent
160.5	2208-12 2nd Avenue	Hobart (store)	Store	1-story retail, built 1929-30, 2 oil burners for heat	not reviewed, not adjacent
160.5	2216-22 2nd Avenue	Niels Hansen Manufacturing Co. (Refrigerators, Store Fixtures), Cash Register Exchange	Manufacturing refrigerators, store fixtures, cash register exchange	2-story office, built 1923, oil burner heat	not reviewed, not adjacent
160.5	2224-28 2nd Avenue	E.G. Spangler Co. Plumbing	Plumbing	3-story retail and apartments, oil burner heat, built 1911	not reviewed, not adjacent
160.5	2221 3rd Avenue	Bethel Pentecostal Temple	Church	1-story church (later retail), built in 1928, oil burner heat	not reviewed, not adjacent
160.5	2209 3rd Avenue	Furse Stage Lines	Garage	1-story garage, stove heat, built 1947, 3 doors on track listed	not reviewed, not adjacent
160.5	212-14 Blanchard Street	Central Sign Co., Sterling Engraving Co.	Sign company, engraving	4-story apartment, retail, stove heat, built 1900, demolished 1972	not reviewed, not adjacent
160.6	305 Bell Street	Peerless Yeast Co.	Food products	1-story retail, built 1925-6, oil burner heat	not reviewed, not adjacent
160.6	Northwest Corner 4th Avenue and Blanchard	No picture ("too many cars")	Office	1-story, 1-room office, stove heat, built 1935?, no picture ("too many cars")	not reviewed, not adjacent
160.7	2212-14 4th Avenue	--	Retail	1-story retail, stove heat, built 1924	not reviewed, not adjacent
160.7	2218 4th Avenue	Willard Automotive Service	Auto service	1-story garage, stove heat, built 1924	not reviewed, not adjacent
160.7	2230 4th Avenue	Charlesgate Apartments	Apartments	3-story apartment, built 1922, oil burner heat	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
160.7	2221-23 5th Avenue	Royal Co.	Warehouse	1-story warehouse, built 1953, oil burner heat	not reviewed, not adjacent
160.7	2217 5th Avenue	Optical company	Optical	1-story office, built 1953, oil burner heat	not reviewed, not adjacent
160.7	2211 5th Avenue	Lewis Casing Co. (butcher supply, sausage casing)	Food products	2-story retail/loft, built 1919, stove heat	not reviewed, not adjacent
160.7	420 Blanchard Street	Windham Apartments	Apartments	7-story apartments, oil burner heat, built 1925	not reviewed, not adjacent
160.8	2209 6th Avenue	--	Used car lot	1-story, 1-room office for used car lot, stove heat, built 1948-9	not reviewed, not adjacent
160.8	2202 5th Avenue	--	Used car lot	1-story office for used car lot, built 1947, stove heat	not reviewed, not adjacent
170.3	2107-2111 1st Avenue	Bell Town Furniture, Battleship Linoleum	Furniture or linoleum company	3-story hotel & retail with oil burner (heat), built in 1907	not reviewed, not adjacent
170.3	2115-17 ½ 1st Avenue	Furniture Co.	Furniture company	3-story hotel/retail, stove heat, built 1906	not reviewed, not adjacent
170.3	2120 Western Avenue	Miller residence	Residence	2-story single-family dwelling with hot air furnace and an oil burner, built in ~1914 ("very old"), torn down in July, 1962	not reviewed, not adjacent
170.3	2141 1st Avenue	--	Retail	1-story retail with stove heat, built in ~1914	not reviewed, not adjacent
170.3	86 Lenora Street	Catherine McMullen residence	Residence	single-family residential dwelling, 2 stories, built in 1891, hot air furnace with oil burner	not reviewed, not adjacent
170.3	2125-2133 1st Avenue	--	Retail	1-story retail, built in 1938, stove heat	not reviewed, not adjacent
	2129 1st Avenue (Polk)				

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
170.4	2115-17 2nd Avenue	Allbestos Corporation, Seattle Radio Supply	Retail	1-story retail, 2 oil burners for heat, 1-3,900 gallon fuel oil tank, built 1923	not reviewed, not adjacent
170.4	2119-23 2nd Avenue	Eagle Fixture Equipment Co.	Fixture company	4-story apartments and retail, built 1909, oil burner heat	not reviewed, not adjacent
180.3	2000-04 Western Avenue	Hotel Conklin	Hotel	3-story hotel with retail, built 1897?, oil burner heat	not reviewed, not adjacent
180.3	2030 Western Avenue	--	Warehouse	1-story warehouse with oil burner for heat, built 1902	not reviewed, not adjacent
180.3	2025-29 1st Avenue	Uncertain ("Laundry" is one business)	Laundry	2-story retail and apartments with stove heat, built 1901	not reviewed, not adjacent
180.3	2017 ½-2023 1st Avenue	Various retail (shoes, hardware)	Retail	3-story hotel/retail, built in 1904, oil burner for heat	not reviewed, not adjacent
180.3	2013-17 1st Avenue	Second hand store	Retail	3-story hotel/retail built in 1904, stove heat; torn down in February 1970	not reviewed, not adjacent
180.3	2031-35 1st Avenue	Nelson Furniture Co.	Furniture company	2-story retail and hotel, built 1901, stove heat	not reviewed, not adjacent
180.4	2020 1st Avenue	--	Parking lot	parking lot shack with stove heat, torn down 1957	not reviewed, not adjacent
190.3	1918-22 Pike Place	The Pork House	Retail	2-story retail and loft, oil burner heat (installed 1945), constructed 1922	not reviewed, not adjacent
190.3	1923 1st Avenue	Marine Engineers, Furniture Exchange	Furniture store	3-story office/retail constructed in 1906; oil burner in 1937, switched to gas by 1968	not reviewed, not adjacent
190.3	1919-21 1st Avenue	Volunteers of America	Retail and lofts	3-story retail and lofts, built in 1910, oil burner heat	not reviewed, not adjacent
190.3	1915-17 1st Avenue	The Rose Furniture, Portland Mortgage / Alaska Trade Building	Furniture store	4-story office building, constructed in 1910, oil burner in addition to steam heat	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
190.3	82-86 Stewart Street	Stewart House Hotel	Hotel	2-story hotel, built 1904, oil burner and steam heat	not reviewed, not adjacent
190.3	1900-1910 Pike Place	Market Rendezvous Beverages, Pike Place Café	Café	1-story retail built in 1911 with stove heat	not reviewed, not adjacent
190.4	1924 1st Avenue	Rector Hotel	Hotel	Oil burner	not reviewed, not adjacent
200.1	90-92 Pine Street	tavern, barber, shoe repair	Shoe repair, tavern	1-story retail with stove heat, built in 1931	not reviewed, not adjacent
200.1	1600-06 Pike Place	Gill Brothers Seed Co., Family Shoe Market	Retail, shoe market	2-story retail constructed in 1912 with stove and/or suspended gas heat	not reviewed, not adjacent
200.1	1601-03 1st Avenue	Seamen's Outfitting Store	Retail	3-story retail and hotel built in 1908, stove heating	not reviewed, not adjacent
210.2	1500-02 Railroad Avenue	A.J. Dahlgren & Co. Produce	Produce	1-story shed with stove heat, built in 1910	vacant commercial property
210.3	1525-29 1st Avenue	--	Retail and hotel	2-story retail and hotel with stove heat, built in 1910, torn down in 1971	not reviewed, not adjacent
210.3	1513-25 1st Avenue	Pike Place Public Market	Public market	1-story sanitary public market with stove heat in office and oil burner for "domestic" use	not reviewed, not adjacent
210.5	1527 – 35 2nd Avenue	Protas & Leavitt (Boeing Sub-lease)	Commercial	Building uses oil heat	not reviewed, not adjacent
210.5	1524-30 1st Avenue	Gatewood Hotel	Retail and hotel	4-story hotel and retail building with oil burner	not reviewed, not adjacent
220.2	1426 Alaskan Way (Railroad Avenue)	Jilg's Sausage Factory	Food products	2-story factory, oil burner in addition to steam heat, constructed 1925	1-story office and apartment building, built 1925, warmed and cooled air
220.2	1400-1410 Alaskan Way	Schwabacher	Warehouse	1-story warehouse built in 1951 with 1 oil burner for heat	One 2-story antique warehouse building, built 1951, space heaters.
220.3	1434 Western Avenue	Unknown	Hotel and retail	hotel/apartments and retail building, 6 stories, constructed in 1911 with oil heat	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
220.3	1423-31 Pike Place	Bartell Drugs	Drug store	2-story retail built in 1921 with oil burner heat	not reviewed, not adjacent
220.3	1412-16 Western Avenue	Brown Poultry Co., Inc.	Food products	1-story warehouse built in 1916 with stove heat	not reviewed, not adjacent
240.4	1212-14 1st Avenue	Knight Building – Pacific Loan Co., Hotel	Hotel	Built 1896, stove heat	2-story retail building, built 1900, space heaters
240.2	1203 Western Avenue/(1206 Western)	John Flinn/Harbor Steps Development (2009)/(machine shop)	Metal works/ (machine shop)	6-story warehouse constructed in 1910 with oil burner heat	not reviewed, not adjacent
240.4	1210 1st Avenue	Schwartz / Gross Fine Tailoring	Tailor	2-story retail & loft, built 1889, stove heat	2-story retail building, built 1900, space heaters
260.4	1013 1st Avenue	Hotel / sportsmen outfitter store	Retail and hotel	4-story hotel (with basement) built in 1906 with oil burner heat	not reviewed, not adjacent
270.3	1st and Madison Street	U.S. Federal Building	Offices	9-story office building constructed in 1932 with 5 oil burners	not reviewed, not adjacent
270.4	912-16 1st Avenue	Palace Hotel	Hotel and retail	6-story hotel & retail, oil burner heat	not reviewed, not adjacent
290.4	713-17 1st Avenue	Hotel Georgia	Hotel	4-story hotel built in 1908 with oil burner for heat, demolished in 1969	9-story parking garage with bank and office/retail, built 1970, no heat
290.4	701 1st Avenue	Hotel	Hotel	7-story hotel built in 1889 with oil burner for heat, demolished 1970	9-story parking garage with bank and office/retail, built 1970, no heat
290.5	706-716 1st Avenue	Hotel & Retail	Hotel and retail	4-story building, built 1902, torn down 1958, oil burner heat	3-story parking garage, built 1958
320.2	116 Washington Street	--	Hotel and retail	2-story hotel/retail, built 1895, stove heat	not reviewed, not adjacent
320.2	118 Washington Street	--	Hotel and retail	4-story hotel/retail, built 1895, stove heat	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
330.2	208 Railroad Avenue South	--	Retail	1-story retail, built 1889, stove heat, torn down 1961	Peoples Supply Company – 2 buildings: 1)1-story storage warehouse, built 1916, hardware supply, space heaters. 2)2-story storage warehouse, built 1961, forced air unit
330.2	210 Railroad Avenue South	People's Supply Company	Retail	1-story retail, built 1916, stove heat	Peoples Supply Company – 2 buildings: 1)1-story storage warehouse, built 1916, hardware supply, space heaters. 2)2-story storage warehouse, built 1961, forced air unit
330.2	212-16 Railroad Avenue South	M. Seigel	Hotel and retail	5-story hotel/retail, built 1914, 2 oil burners	OK Hotel: 5-story hotel/retail, built 1914, steam heat
330.2	218 Railroad Avenue and 76 Main	--	Hotel and retail	3-story hotel/retail, built 1907, stove heat	Boston Hotel: office/retail, built 1907, space heaters; Victor Appel Building, Argens Lock Parking Garage., 2-story storage warehouse, built 1950, electric wall heat
330.2	81 Main / 219 1st Avenue South	--	Office and retail	3-story building, built 1889, oil burner	New England Building: 4-story office/retail, built 1900, steam heat
330.2	213-1/2 1st Avenue South	--	Hotel and retail	3-story building, built 1889, stove heat	mixed retail/residential, built 1900, electric wall heat/ Lucky Hotel/Killion Building: mixed retail/residential, built 1900, space heaters
330.2	211 1st Avenue South	--	Hotel and retail	3-story hotel / retail, built 1889, stove heat	mixed retail & residential, built 1900, electrical wall heat/Lucky Hotel/Killion Building, mixed retail/residential, built 1900, space heaters
330.2	207 1st Avenue South	--	Retail	3-story retail, built 1889, stove heat	Skagit Hotel: 3-story office, built 1900, electric wall heat/ Solomon Building: 3-story office, built 1900, electric wall heat

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
330.2	209 1st Avenue South	--	Retail	3-story retail, built 1899, stove heat	Skagit Hotel: 3-story office, built 1900, electric wall heat/ Solomon Building: 3-story office, built 1900, electric wall heat
330.2	201-205 1st Avenue South	--	Hotel and retail	3-story hotel / retail, built 1900, oil burner	J & M Hotel Building: 3-story restaurant & vacant hotel, built 1900, hot water heat
330.2	81-85 Washington Street	St. Charles Hotel	Hotel and retail	3-story hotel / retail, built 1889, stove heat	Lutheran Compass Mission Center: 5-story home shelter, built in 1903, steam heat / Street Charles Hotel: 3-story office, built 1900, electric wall heat
330.2	78-86 Main Street	Sing Chinese Laundry	Retail and warehouse	1-story retail, built 1895, stove heat, torn down 1948; 2-story retail / warehouse, built 1950, stove heat	Boston Hotel: office/retail, built 1907, space heaters, Victor Appel Building, Argens Lock Parking Garage: 2-story storage warehouse, built 1950, electric wall heat
340.1	317 1st Avenue South	--	Retail and loft	4-story retail / loft, built 1900, oil burner	Crown Hotel Building: 4-story office, built 1900, forced air unit
340.1	301 1st Avenue South	--	Hotel, shelter	3-story hotel, built 1889, stove heat	Bread of Life Mission; 3-story shelter, built 1900, heat pump
340.2	311-313 Occidental Avenue	Everwear Mfg. Co.	Retail	retail / studio, built 1890, oil burner	not reviewed, not adjacent
350.2	409 1st Avenue South	--	Warehouse	7-story warehouse, built 1906, oil burner	Hambach-Seller Building: 7-story office, built 1913, heat pump
350.3	414 1st Avenue South	International Express System	Commercial	5-story store / loft, built 1907, oil burner	not reviewed, not adjacent

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
360.1	525 Alaska Way, building A.	--	Pier, warehouse, maintenance buildings	1-story gate house, built 1965, oil heat	Pier 46 terminal (marine/commercial/fish) – 4 buildings: 1) 2-story transit warehouse/gate/guardhouse, 401 Alaskan Way South, built 1967, warmed and cooled air; 2)office building, built 1967, warmed and cooled air; 3)transit warehouse/transit shed, built 1967, space heaters; 4) storage warehouse/maintenance, built 1967, space heaters
360.1	1049 Railroad Avenue South	The B.F. Goodrich Company	Waterfront property	3-story warehouse, built 1922-23, oil burner	Port of Seattle: commercial, terminal (marine, commercial fish)
360.1	32 West Connecticut Street	A.M. Castle & Co.	Waterfront property, warehouse	2-story warehouse, built 1918, oil burner	Port of Seattle: commercial, terminal (marine, commercial fish)
360.15	90 West Dearborn	Auto Freight Depot	Warehouse	3-story warehouse, built 1921, oil burner	2-story athletic club/retail, built 1923, warmed and cooled air heat
370.1	77 West Dearborn (also given address 801 1st Avenue South)	Union Pacific Freight Station	Railway, warehouse and loading dock	2-story freight depot, built 1912; 1-story freight depot and garage, built 1935, stove heat	W O S C A Terminals – 3 buildings: 1) 1-story transit/freight warehouse, built 1912, steam & no boiler heat; 2) 1-story transit warehouse/loading dock, built 1935, no heat; 3) 2-story office, built 1912, forced air unit
370.1	1019 1st Avenue South	--	Railway, warehouse and loading dock	1-story team track office, built 1941, stove heat; building moved in 1968	W O S C A Terminals – 3 buildings: 1)1-story transit/freight warehouse, built 1912, steam & no boiler heat; 2)1-story transit warehouse/loading dock, built 1935, no heat; 3)2-story office, built 1912, forced air unit

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
370.1	1041-51 1st Avenue South	--	Clothing warehouse	2-story warehouse, built 1939, oil burner	Gerry Sportswear (1041 1st. Avenue South): 2-story warehouse, built 1939, space heaters
370.2	1014-16 1st Avenue South	Backus Import Company Corporation	Warehouse	4-story warehouse/store, built 1907, oil burner	4-story storage warehouse built 1907, space heaters
370.2	932 1st Avenue South	Cragin & Company	Retail and warehouse	1-story office, built 1918, oil burner; 6-story warehouse, built 1910	1-story sports bar building, built 1918, complete HVAC system
380.1	1241 Railroad Avenue South	Merchants Transfer & Storage	Waterfront property, warehouse	warehouse, built 1907, oil burner, torn down 1966	Pier 46 terminal (marine/commercial/fish) – 4 buildings: 1) 2-story transit warehouse/ gate/ guardhouse, 401 Alaskan Way, built 1967, warmed and cooled air; 2) office building, built 1967, warmed and cooled air; 3) transit warehouse/transit shed, built 1967, space heaters; 4) storage warehouse/maintenance, built 1967, space heaters
380.1	1215 Railroad Avenue South	A.M. Castle & Co.	Office, maintenance, and transit shed buildings	built 1918, stove heat, 1 tank (type unknown – listed under plumbing)	Four buildings: 1) 2-story gate and guard houses, built 1967, warmed and cooled air; 2) 2-story office building, built 1967, warmed and cooled air; 3) one-story transit shed, built 1967, space heaters; 4) 1-story maintenance building, built 1967, space heaters
380.4	1230 1st Avenue South	M. Block & Co.	Warehouse, sport facility	warehouse, built 1910, stove heat	Safeco Field Sport Facility
380.4	1212 1st Avenue South	General Electric Supply Corporation	Warehouse, sport facility	3-story warehouse, built 1929, oil burner in office only	Safeco Field Sport Facility

Exhibit B-5. Oil Heat Only Sites

Block	Address (Archive)	Property Type/ Business Name (Archive)	Property Use	Comments/Description (Archive)	Current Tax Assessor Notes
380.4	1258 1st Avenue South	Former automotive supply	Warehouse, sport facility	warehouse, built 1926, oil burner; sign indicates automotive supply (i.e. batteries, tires)	Safeco Field Sport Facility
390.1	West of 170 West Massachusetts Street	--	Waterfront property, warehouse	2-story warehouse, built 1925, stove heat	Pier 46 terminal (marine/commercial/fish) – 4 buildings: 1) 2-story transit warehouse/gate/guardhouse, 401 Alaskan Way South, built 1967, warmed and cooled air; 2) office building, built 1967, warmed and cooled air; 3)transit warehouse/transit shed, built 1967, space heaters; 4) storage warehouse/maintenance, built 1967, space heaters

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ATTACHMENT C

UST Study

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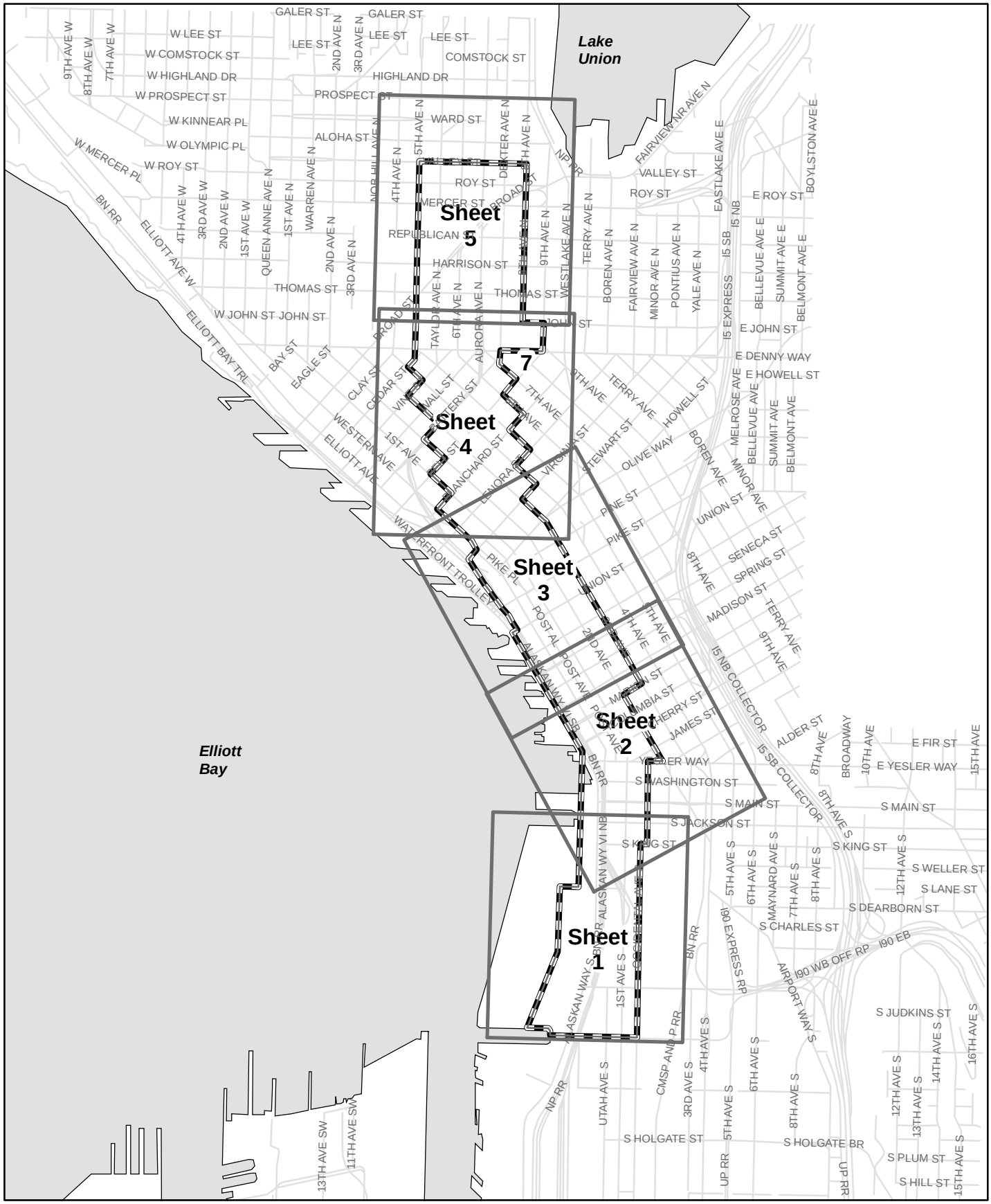
ATTACHMENT C

Tanks that may still be in the ground are presented in Exhibits C-2, C-3, and C-4 and are shown on Exhibit C-1. Exhibits C-5 and C-6 summarize tanks that likely have been removed because of redevelopment. The tanks displayed include the following:

1. All registered tanks, where the tank has not been removed.
2. Former gas stations adjacent to the alignment, where the property has not been significantly redeveloped (i.e., no subsurface disturbance).
3. Properties adjacent to the alignment that are heated with oil and that have buildings older than 1980, or that have not been redeveloped (i.e., vacant land or parking lots).



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INDEX OF SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL TANKS

N

0 1,000 2,000 4,000 Feet

Exhibit C-1
Sheet A

LEGEND

(See Exhibit C-2, C-3 and C-4 for a summary of each tank)

Registered UST Status

110 Operating Tanks

110 Closure in Process (Status Uncertain)

110 Tanks Closed in Place

Study Area

Alaskan Way Viaduct Replacement Project

To be Decomissioned

Alaskan Way Viaduct Program Element

Gas Station Tank Status

3xx Status Unknown

4xx Gas Station Tanks Likely

Oil Tank Status

5xx Status Unknown

6xx Oil Tank Likely

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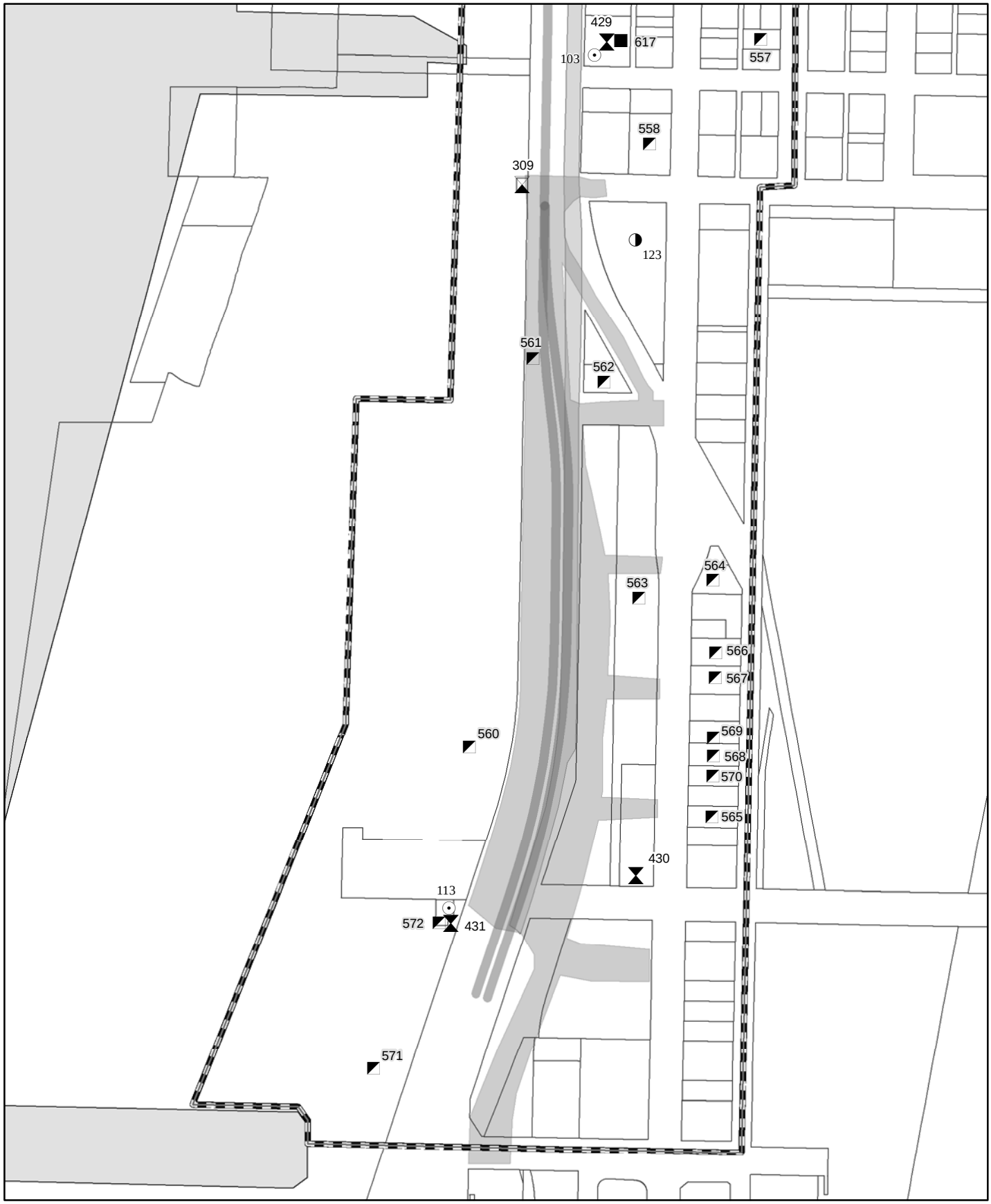
LEGEND FOR SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL TANKS

Exhibit C-1
Sheet B



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SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL AND GASOLINE USTs

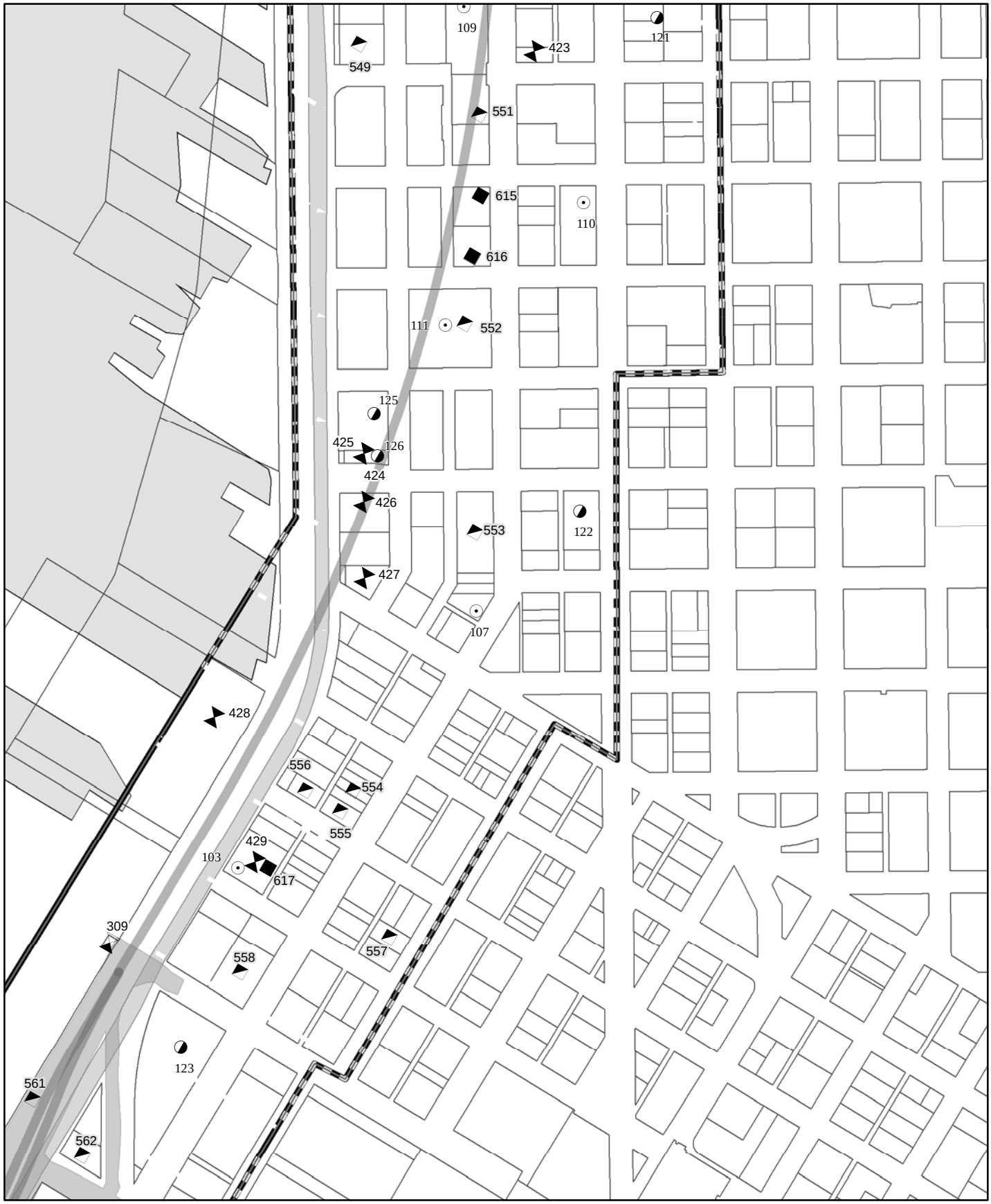
N

0 200 400 800 Feet

NOTE: See Exhibit D-1, Sheet B for Legend of Sites with Registered USTs, Portential Heating Oil Tanks, or Gas Tanks

Exhibit C-1

Sheet 1 of 5



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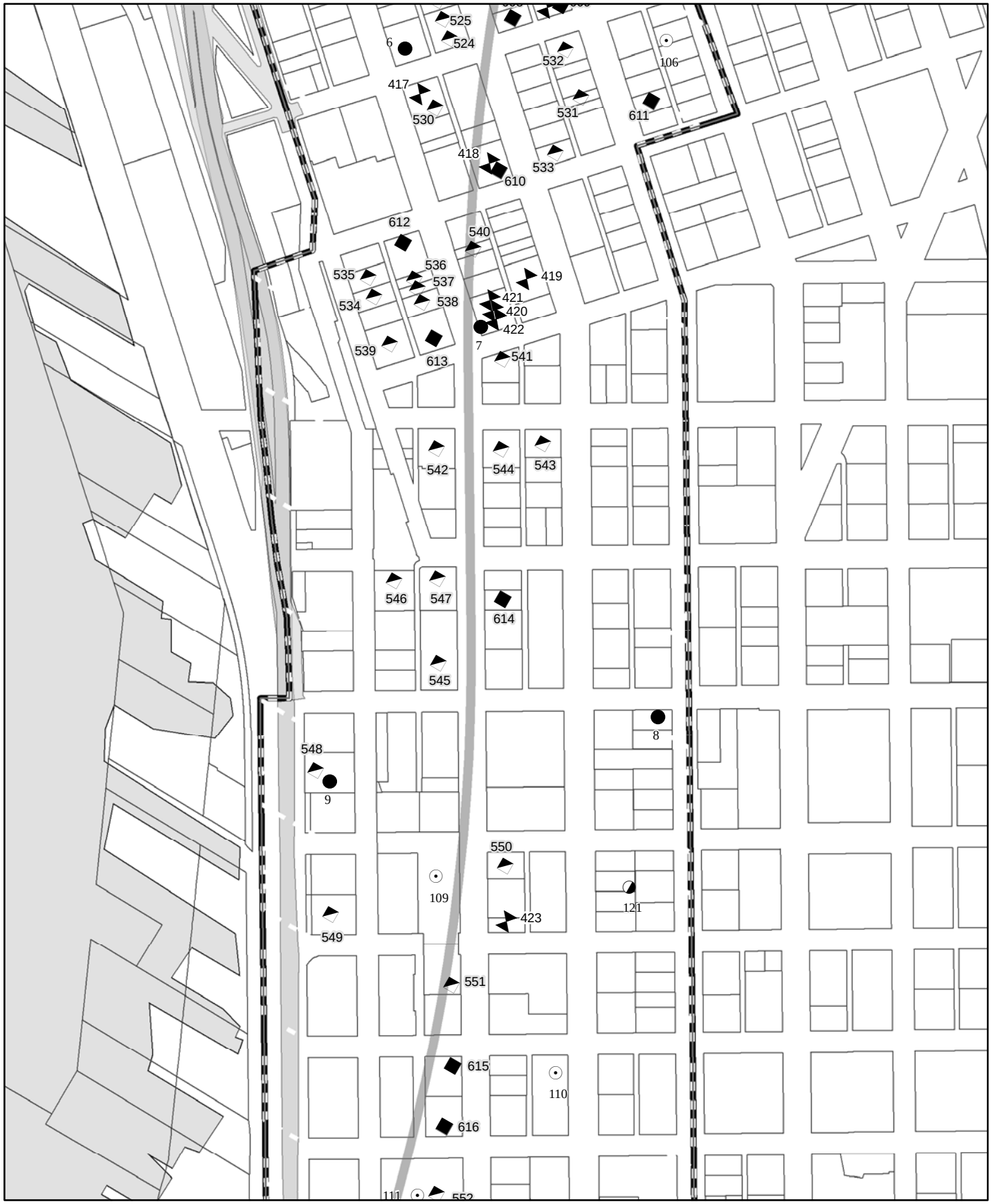
SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL AND GASOLINE USTs

N

0 200 400 800 Feet

NOTE: See Exhibit D-1, Sheet B for Legend of Sites with Registered USTs, Portential Heating Oil Tanks, or Gas Tanks

Exhibit C-1
Sheet 2 of 5



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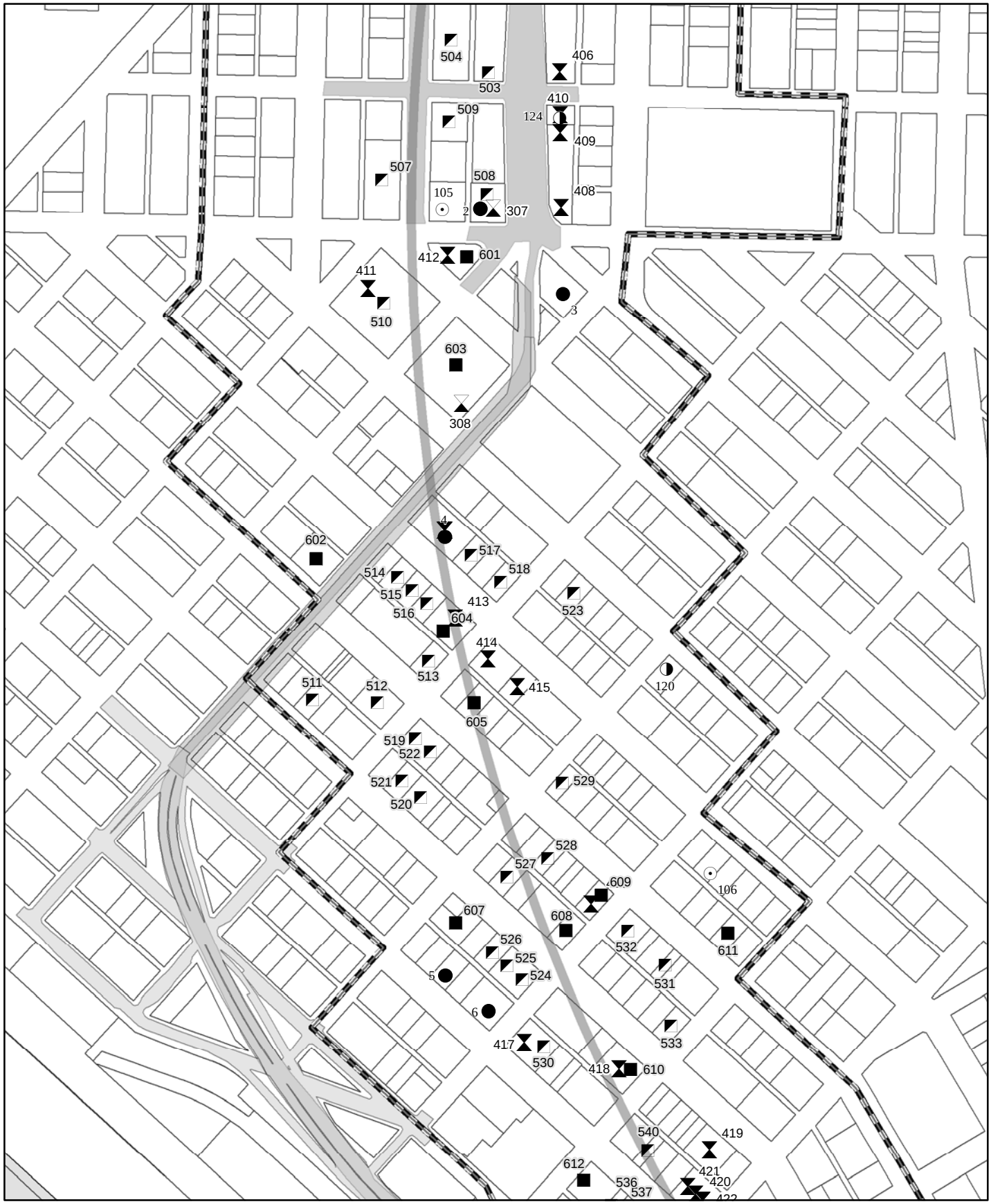
SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL AND GASOLINE USTs

N

0 200 400 800 Feet

NOTE: See Exhibit D-1, Sheet B for Legend of Sites with Registered USTs, Portential Heating Oil Tanks, or Gas Tanks

Exhibit C-1
Sheet 3 of 5



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SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL AND GASOLINE USTs

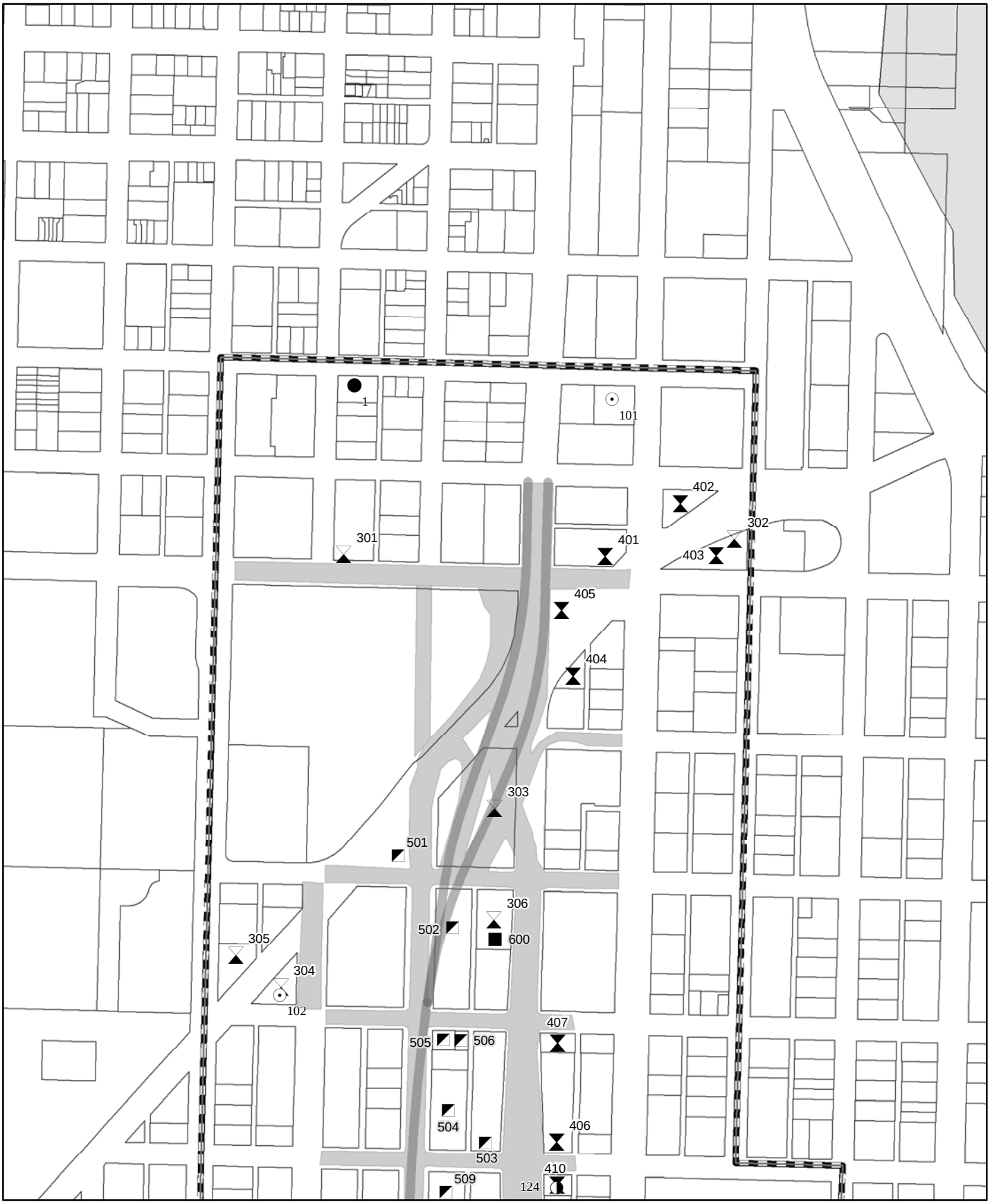
N

0 200 400 800 Feet

NOTE: See Exhibit D-1, Sheet B for Legend of Sites with Registered USTs, Portential Heating Oil Tanks, or Gas Tanks

Exhibit C-1

Sheet 4 of 5



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SITES WITH REGISTERED USTs OR POTENTIAL HEATING OIL AND GASOLINE USTs

N

0 200 400 800 Feet

NOTE: See Exhibit D-1, Sheet B for Legend of Sites with Registered USTs, Portential Heating Oil Tanks, or Gas Tanks

Exhibit C-1
Sheet 5 of 5

Exhibit C-2. Registered USTs

TANK DESIG-NATION	PROPERTY NAME	ADDRESS	INSTALL DATE	SITE DESCRIPTION	OPERATING TANK DESCRIPTION	NUMBER OF TANKS IN USE	SITE IDENTIFIED ON MULTIPLE REGULATORY LISTS
1	PLAID PANTRY NO. 309	720 TAYLOR AVE N	1/1/1954, 1/1/1985	3 tanks, operational, 8/7/1998	10,000 - 19,999 gal. coated steel tanks, single wall tanks, corrosion resistant, automatic tank gauging, 8/6/1996	3	YES
2	DENNY WAY SHELL; FORMER WRIGHTS RESTAURANT	620 DENNY WAY; 101 AURORA AVE S.	9/10/1997; 1/1/1964	2 tanks, operational 1/1/2001; 3 tanks exempt	10,000 - 19,999 gal. fiberglass reinforced tanks, double wall tanks, corrosion resistant, automatic tank gauging, 9/10/1997	2	NO
3	ELEPHANT CAR WASH	616 BATTERY ST.	1/1/1978	3 tanks, operational 8/26/1996	all 3 tanks: 10,000-19,999 gal. steel, single wall tanks, impressed current and interior lining, automatic tank gauging, 8/6/1996	3	YES
4	SEATTLE FIRE STATION 2	2334 4TH AVE.	12/31/1964, 1/1/1982, 6/10/1999	3 tanks, 2 removed 7/31/1999 and 2/23/2000. 1 tank operational 1/1/2001	2001-4999 gal. steel clad with corrosion-resistant composite, double wall tank, corrosion resistant, suction, 12/10/1999	1	YES
5	PARKING LOT UST 510091	2120 1ST AVE	1/1/1900	1 tank, unknown status 8/24/1999	actual status date 12/10/1999	UNKNOWN	NO
6	QWEST CORPORATION W00A80	120 LENORA ST	1/1/1986	1 tank, operational 8/26/1996	10,000 - 19,999 gal. fiberglass reinforced plastic, single wall tank, corrosion resistant, automatic tank gauging, 1/1/1986	1	NO
7	UNITED PARKING	1ST & STEWART	1/1/1900	2 tanks, exempt 8/20/1999		2 EXEMPT	NO
8	JOHN JONES/AMPCO PARKING-JONES BLDG.GA	1331 3RD AVE	12/31/1964	1 tank, unknown status 8/26/1996	111-1,100 gal 8/6/96	UNKNOWN	YES
9	SEATTLE STEAM CO WESTERN AV	1319 WESTERN AV	12/31/1964	2 tanks, exempt 8/26/1996	both tanks concrete, 1 unknown construction, the other double wall 8/6/1996	2 EXEMPT	YES

Exhibit C-2. Registered USTs

TANK DESIG-NATION	PROPERTY NAME	ADDRESS	INSTALL DATE	SITE DESCRIPTION	OPERATING TANK DESCRIPTION	NUMBER OF TANKS IN USE	SITE IDENTIFIED ON MULTIPLE REGULATORY LISTS
101	AUTO SERVICE EUROPA INC	717 DEXTER AVE N	12/31/1964	1 tank, closed in place 8/26/1996			NO
102	SEATTLE CITY BROAD ST SUBSTATION	319 6TH AVE N	12/31/1964	3 tanks, closed in place 8/26/1996			NO
103	OLD SEATTLE PARKING GARAGE	74 JACKSON STREET	12/31/1964	3 tanks, closed in place 3/16/1993			YES
104	PIONEER TITLE BUILDING	719 2ND AVE	12/31/1964	2 tanks, closed in place 8/26/1996			NO
105	JAPANESE AUTO CLINIC	600 DENNY WAY	12/31/1964	4 tanks, closed in place 8/26/1996			YES
106	JIFFY LUBE STORE 2077	2025 4TH AVE	1/1/1987	1 tank, closed in place 2/25/1997			YES
107	SEATTLE STEAM CO. POST	633 POST AVE	12/31/1964	3 tanks: 1 exempt, 2 closed in place 8/6/1996			NO
109	HARBOR PROPERTIES INC	85 UNIVERSITY ST	12/31/1961, 12/31/1964	2 tanks, closed in place 8/26/1996			NO
110	FEDERAL RESERVE BANK OF SAN FRANCISCO	1015 2ND AVE	1/1/1949	1 tank, closed in place 3/18/1999			NO
111	US GSA SEATTLE OLD FEDERAL OFFICE BLDG	909 1ST AVE	12/31/1964	1 tank, closed in place 8/26/1996			NO
112	SEATTLE PORT TERMINAL 46	401 ALASKAN WAY SOUTH	12/31/1964, 3/26/1992	7 tanks: 4 closed in place, 3 removed 8/6/1996			YES

Exhibit C-2. Registered USTs

TANK DESIG-NATION	PROPERTY NAME	ADDRESS	INSTALL DATE	SITE DESCRIPTION	OPERATING TANK DESCRIPTION	NUMBER OF TANKS IN USE	SITE IDENTIFIED ON MULTIPLE REGULATORY LISTS
113	TERMINAL 37	1201 ALASKAN WAY S	1/1/1978 (3), 7/3/1993	4 tanks, 2 removed 8/26/1996, 1 removed 4/24/2003, 1 closed in place 8/26/1996			YES
120	LEE COURT	2133 5TH AVE	12/31/1964	2 tanks, closure in process 8/26/1996			NO
121	APCOA CORPORATION	212 SENECA ST	12/31/1964	2 tanks, closure in process 8/26/1996			NO
122	MARTIN SELIG REAL ESTATE UST 102105	115 COLUMBIA ST	12/31/1964	2 tanks, closure in process 8/26/1996, 9/11/1996			NO
123	83 KING STREET BUILDING	83 KING ST	1/1/1900	2 tanks, 1 removed, 1 closure in process 4/2/1999			NO*
124	DAVES AUTO ELECTRIC	701 JOHN ST	1/1/1900, 1/1/1964	2 tanks, closure in process 3/2/1999			NO
125	TURNER & PEASE CO	815 WESTERN AVE	1/1/1950, 12/31/1964	2 tanks, 1 removed, 1 closure in process 8/26/1996			YES
126	COMMUTER CENTRE PARKING	801 -809 WESTERN AVE	801: 12/31/1964 (6), 1/10/1960 (1) 809: 12/31/1964 (2)	801: 7 tanks, 5 removed, 2 closure in process 8/26/1996 809: 2 tanks, closure in process 8/26/1996			YES

key: Tank Numbers 1-9 = operating tanks
Tank Numbers 101-113 = tanks closed in place
Tank numbers 120-126 = closure in process (status uncertain)

Notes: * One site that does not appear on other lists was considered further because of historical site use other than the presence of USTs.

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
30.01	30.01-3	1-story gas station & grease shop, built 1928, no heating system, tanks not listed	1938, 1940, 1951	1950	5458300425	1 2-story office building, constructed in 1952, heated by hot water.	P	301
30.05	30.05-2	1-story office & material yard, built 1945?, stove; new parking lot in 1962		1950	2249000170	1-4 story, hotel, constructed 1999, heat pump.	N	
30.1	30.1-1	1-story gas station, built 1930, demolished 1941?			2249000100	1-1 story, constructed 1919, forced air unit.	Y	401
30.2	30.2-1	1-story shop building built 1929, stove heat, used for auto repair, 1-story gas station built 1929, stove heat	/1951 (1956, 1960)	1950	2249000080	vacant land	Y	402
30.3	30.3-2	Gas station, built 1930, torn down 1956, stove heat			2249000055	no report available for parcel	P	302
30.3	30.3-3	gas station	1938/(1940)		2249000055	vacant land	Y	403
40.1	40.1-2	Built in 1933, single story gas station, with stove.	1938, 1940 / 1951	1950	1988201155	Gates Foundation 2 buildings 1) built in 1994,2) 6-story building in 2009.	N	
40.2	40.2-3	Built in 1934, single story service station, stove heat, addition in 1948.	1938, 1940, 1951	1950	1988201260	Commercial, vacant lot	Y	404
40.2	40.2-4	Built in 1930, single-story gas station with stove. 1 2,000-gallon tank and 2 3,000-gallon tanks	1938, 1940, 1943-44, 1951, 1956	1950	#N/A	No parcel number/ part of the Broad Street	Y	405
50.05	50.05-2		1938, 1940, 1943-44, 1951	1950	2570400000	1-5-story building, constructed in 2009 parking garage.	N	
50.1	50.1-1	Built in 1944-45, 1-story laundry with boilers and garage. Tank inventory includes 1-9,550 gallon fuel oil tank for delivery trucks.	1951, 1956, 1960	1950	1988201090	Seattle Dept of Transp Parking Lot and Storage Yard	P	303
60.1	60.1-1	1-story service station, built 1958, oil burner; 1-6,000 gallon, 2-4,000 gallon & 2-500 gallon tanks, 1 hydraulic lift	1960	1950, 1969	1991200405	1 4-story light commercial utility building, constructed in 1950, heated by electric, this part of the joined parcel is vacant.	P	304

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
60.1	60.1-2	1-story gas station, built 1946, stove, 3-1,500 gallon tanks, 1 hoist; also 1-5,000 gallon, 1-20,000 gallon, 1-10,000 (diesel) gallon, & 1 oil tank (no volume)		1950, 1969	1991200375	1 2-story mixed use retail, constructed in 1963, heated by forced air unit.	P	305
60.3	60.3-1	1-story cleaning plant & laundry, built 1946, steam heat/oil burner; replaced by 3-story motel, built 1961, electric heat	1938, 1940, 1951	1950	1991200800	1-3 story, Motel, constructed 1961, electric wall heat.	P	306
70.5	70.5-3	1-story hotel, built in 1951, steam heat	1938, 1940, 1943-44		1991200940	1 1-story motel, constructed in 1947, heated by hot water.	Y	406
70.5	70.5-4	1-story gas station, built 1933, stove, 2nd building is "grease shed", no mention of tanks; torn down in 1955; replaced by 1-story warehouse and office building, built 1956, suspended gas steam heating units	1938, 1940	1950	1991201000	1-1 story, Storage Warehouse, constructed 1956, space heaters.	Y	407
80.5	80.5-1	1-story gas and service station, built 1934, stove heat, torn down 1953; replaced by café, oil burner heat, built 1954	1938, 1940, 1943-44, 1951	1950	1991200685	1-1 story, Convenience Market, constructed 1998, heat pump.	P	307
80.5	80.5-2	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1-550 gallon tank, 2 hoists	1956, 1985 / 1989	1950, 1969	1991200695	Hyatt Place- 80 story commercial condominium, built 2008	N	
80.5	80.5-3	1-story gas station and repair shop, built in 1931, torn down 1942, stove heat, 2 pumps	1938		1991200695	Hyatt Place- 80 story commercial condominium, built 2008	N	

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
80.6	80.6-2	1-story gas station, stove heat, built 1936, removed 1954; grease shed, oil service on gravel area, 3 pumps	1938, 1940, 1943-44, 1951	1950	1991201050	Commercial, parking lot	Y	408
80.6	80.6-3	1-story service station, built 1940, 2-2,000 gallon tanks, 4-1,500 gallon tanks, 1 hoist; 3 pumps, torn down in 1948			1991201050	Commercial, parking lot	Y	409
80.6	80.6-4	1926: 1-story auto repair service, built in 1926, 3-550 gallon tanks, 1 hydraulic lift, torn down by 1943; replaced with 1-story gas station built 1943, stove heat, hoist, 1-1,000 gallon tank, 1-2,000 gallon tank, 1-8,000 gallon tank; tanks & buildings removed 1951; new repair garage built 1961.	1965, 1970, 1975, 1980, 1985, 1989	1950, 1969	1991201075	1-1 story, Garage, Service Repair, constructed 1961, space heaters.	Y	410
130.8	130.8-1	garage and storage, 2-stories, built 1949-50, 2-1000 gallon tanks listed, no heat listed	1951 / 1965 / 1970	/ 1969 /	0697000025	18-story apartment, constructed in 1949, heated by hot water (site is located on undeveloped portion of property).	Y	411
130.9	130.9-1	auto service/gas station built 1934, stove heat, 3-1,000 gallon tanks; 1959: station remodeled - oil burner heat, 4-4,000 gallon tanks, 1-1,000 gallon tank, 1-550 gallon tank, 2 hoists.	1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970, 1975	1949, 1969	0697000370	Commercial, parking lot	Y	412
140.7	140.7-2	1. 1-story gas station, stove heat, built in 1927-1928, 1-1,000 gallon tank, 1-550 gallon tank, 1-hydraulic hoist, torn down ~1960?	2. 1938/(1943-44) / <1951, 1956, 1965, 1970>/1990's	2. (1949)	0696000250	1 6-story apartment, constructed in 1998, heated by electric.	N	
140.8	140.8-1	gas station	1938, 1940, 1943-44		0697000064	1-3 story, Office Building, constructed 1947, complete HVAC.	P	308

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
150.6	150.6-2	1-story building, built 1936, service station, then upholstery shop, 3 tanks in drawing from 1937, 2 tanks noted on card in year 1958	1938, 1940, 1943 / (1951, 1956, 1960, 1965)	1949, 1969	0656000615	1 1-story storage warehouse, constructed in 1914, heated by hot water; no documentation regarding the demolition of the 1936 building	Y	413
150.7	150.7-3	1-story store and warehouse, built 1913, 2 oil burners for heat	1943 / 1943	0	0696000175	1 6-story office building, constructed in 2002, heated by complete HVAC.	N	
160.6	160.6-3	1-story gas station, stove heat, built 1926, torn down 1957, 1-250 gallon tank			0694000115	Security House Apts.1-13 story apartment building, constructed 1978, electric wall heat.	Y	414
160.6	160.6-4	1. 1-story garage, stove heat, built 1924, auto repair, auto painting	1. 1951, 1960/2. 1938, 1940/(1965, 1970, 1975)	0	0694000125	1 1-story restaurant, table service, constructed in 1924, heated by space heaters.	Y	415
170.4	170.4-5	1-story service station, built in 1917, oil burner heat, 2-5000 gallon tanks	1938, 1940, 1943 / 1960, 1965, 1970, 1975 / 1965	1949, 1969	1977200740	1 12-story industrial light manufacturing, constructed in 1985, heated by hot & chilled water.	N	
170.5	170.5-4	1.1-story gas station, built 1926, 3-550 gallon gas tanks, grease pit under entire building, used as antique store date unknown, heating: stove.	1.1938, 1940 / (1951)/2.1938, 1940, 1943	1.1969	1977201195	1-story building, built in 1926, electric heat.	Y	416
180.4	180.4-1	2-story parking garage with gas & oil, built 1918, steam heat	1943-44 /	1949 / 1969	1977200855	1-3 story, Office Building, constructed 1918, warmed and cooled air.	Y	417

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
180.4	180.4-3	1-story retail building, built 1914, torn down 1968; 1 story retail building built in 1920, torn down 1953; 2-2,000 gallon tanks noted; gas station on Virginia St.	1.1938, 1940, 1943-44, 1951, 1960/ 2.1938, 1940, 1943-44/3.1994		6391350000	One Pacific Towers Condominium, 27 stories, built 1994, electric heat	N	
180.4	180.4-4	4-story hotel, built 1910, torn down 1972, oil burner and stove heat		1949	1977200900	Commercial, parking lot	Y	418
190.4	190.4-3	Parking and Service garage	1938, 1940, 1943, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989/1980	1969	1977200950	Second Avenue Parking garage, 3-story, built in 1926, space heaters.	Y	419
190.4	190.4-5	1-story parking garage, signs for fuel service; built in 1909, torn down 1949			1977200960	parking lot	Y	420
190.4	190.4-6	2-5,000 gallon storage tanks, built 1959, torn down 1970	1938, 1940, 1943-44, 1951, 1956		1977200960	parking lot	Y	421
190.4	190.4-8	gas station		1969	1977200960	parking lot	Y	422
240.4	240.4-4	gas station	1938 / 1943-44, 1951, 1956, 1960, 1965		1974700210	Vacant lot, play yard	Y	423
280.2	280.2-2	Constructed 1906, first floor of 4-story building described in 1936 as service station - "gasoline equipment" listed but no tanks listed	1938, 1940	1949, 1969	7666202560	parking lot	Y	424
280.2	280.2-3	half of printing building torn down to leave lot 4 with 1-story gas station built in 1942; stove heating, 3 pumps listed in 1967; tanks: 3-1000-gallon & 1-550-gallon	1975, 1980, 1985, 1989-90		7666202560	parking lot	Y	425

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
290.2	290.2-3	gas station	1938,1940,1944-45,1951, 1956, 1960, 1965, 1970/[1956, 1960, 1965]/ <1970, 1975, 1980, 1985>		7666202565	6-story office, built 1910, steam heat without boiler	Y	426
290.2	290.2-4	Constructed 1938, 1-story, automotive repair building, possible fueling - pumps observed in photo; 2 hydraulic lifts, stove heat, demolished 1966 for parking lot	1938 / 1940, 1943-44, 1951, 1956, 1960, 1965	1949	7666202575	surface parking lot	Y	427
	330.1-1	gas station	1938, 1940		7666202630	1 2-story storage warehouse, constructed in 1901, heated by space heaters.	Y	428
	340.1-1	2-story garage, built 1909, oil burner, 3 gas tanks, automotive and truck steam cleaning	1938, 1940, 1943-44, 1951, 1956, 1960/ 1970/ 1975, 1980, 1985/ 1989-90	1969	5247800150	1 3-story parking structure, constructed in 1909, no heat.	Y	429
	350.1-2	1-story warehouse, built 1963-64, inventory is listed in tank section, a portion of the inventory is covered by photo	1938, 1940	1950	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N	
350.1	350.1-4	gas station		1916	7666207695	1 3-story office building, constructed 2005, heated by complete HVAC.	N	
	350.2-1	1-story gas station, built 1937, stove heat	1938	1950	5247800201	1 3-story parking structure, constructed in 1984, no heat.	N	
	360.1-1	gas station		1916 / 1950	7666207697	1 1-story basement, unfinished, constructed in 1970, no heat	P	309

Exhibit C-3. Potential Gasoline Tanks Located Adjacent to the Alignment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010	Tank Designation
	360.1-3	1-story metal shop/restaurant/office building, built in 1890, stove heat	1938, 1940 /1940 /	/ 1950 / 1916	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N	
	360.1-4	dock, built 1964-65, 2,000 gallon tank			7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N	
	360.1-5	1-story scale house, built 1923, stove heat	0	1916 / 1950 / 1969	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N	
	360.1-8	1-story service station, unknown construction date, stove heat, 4x14 grease pit	1938, 1940, 1951, 1956, 1960	1950	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N	
360.2	360.2-3	gas station	1938, 1940		7666206895	2 7-story office buildings, built 1904 and 2009, warmed and cooled air, complete HVAC	N	
370.1	370.1-1	gas station	1938, 1940, 1943		7666206955	1-2 story, Distribution Warehouse, constructed 1939, space heaters.	Y	430
380.1	380.1-1	gas station, built 1922, stove heat, torn down 1944; garage remodeled in 1939 for tire room; rear structure on property: grease shed with gas station.	1938, 1940 (gas station)	1950, 1969 / 1950, 1969	7666207750	1-1 story, Storage Warehouse, constructed 1970, no heat.	Y	431

Notes:

Y = yes

P = probably

N= No (site has had significant redevelopment)

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
80.5	2	1	1991200695	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1-550 gallon tank, 2 hoists	Hyatt Place 8-story commercial condominium, built 2008	N	-
80.6	1	1	1991201025	1-story body works garage, oil burner heat, built 1945, torn down 1969	Hyatt Place 8-story commercial condominium, built 2008	N	-
50.05	2	1	Within Broad Street	2-story office, oil burner, built 1956, torn down 1963	Condemned for Broad St. and Sixth Ave. on-ramp to Broad St.; remainder is open space.	P	501
80.4	2	1	1991200600	2-story office building, built 1932, steam heat/oil burner	1 6-story apartment, constructed in 2008, heated by electric wall.	N	-
60.3	2	1	1991200845	3-story office building, built 1957, hot water heat/oil burner	1 3-story office building, constructed in 1957, heated by complete HVAC.	P	502
60.3	1	1	1991200800	1-story cleaning plant & laundry, built 1946, steam heat/oil burner; replaced by 3-story motel, built 1961, electric heat	1 3-story motel, constructed in 1961, heated by electric wall.	Y	600
80.4	3	1	1991200600	2-story office building, built 1954-55, remodel/addition 1957, hot water heat/oil burner	1 6-story apartment, constructed in 2008, heated by electric wall.	N	-
70.4	1	1	1991200730	1 story store building, built 1930, steam heat/oil burner; remodeled 1944 as dry cleaner & laundry	1-5 story, Motel, constructed 1959, hot water heat.	P	503
130.9	1	1	0697000370	auto service/gas station built 1934, stove heat, 3-1,000 gallon tanks; 1959: station remodeled - oil burner heat, 4-4,000 gallon tanks, 1-1,000 gallon tank, 1-550 gallon tank, 2 hoists	Commercial, parking lot	Y	601
80.5	2	2	1991200695	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1-550 gallon tank, 2 hoists	Hyatt Place 8-story commercial condominium, built 2008	N	-
70.4	2	1	1991200765	4-story motel, built 1958-59, hot water heat/oil burner	1 4-story motel, constructed in 1959, heated by electric wall.	P	504
140.6	1	2	0656000470	2-story rooming house with stove heat, built in 1890, torn down 1946; 2-story commercial building with 2 oil burners for heat, built 1947	1-story retail and office, built 1946-1947, hot water heat	Y	602

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
130.7	1	1	0696000260	4-story rooming house, coal stoker heat, built in 1904, demolished 1962; replaced by 1-story office & used car lot, built in 1962, 1-1000(?) gallon tank; gas station noted, built 1941(?)	1 6-story mixed retail w/res. units, constructed in 2000, heated by electric wall.	N	-
70.4	3	1	1991200790	1-story office building, built 1950-51, hot water heat/oil burner; remodeled as motel, hot water/suspended gas heat	1 1-story office building, constructed in 1951, heated by hot water.	P	505
140.8	2	1	0697000064	newspaper plant, built 1947-1948, oil burner heat, presses and ink storage	1 3-story office building, constructed in 1947, heated by complete HVAC.	Y	603
130.7	2	1	0696000260	1-story garage, built 1946, oil burner heat, 1-hoist listed	1 6-story mixed retail w/res. units, constructed in 2000, heated by electric wall.	N	-
70.4	4	1	1991200795	2-story 4 family, built 1925, steam then hot water heat/oil burner	1 2-story multiple residence (low rise), constructed in 1925, heated by hot water.	P	506
150.6	3	1	0656000615	1-story warehouse and store, oil burner heat, built 1914	1 1-story storage warehouse, constructed in 1914, heated by hot water.	Y	604
140.7	2	2	0696000250	1. 1-story gas station, stove heat, built in 1927-1928, 1-1,000 gallon tank, 1-550 gallon tank, 1-hydraulic hoist, torn down ~1960?	Apartments (all lots): 6 stories, built 1998, electric heat	N	-
80.4	1	1	1991200580	1-story bank building, built 1950, hot water heat/oil burner	1 1-story bank, constructed in 1950, heated by hot water.	P	507
160.6	2	1	0694000105	2-story office building, built 1929, oil heat	1 1-story office building, constructed in 1929, heated by space heaters.	Y	605
140.7	4	1	0696000250	2-story warehouse, built 1919, oil burner heat	Apartments (all lots): 6 stories, built 1998, electric heat	N	-
80.5	1	1	1991200685	1-story gas and service station, built 1934, stove heat, torn down 1953; replaced by café, oil burner heat, built 1954	1-1 story, Convenience Market, constructed 1998, heat pump.	P	508
170.4	3	1	1977200695	3-story apartments and retail building, built in 1910, oil burner heat	1 3-story multiple residence (low rise), constructed in 1910, heated by electric wall.	Y	607
140.7	5	1	0696000250	2-story warehouse & store, creosoted pile foundation, oil burner heat, built in 1953-54	Apartments (all lots): 6 stories, built 1998, electric heat	N	-
80.5	4	1	1991200705	3-story office building, built 1951-52, oil burner heat, 1-4,000 gallon tank	1 3-story office building, constructed in 1952, heated by hot water.	P	509
170.5	1	1	1977201200	1-story, built 1921, oil burner, 1-550 gallon tank	parking lot	Y	608
150.6	1	1	0656000550	1-story warehouse, built 1924, stove heat, 1-6,000 gallon fuel oil tank, several businesses over time but predominantly news printing	1 7-story mixed retail w/res. units, constructed in 2007, heated by electric.	N	-

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
130.8	2	1	0697000025	18-story apartment building, built 1949 had 10,000-gallon Bunker C UST inside building.	18-story apartment building, built 1949, hot water heat (site is located on undeveloped portion of property)	P	510
170.5	4	3	1977201195	1-story gas station, built 1926, 3-550 gallon gas tanks, grease pit under entire building, used as antique store date unknown, heating: stove.	1 1-story retail store, constructed in 1926, heated by electric.	Y	609
150.7	3	2	0696000175	1-story store and warehouse, built 1913, 2 oil burners for heat	1 6-story office building, constructed in 2002, heated by complete HVAC.	N	-
150.5	2	2	0656000230	1-story retail, built 1928, 2 oil burners for heat	1 1-story retail store, constructed in 1928, heated by hot water.	P	511
180.4	4	1	1977200900	4-story hotel, built 1910, torn down 1972, oil burner and stove heat	Commercial, parking lot	Y	610
160.5	9	2	0698800000	1-story retail, built 1929-30, 2 oil burners for heat	1 8-story condo/apartments plus commercial, constructed in 2002, heated by complete HVAC	N	-
150.5	5	1	0656000290	1-story plant, built 1926, oil burner heat, torn down 1962, also a dance hall, church, and bowling alley	1 5-story apartment, constructed in 1990, heated by electric wall.	P	512
180.6	1	1	1977201240	1-story, 2-stores, built 1925, heating: steam-oil burner, purchased by drug store in 1945	parking lot	Y	611
160.6	3	1	0694000115	1-story retail, built 1925-6, oil burner heat	1 13-story apartment, constructed in 1978, heated by warmed and cooled air.	N	-
150.6	6	1	0656000540	3-story apartments, built 1916, oil burner heat	1 3-story multiple residence (low rise), constructed in 1916, heated by hot water.	P	513
190.3	2	1	1977200395	6-story hotel/retail, built in 1901, oil burner and steam heat, sign indicating tailor/dye shop	6-story apartment, constructed in 1901, heated by electric wall.	Y	612
180.3	1	3	5160650000	1-story service station, built in the 1950s, stove heat, 3-6000 gallon tanks	1 21-story condominium with retail space; constructed in 1982; complete HVAC	N	-
150.6	5	1	065600596	1-story, 3-office building with oil burner heat, built 1946	1 1-story retail store, constructed in 1946, heated by forced air unit.	P	514
190.3	4	1	1977200435	5-story hotel built in 1913-14 with oil burner heat in addition to steam	1 1-story retail store, constructed in 1925, heated by space heaters.	Y	613
180.5	3	1	1977201090	1-story retail, built 1912, stove heat	1 6-story apartment, constructed in 1999, heated by electric.	N	-
150.6	7	1	0656000600	3-story apartments, built 1918, oil burner heat	1 3-story multiple residence (low rise), constructed in 1918, heated by hot water.	P	515
220.4	1	1	1975700560	former building, oil burner/steam heat	1 2-story retail store, constructed in 1916, heated by steam.	Y	614

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
360.1	10	3	7666207695	2-story machine shop/office building, built 1945, 3 oil burners	1 3-story office building, constructed in 2005, heated by complete HVAC.	N	-
150.6	8	1	0656000605	1-story café, oil burner heat, built 1923	1 1-story mixed use retail, constructed in 1923, heated by space heaters.	P	516
260.4	1	1	1974600025	Two buildings: 1 3-story hotel full service, constructed in 1901, and 1 4-story building built 1906, oil burner	Two buildings: 1 3-story hotel full service, constructed in 1901, heated by package unit and 1 4-story building built 1906	Y	615
150.7	7	1	0696000155	1-story retail, stove heat, built 1923, torn down 1959	1 1-story retail store, constructed in 1923, heated by forced air unit.	P	517
260.4	3	1	1974600035	5-story building constructed in 1904 with oil heat	1 5-story hotel full service, constructed in 1904, heated by warmed and cooled air.	Y	616
150.7	6	1	0696000140	1-story garage built 1923, stove heat	1 1-story open office, constructed in 1924, heated by hot water.	P	518
340.1	1	3	5247800150	2-story garage, built 1909, oil burner, 3 gas tanks, automotive and truck steam cleaning	1 3-story parking structure, constructed in 1909, heated by no heat.	Y	617
160.5	4	1	0694000040	1. 1-story gas station, stove heat, built in ~1911, demolished 1955, 3 pumps, 1-hydraulic lift, 1-550 gallon tank, new tanks noted in 1953	Regrade Park- Seattle Parks Department	P	519
160.5	7	1	0694000020	2-story office, built 1923, oil burner heat	1 2-story mixed use retail, constructed in 1923, heated by hot water.	P	520
160.5	8	1	0694000030	3-story retail and apartments, oil burner heat, built 1911	1 3-story mixed retail w/res. units, constructed in 1911, heated by hot water.	P	521
160.5	11	1	0694000050	1-story church (later retail), built in 1914, oil burner heat	1 1-story retail store, constructed in 1914, heated by space heaters.	P	522
160.7	3	1	0696000110	1-story office building, built 1946, oil burner heat	1 1-story retail store, constructed in 1946, heated by forced air unit.	P	523
170.4	5	2	1977200740	1-story service station, built in 1917, oil burner heat, 2-5000 gallon tanks	1 12-story industrial light manufacturing, constructed in 1985, heated by hot & chilled water.	P	524
170.4	8	2	1977200725	1-story retail, 2 oil burners for heat, 1-3,900 gallon fuel oil tank, built 1923	1 1-story retail store, constructed in 1923, heated by hot water.	P	525
170.4	9	1	1977200720	4-story apartments and retail, built 1909, oil burner heat	1 4-story apartment, constructed in 1909, heated by hot water.	P	526
170.5	9	2	1977201160	2-story offices with 2 oil burners, built 1948-9	1 2-story office building, constructed in 1949, heated by forced air unit.	P	527
170.5	10	1	1977201170	1-story office with oil burner heat, built 1948	Plymouth Housing Group	P	528
170.6	10	1	0694000195	2-story store and loft, stove heat, built 1919	1 2-story mixed use office, constructed in 1919, heated by forced air unit.	P	529

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
180.4	1	1	1977200855	2-story parking garage with gas & oil, built 1918, steam heat	1 3-story office building, constructed in 1918, heated by warmed and cooled air.	P	530
180.5	6	2	1977201120	1-story, built 1913, heating: 2 boiler, remodeled 1922 and 1961/(as of 1974 office)	1 1-story office building, constructed in 1913, heated by hot water.	P	531
180.5	8	1	1977201095	2-story, built 1919, mix use with auto repair and garage, 1-550 gal and 1-1000 gal UST,2-hydraulic hoists, heating: steam Western Oil burner/(Garage converted to mix use as of 1983)	1 2-story office building, constructed in 1919, heated by warmed and cooled air.	P	532
180.5	9	3	1977201140	8-story hotel, built 1910, 2 oil burners for heat, 1-2,500 gal. tank	8-story mixed retail/residential, built 1910, electric wall heat	P	533
190.3	5	1	1977200410	2-story retail and loft, oil burner heat (installed 1945), constructed 1922	1 2-story office building, constructed in 1922, heated by steam without boiler.	P	534
190.3	6	1	1977200405	3-story warehouse; built 1928; oil tank	1 3-story retail store, constructed in 1928, heated by hot water.	P	535
190.3	7	1	1977200415	3-story office/retail constructed in 1906; oil burner in 1937, switched to gas by 1968	1 3-story mixed retail w/res. units, constructed in 1906, heated by heat pump.	P	536
190.3	8	1	1977200416	3-story retail and lofts, built in 1910, oil burner heat	1 3-story mixed use retail, constructed in 1910, heated by hot water.	P	537
190.3	9	1	1977200420	4-story office building, constructed in 1910, oil burner in addition to steam heat	1 4-story mixed use office, constructed in 1910, heated by hot water.	P	538
190.3	10	1	8008550000	3-story hotel, built 1904, oil burner and steam heat	3-story hotel, built 1904, electric heat	P	539
190.4	13	1	1977200935	1 4-story office building, constructed in 1909, oil burner	1 4-story office building, constructed in 1909, heated by hot water.	P	540
200.2	1	1	1977200020	Lot 8 permit was obtained for a new oil burner and furnace.	1 12-story office building, constructed in 1986, heated by complete HVAC.	P	541
210.4	2	1	1976200210	1 4-story; built 1942; oil heating	1 4-story mixed retail w/res. units, constructed in 1942, heated by forced air unit.	P	542
210.5	7	1	1975700605	1 4-story office building, constructed in 1919, oil heat	1 4-story office building, constructed in 1919, heated by warmed and cooled air.	P	543
210.5	6	1	1975700600	4-story hotel and retail building with oil burner	1 4-story hotel, constructed in 1900, heated by steam without boiler.	P	544
220.3	2	1	7877100000	4-story hotel built in 1910 with an oil burner for heat	residential condominium complex, built 1985, electric heat	P	545
220.3	1	1	4193800000	6-story hotel/apartments and retail building, constructed in 1908 with oil heat	6-story building built in 1908	P	546
220.3	4	1	1976200105	2-story retail built in 1900 with oil burner heat	1 2-story retail store, constructed in 1900, heated by hot water.	P	547

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
230.2	1	1	7666202445	1-story building with basement built in 1895 (fronts Western) also 1-story boiler house built in 1955 with "oil tank retention wall" noted in drawing (AST)	1 2-story industrial light manufacturing, constructed in 1900, heated by steam without boiler.	P	548
240.2	2	1	7666202480	7-story warehouse constructed in 1910 with oil burner heat	1 7-story office building, constructed in 1910, heated by heat pump.	P	549
240.4	1	1	1974700170	4-story hotel & retail, built 1889, oil burner	1 4-story mixed retail w/res. units, constructed in 1900, heated by steam.	P	550
250.4	2	1	1697500000	4-story hotel & retail constructed in 1902 with oil heat	Colonial Grand Pacific 6 story Condominium, built in 1902, electric	P	551
270.3	1	5	7666202530	9-story office building constructed in 1932 with 5 oil burners	9-story office building constructed in 1932	P	552
290.4	3	1	8591400025	4-story hotel built in 1908 with oil burner for heat, demolished in 1969	9-story parking garage with office/retail, built 1970, no heat	P	553
330.2	3	2	5247800115	1 3-story mixed retail w/res. units, constructed in 1900, 2 oil burners	1 3-story mixed retail w/res. units, constructed in 1900, heated by space heaters.	P	554
330.2	4	1	5247800105	4- story hotel, built 1900, steam heat, oil burner	4- story office building, built 1900, steam heat	P	555
330.2	1	1	5247800100	3-story hotel / retail, built 1900, oil burner	1 2- story warehouse, built 1950, electric wall heat	P	556
340.2	5	1	5247800355	3-story retail / studio, built 1890, oil burner	3-story office building with retail, built 1890, forced air	P	557
350.2	2	1	5247800200	7-story warehouse, built 1906, oil burner	1 7-story office building, constructed in 1913, heated by heat pump.	P	558
360.1	6	1	7666207695	1-story gate house, built 1965, oil heat	1 3-story office building, constructed in 2005, heated by complete HVAC.	P	559
360.1	12	1	7667800005	3-story warehouse, built 1922-23, oil burner	1 3-story office building, constructed in 2005, heated by complete HVAC.	P	560
360.1	13	1	7667800005	2-story warehouse, built 1918, oil burner	1 3-story office building, constructed in 2005, heated by complete HVAC.	P	561
360.15	1	1	7666206945	3-story warehouse, built 1921, oil burner	1 3-story industrial light manufacturing, constructed in 1921, heated by steam.	P	562
370.1	2	1	7666206950	2-story warehouse, built 1939, oil burner	WSDOT lot/laydown yard.	P	563
370.2	7	2	7666206640	4-story warehouse/store, built 1904, 2 oil burners	4-story warehouse/store, built 1904, hot water	P	564
370.2	18	1	7666206710	1-story office, built 1920, oil burner	Parking lot	P	565
370.2	10	1	7666206660	1 story store, built 1929, oil burner	1 story store, built 1929, space heaters	P	566
370.2	11	1	7666206670	1 story store, built 1938, oil burner	Parking lot	P	567
370.2	13	1	7666206678	1 story office, built 1918, oil burner	1 story office, built 1918, HVAC	P	568

Exhibit C-4. Properties with Potential Oil Tanks Located Adjacent to the Alignment

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?	Designation
370.2	20	1	7666206690	4-story warehouse, built 1907, oil burner	4-story warehouse, built 1907, space heaters	P	569
370.2	15	1	766206700	4-story warehouse, built 1909, oil burner	4-story warehouse, built 1909, space heaters	P	570
380.1	4	1	7666207695	warehouse, built 1907, oil burner, torn down 1966	Port of Seattle	P	571
380.1	5	1	7666207695	built 1918, stove heat, 1 tank (type unknown – listed under plumbing)	Port of Seattle	P	572

Exhibit C-5. Potential Gasoline Tanks Located Adjacent to the Alignment Where There Has Been Significant Redevelopment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010
30.05	30.05-2	1-story office & material yard, built 1945?, stove; new parking lot in 1962		1950	2249000170	1-4 story, hotel, constructed 1999, heat pump.	N
40.1	40.1-2	Built in 1933, single story gas station, with stove.	1938, 1940 / 1951	1950	1988201155	Gates Foundation 2 buildings 1) built in 1994,2) 6-story building in 2009.	N
50.05	50.05-2	gas station	1938, 1940, 1943-44, 1951	1950	2570400000	1-5-story building, constructed in 2009 parking garage.	N
80.5	80.5-2	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1-550 gallon tank, 2 hoists	1956, 1985 / 1989	1950, 1969	1991200695	Hyatt Place- 8-story commercial condominium, built 2008	N
80.5	80.5-3	1-story gas station and repair shop, built in 1931, torn down 1942, stove heat, 2 pumps	1938		1991200695	Hyatt Place- 8-story commercial condominium, built 2008	N
140.7	140.7-2	1. 1-story gas station, stove heat, built in 1927-1928, 1-1,000 gallon tank, 1-550 gallon tank, 1-hydraulic hoist, torn down ~1960?	2. 1938/(1943-44) / <1951, 1956, 1965, 1970>/1990's	2. (1949)	0696000250	1 6-story apartment, constructed in 1998, heated by electric.	N
150.7	150.7-3	1-story store and warehouse, built 1913, 2 oil burners for heat	1943 / 1943		0696000175	1 6-story office building, constructed in 2002, heated by complete HVAC.	N

Exhibit C-5. Potential Gasoline Tanks Located Adjacent to the Alignment Where There Has Been Significant Redevelopment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010
170.4	170.4-5	1-story service station, built in 1917, oil burner heat, 2-5000 gallon tanks	1938, 1940, 1943 / 1960, 1965, 1970, 1975 / 1965	1949, 1969	1977200740	1 12-story industrial light manufacturing, constructed in 1985, heated by hot & chilled water.	N
180.4	180.4-3	1-story retail building, built 1914, torn down 1968; 1 story retail building built in 1920, torn down 1953; 2-2,000 gallon tanks noted; gas station on Virginia St.	1.1938, 1940, 1943-44, 1951, 1960/ 2.1938, 1940, 1943-44/3.1994		6391350000	One Pacific Towers Condominium, 27 stories, built 1994, electric heat	N
	350.1-2	1-story warehouse, built 1963-64, inventory is listed in tank section, a portion of the inventory is covered by photo	1938, 1940	1950	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N
350.1	350.1-4	gas station		1916	7666207695	1 3-story office building, constructed 2005, heated by complete HVAC.	N
	350.2-1	1-story gas station, built 1937, stove heat	1938	1950	5247800201	1 3-story parking structure, constructed in 1984, no heat.	N
	360.1-3	1-story metal shop/restaurant/office building, built in 1890, stove heat	1938, 1940 /1940 /	/ 1950 / 1916	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N
	360.1-4	dock, built 1964-65, 2,000 gallon tank			7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N
	360.1-5	1-story scale house, built 1923, stove heat	0	1916 / 1950 / 1969	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N

Exhibit C-5. Potential Gasoline Tanks Located Adjacent to the Alignment Where There Has Been Significant Redevelopment

Block	Site No.	Description (Archive)	Polk Directory Years	Sanborn Map Years	Tax Parcel No.(2009)HIDE	2009 Assessor Record	Is the gasoline tank likely present?-2010
	360.1-8	1-story service station, unknown construction date, stove heat, 4x14 grease pit	1938, 1940, 1951, 1956, 1960	1950	7666207695	1 3-story office building, constructed in 2005, heated by complete HVAC.	N
360.2	360.2-3	gas station	1938, 1940		7666206895	2 7-story office buildings, built 1904 and 2009, warmed and cooled air, complete HVAC	N

Notes:

N= No (site has had significant redevelopment)

Exhibit C-6. Properties With Potential Oil Tanks Located Adjacent to the Alignment, Where Significant Redevelopment Has Occurred

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?
80.5	2	1	1991200695	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1 550-gallon tank, 2 hoists	Hyatt Place 8-story commercial condominium, built 2008	N
80.6	1	1	1991201025	1-story body works garage, oil burner heat, built 1945, torn down 1969	Hyatt Place 8-story commercial condominium, built 2008	N
80.4	2	1	1991200600	2-story office building, built 1932, steam heat/oil burner	1 6-story apartment, constructed in 2008, heated by electric wall	N
80.4	3	1	1991200600	2-story office building, built 1954-55, remodel/addition 1957, hot water heat/oil burner	1 6-story apartment, constructed in 2008, heated by electric wall	N
80.5	2	2	1991200695	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1 550-gallon tank, 2 hoists	Hyatt Place 8-story commercial condominium, built 2008	N
130.7	1	1	0696000260	4-story rooming house, coal stoker heat, built in 1904, demolished 1962; replaced by 1-story office & used car lot, built in 1962, 1-1000(?) gallon	1 6-story mixed retail w/res. units, constructed in 2000, heated by electric wall	N
130.7	2	1	0696000260	1-story garage, built 1946, oil burner heat, 1-hoist listed	1 6-story mixed retail w/res. units, constructed in 2000, heated by electric wall	N
140.7	2	2	0696000250	1. 1-story gas station, stove heat, built in 1927-1928, 1-1,000 gallon tank, 1-550 gallon tank, 1-hydraulic hoist, torn down ~1960?	Apartments (all lots): 6 stories, built 1998, electric heat	N

Exhibit C-6. Properties With Potential Oil Tanks Located Adjacent to the Alignment, Where Significant Redevelopment Has Occurred

Block	Site No.	Oil Heat /Tanks	Parcel Number(s)	Archive Description	2009 Tax Assessor Record Description	Oil Tank Present?
140.7	4	1	0696000250	2-story warehouse, built 1919, oil burner heat	Apartments (all lots): 6 stories, built 1998, electric heat	N
140.7	5	1	0696000250	2-story warehouse & store, creosoted pile foundation, oil burner heat, built in 1953-54	Apartments (all lots): 6 stories, built 1998, electric heat	N
150.6	1	1	0656000550	1-story warehouse, built 1924, stove heat, 1-6,000 gallon fuel oil tank, several businesses over time but predominantly news printing	1 7-story mixed retail w/res. units, constructed in 2007, heated by electric	N
150.7	3	2	0696000175	1-story store and warehouse, built 1913, 2 oil burners for heat	1 6-story office building, constructed in 2002, heated by complete HVAC	N
160.5	9	2	0698800000	1-story retail, built 1929-30, 2 oil burners for heat	1 8-story condo/apartments plus commercial, constructed in 2002, heated by complete HVAC	N
160.6	3	1	0694000115	1-story retail, built 1925-6, oil burner heat	1 13-story apartment, constructed in 1978, heated by warmed and cooled air	N
180.3	1	3	5160650000	1-story service station, built in the 1950s, stove heat, 3-6000 gallon tanks	1 21-story condominium with retail space; constructed in 1982; complete HVAC	N
180.5	3	1	1977201090	1-story retail, built 1912, stove heat	1 6-story apartment, constructed in 1999, heated by electric	N
360.1	10	3	7666207695	2-story machine shop/office building, built 1945, 3 oil burners	1 3-story office building, constructed in 2005, heated by complete HVAC	N

ATTACHMENT D

Historical Land Uses of Sites

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ATTACHMENT D

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
20.0	20.0-1	auto repair and gas station	coal office built 1909 and burned in 1945	1938	1917	1 4-story hotel , constructed in 1996 , heated by electric wall.		unlikely	Low	pet, gas
20.0	20.0-2	gas station/gas station	two gas stations: one gas station built 1933 and burned down in 1946, heated with stove; and one gas station/service station, built 1954-55 and torn down in 1972, oil heat	1938, 1940, 1943/44, 1951, 1956, 1960, 1965, 1970	1950	1 4-story motel , constructed in 1996 , heated by wall furnace.	Yes	unlikely	Low	gas
20.0	20.0-3	fuel dealer & towing company	1-story office building, constructed 1931, heated with stove	1938, 1940, 1943/44, 1956, 1965, 1970, 1975, 1989/90		1 4-story motel , constructed in 1996 , heated by wall furnace.		unlikely	Low	pet, gas
20.0	20.0-4	gas station equipment, metal manufacturing, sign company	repair shop in portion of building constructed in 1962	1951, 1956, 1960, 1965, 1989/90		1 4-story motel , constructed in 1996 , heated by wall furnace.		unlikely	Low	pet, metals, solv
20.01	20.01-1	auto body manufacturers / maintenance department & auto repairs	1- & 2-story factory building then warehouse & offices, built 1928, hot water/oil burner then gas furnaces	1938, 1943, 1960, 1965, 1970, 1975	1969	1 2-story industrial light manufacturing, constructed in 1928, no heat.		unlikely	Low	pet
20.01	20.01-2	cleaners	1-story store & factory building, built 1927, remodeled 1929, stove for shop	1989		2-story building constructed in 1937, complete HVAC		unlikely	Moderate	solv
20.01	20.01-3	auto repair	1-story garage, built 1920, no heat	1980, 1985, 1989	1950	1 1-story garage, service repair, constructed in 1920, no heat.		unlikely	Low	pet
20.01	20.01-4	gas station	1-story gas station, built 1909, stove, tanks not listed	1938, 1940, 1943, 1951	1950	4-story building, constructed in 1984, heat pump		unlikely	Low	gas

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
20.01	20.01-5	convenience store	not available	1989/90		1 1-story retail store, constructed in 1985 , heated by heat pump.	Yes	unlikely	Low	gas
20.1	20.1-1	auto repair	1-story office & warehouse, built 1928, oil burner	1943/1985, 1989-90		1 1-story garage, service repair, constructed in 1928 , heated by space heaters.		unlikely	Low	pet
20.1	20.1-2	engine repair	1-story store and garage, built 1937. Safeway in 1937 photo, parking garage in 1962 photo.		1950, 1969	1 2-story office building, constructed in 1937 , heated by complete hvac.		unlikely	Low	pet
20.2	20.2-1	laundry	1-story building built 1925, heat not listed, demolished 1948/ 1-story building, built 1947 (additions to original building on lot 1?), 2 oil burners, gas pumps shown in photo, 2-6,000-gallon tanks, 2-550 gallon tanks, also includes garage (for delivery trucks?)	1938, 1940/ 1943, 1951, 1956, 1960, 1965		1 1-story garage, service repair, constructed in 1947 , heated by hot water.	Yes	unlikely	Moderate	solv, gas, pet
20.2	20.2-2	auto repair	Associated with Laundry		1950, 1969	1 1-story garage, service repair, constructed in 1947 , heated by hot water.		unlikely	Moderate	solv, gas, pet
20.2	20.2-3	gas station/(gas station)/<gas station>	1-story gas station, built 1931, stove heat, 2 wood grease pits, 2-1,400 gallon tanks, 2-3,500 gallon tanks, 1-550 gallon tank, & 2-5,000 gallon tanks, demolished 1966	1938, 1940, 1943, 1951/ (1956)/ < 1960>	1950	1 1-story garage, service repair, constructed in 1947 , heated by hot water.		unlikely	Moderate	solv, gas, pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
20.2	20.2-4	garage with fueling	Associated with Laundry		1950, 1969	1 1-story garage, service repair, constructed in 1947 , heated by hot water.		unlikely	Moderate	solv, gas, pet
30.0	30.0-1	garage, sign painting	four buildings: 1-story office building with garage in basement, built 1923, heated with oil; one recreation hall/paint storage building, built 1923, heated with		1950	1-4 story building, constructed in 2007, warmed and cooled air.		LOW	Low	solv/pet/pah
30.0	30.0-2	sheet iron billboard shop, paint storage			1950			LOW	Low	solv/metals/pah
30.0	30.0-3	laundry	1-story warehouse used as a laundry, built 1923, heated with steam and suspended gas units	1938, 1940		1-4 story building, constructed in 2007, warmed and cooled air.	Yes	LOW	Moderate	solv/pah
30.01	30.01-1	sheet metal works / gas engine rebuild	1-story showroom & warehouse building, built 1946, oil burner	1965, 1970, 1975, 1980, 1985, 1989	1950 / 1969	1 1-story warehouse office, constructed in 1946 , heated by forced air unit.	Yes	LOW	Low	pet, gas
30.01	30.01-2	cabinet shop	1-story woodworking shop, stove		1950	1 2-story office building, constructed in 1952 , heated by hot water.		unlikely	Low	solv
30.01	30.01-3	gas station	1-story gas station & grease shop, built 1928, no heating system, tanks not listed	1938, 1940, 1951	1950	1 2-story office building, constructed in 1952 , heated by hot water.		LOW	Low	gas
30.05	30.05-1	oil burner service	2-story store & offices, built 1941, hot water/oil burner; remodeled as warehouse & offices, 1953 ?		1950	1 2-story office building, constructed in 1941 , heated by hot water.		LOW	Low	pet
30.05	30.05-2	contractor's warehouse	1-story office & material yard, built 1945?, stove; new parking lot in 1962		1950	1 4-story hotel suite, constructed in 1999 , heated by heat pump.		LOW	Low	gas
30.1	30.1-1	gas station	1-story gas station, built 1930, demolished 1941?			1 1-story warehouse office, constructed in 1919 , heated by forced air unit.		LOW	Low	gas

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
30.1	30.1-2	varnish mfrs., laundry, coated wall board mfrs.	1-story building, built 1919, boilers and cleaning department shown on record	1940, 1943	1950	1 1-story storage warehouse, constructed in 1946, no heat.		LOW	Moderate	solv
30.1	30.1-3	gas station and auto repair	1-story gas station, built 1930, demolished 1945?	1938, 1940 / 1943		1 1-story storage warehouse, constructed in 1946, no heat.		unlikely	Low	gas
30.1	30.1-4	paint products, floor factory	1-story floor factory, built 1926, steam heat	1938		1 1-story storage warehouse, constructed in 1946, no heat.		LOW	Low	solv
30.2	30.2-1	2.(gas station)/auto repair	2. 1-story shop building built 1929, stove heat, used for auto repair, 1-story gas station built 1929, stove heat	1951/ 1951, 1956, 1960	1950	vacant land		LOW	Low	gas
30.3	30.3-1	sign painting/printers/cabinet and sign shop	One masonry factory building built 1924, addition 1962, oil burner	1975, 1980, 1985, 1989-90		1 1-story industrial light manufacturing, constructed in 1924 , heated by space heaters.		unlikely	Moderate	solv
30.3	30.3-2	gas station and auto repair	Gas station, built 1930, torn down 1956, stove heat			no report available		LOW	Low	gas
30.3	30.3-3	gas station/gas station		1938/(1940)		vacant land		LOW	Low	gas
40.05	40.05-1	bus maintenance	1-story bus barn & offices, built date not recorded, hot water/oil burner	1938, 1940, 1943, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985	1917, 1950, 1969	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.	Yes	LOW	Low	solv, metals, pet
40.05	40.05-2	substation & transformer house			1917, 1950	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.		unlikely	Moderate	pcbs
40.1	40.1-1	machine shop			1950	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.		MODERATE	Low	solv, metals

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
40.1	40.1-2	gas station	Built in 1933, single story gas station, with stove.	1938, 1940 / 1951	1950	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.		MODERATE	Low	gas
40.1	40.1-3	auto repair		1938	1950	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.		MODERATE	Low	pet
40.1	40.1-4	paint removing		1938, 1940, 1943, 1951, 1956, 1960		1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.		HIGH	Moderate	solv
40.1	40.1-5	sports facility			1950	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.	Yes	MODERATE	Low	solv
40.2	40.2-1	1.battery manufacturer/(auto repair)/2.[plating company]	Built in 1928, listed as single story garage building with oil burner stove. Business is wholesale photographic distributors.	1. 1938/(1975)/2. [1975, 1980, 1985, 1989-90]		1 1-story retail store, constructed in 1928 , heated by forced air unit.		unlikely	Moderate	metals, pet
40.2	40.2-2	printing / auto repair	Built in 1930, listed as single story garage building/warehouse.	1938, 1940 / 1956 / 1965, 1970, 1989	/ 1950 / 1969	1 1-story garage, service repair, constructed in 1930 , heated by space heaters.		LOW	Low	pet, solv
40.2	40.2-3	gas station	Built in 1934, single story service station, stove heat, addition in 1948.	1938, 1940, 1951	1950	Commercial, vacant lot		LOW	Low	gas
40.2	40.2-4	laundry, gas station	Built in 1930, single story gas station with stove. 1-2,000 gallon tank and 2-3,000 gallon tanks	1938, 1940, 1943-44, 1951, 1956	1917, 1950	No parcel number/ part of the Broad Street		LOW	Low	gas
40.3	40.3-1	printers	3-story bank building, built in 1956, oil heat, print shop in basement			1 3-story office building, constructed in 1956 , heated by warmed and cooled air.		unlikely	Moderate	solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
40.3	40.3-2	auto repair	1-story repair garage, built 1957			1 1-story retail store, constructed in 1957 , heated by space heaters.		unlikely	Low	pet
50.02	50.02-1	hotel supply	2-story store & warehouse, built 1918, hot water heat; then dairy building.	1950		See Blocks 40.05, 40.1 and 50.05.		unlikely	Low	pet
50.05	50.05-1	autobody works & repairing, paint room	1-story garage, built 1947, paint shop noted, oil burner, auto rebuild noted, torn down 1962		1950	1 2-story fitness center, constructed in 1994 , heated by warmed and cooled air.		LOW	Low	solv, pet
50.05	50.05-2	gas station and auto repair		1938, 1940, 1943-44, 1951	1950	1-5-story building, constructed in 2009 parking garage.		LOW	Low	gas
50.1	50.1-1	cleaners	Built in 1944-45, 1-story laundry with boilers and garage. Tank inventory includes 1-9,550 gallon fuel oil tank for delivery trucks.	1951, 1956, 1960	1950	Seattle Dept of Transp Parking Lot and Storage Yard		HIGH	Moderate	solv
50.1	50.1-2	cleaning supply company	Built in 1924, listed as a two-story warehouse [furniture repair], with oil burner. Company provides dry cleaning supplies and laundry dyes.	1938, 1940	1950	Seattle Dept of Transp Parking Lot and Storage Yard		HIGH	Moderate	solv
50.1	50.1-3	auto repair			1950, 1969	Seattle Dept of Transp Parking Lot and Storage Yard		MODERATE	Low	pet
50.1	50.1-4	battery mfr.	Built in 1922, listed as two-story store building with stove.	1938, 1940, 1943, 1951, 1956		Seattle Dept of Transp Parking Lot and Storage Yard		LOW	Moderate	metals

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
50.2	50.2-1	fuel dealer	Photograph shows small shed structure with fuel sign with price list. No other information available for the property.	1938, 1940, 1943		1-5-story building, constructed in 2009 parking garage.		unlikely	Low	pet
50.2	50.2-2	film processing/(printers)	1-story warehouse, built in 1948, gas heat	1980/(1985, 1989-90)		1 1-story industrial light manufacturing, constructed in 1948 , heated by space heaters.		LOW	Low	solv
50.2	50.2-3	sign painting/maintenance shop, oil co.	1-story warehouse, built 1924, steam, sawdust burner		1969/1950	parking lot		LOW	Low	solv, pet
50.2	50.2-4	Department of Ecology Site				1 2-story industrial light manufacturing, constructed in 1900 , heated by hot water.	Yes	LOW	Low	pet
50.3	50.3-1	printers	Built in 1928, listed as two-story re-conditioned factory with oil burner	1951, 1956		parking lot		unlikely	Low	solv
50.3	50.3-2	wood working / painting	2-story building, built 1928, steam heat		1950	1 2-story industrial light manufacturing, constructed in 1928 , heated by forced air unit.		unlikely	Low	solv
50.3	50.3-3	auto factory	Built in 1930, listed as single-story warehouse with two oil burners. Floor plans indicate building once used as masonry factory garage.			1 1-story industrial light manufacturing, constructed in 1930 , heated by forced air unit.		unlikely	Low	solv, pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
60.1	60.1-1	gas station	1-story service station, built 1958, oil burner; 1-6,000 gallon, 2-4,000 gallon & 2-500 gallon tanks, 1 hydraulic lift	1960	1950, 1969	4 buildings: 1) 1-story office building, built 1950, electric; 2) crane tower, electric heat; 3) 2-story office building, built 1950, electric; 4) 1-storypump room, built 1950,electric; this part of the joined parcel 60.2 is vacant.		LOW	Low	gas
60.1	60.1-2	gas station and auto repair	1-story gas station, built 1946, stove, 3-1,500 gallon tanks, 1 hoist; also 1-5,000 gallon, 1-20,000 gallon, 1-10,000 (diesel) gallon, & 1 oil tank (no volume)		1950, 1969	1 2-story mixed use retail, constructed in 1963 , heated by forced air unit.		LOW	Low	gas
60.1	60.1-3	oil company	new 2-story shop & office building, built 1963-1964, hot air furnace/oil burner					LOW	Low	pet
60.1	60.1-4	dry cleaners	1-story building with balcony, store & warehouse building, built 1929, steam/oil burner; dry cleaning plant	1938, 1940, 1943, 1951, 1956, 1960, 1965, 1970	1917, 1950, 1969	1 2-story restaurant, table service, constructed in 1929 , heated by forced air unit.		LOW	Moderate	solv
60.2	60.2-1	public utility	Transfer yard and associated structures including: 1-story control building, built 1950, electric heat; 1-story shop, pump room, and crane tower, built 1950, electric heat	1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985	1950, 1969	1 4-story light commercial utility building, constructed in 1950 , heated by electric.		MODERATE	Moderate	pcbs
60.3	60.3-1	dry cleaner/gas station	1-story cleaning plant & laundry, built 1946, steam heat/oil burner; replaced by 3-story motel, built 1961, electric heat	1938, 1940, 1951	1950	1 3-story motel , constructed in 1961 , heated by electric wall.	Yes	HIGH	Moderate	solv, gas

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
60.4	60.4-1	auto repair	1-story garage, built 1936, stove; 1-story workshop and office, remodeled garage 1956, hot water heat/oil burner	1938		1 4-story broadcast facilities, constructed in 1947 , heated by complete hvac.		LOW	Low	pet
60.5	60.5-1	printers		1989-90		1 1-story retail store, constructed in 1950 , heated by forced air unit.		unlikely	Low	solv
70.4	70.4-1	cleaners/laundry	1 story store building, built 1930, steam heat/oil burner; remodeled 1944 as dry cleaner & laundry	1938, 1940 / 1943-44, 1951, 1956	1950	1 5-story motel , constructed in 1959 , heated by hot water.		unlikely	Moderate	solv
70.5	70.5-1	mfg. chemist, generators	1-story warehouse and factory, built 1950, gravity hot air furnace/oil burner	/ 1975	1969 /	1 1-story storage warehouse, constructed in 1950 , heated by space heaters.		unlikely	Low	solv
70.5	70.5-3	gas station	1-story hotel, built in 1951, steam heat	1938, 1940, 1943-44		1 1-story motel , constructed in 1947 , heated by hot water.		unlikely	Low	gas
70.5	70.5-4	gas station	1-story gas station, built 1933, stove, 2nd building is "grease shed", no mention of tanks; torn down in 1955; replaced by 1-story warehouse and office building, built 1956, suspended gas steam heating units	1938, 1940	1950	1 1-story storage warehouse, constructed in 1956 , heated by space heaters.		unlikely	Low	gas
70.6	70.6-1	petroleum, asbestos goods, auto repair	1-story office and shop, built 1931, oil heat	1940 / 1943, 1951, 1956 / 1989		1 1-story industrial light manufacturing, constructed in 1931 , heated by hot water.		unlikely	Low	pet
70.6	70.6-2	press	2-story office and shop, built 1954, oil burner, "service shop" noted	1980, 1985, 1989		1 2-story office building, constructed in 1954 , heated by forced air unit.		unlikely	Low	solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
70.6	70.6-3	1. auto repair, paints/2. printers/3. auto repair	3-story warehouse/garage, built 1933, oil heat	1. 1943, 1951, 1956, 1960, 1965/2. 1970, 1975, 1980, 1985 (1989-90)/3. 1938-1940	1. & 2. 1950, 1969	1 1-story open office, constructed in 1933 , heated by space heaters.		unlikely	Moderate	solv
80.3	80.3-1	repair shop; auto repairing, fueling			1917; 1950			unlikely		gas
80.3	80.3-2	1.laundry/2. fuel company		1.1938,1940/2.1938, 1940,1943-44	1917			unlikely		solvents/petroleum
80.3	80.3-3	electric repair shop			1950			unlikely		PCBs
80.3	80.3-4	dry cleaning, dyeing			1904-05, 1917, 1950			unlikely		solvents
80.5	80.5-1	gas station and auto repair	1-story gas and service station, built 1934, stove heat, torn down 1953; replaced by café, oil burner heat, built 1954	1938, 1940, 1943-44, 1951	1950	1 1-story convenience market, constructed in 1998 , heated by heat pump.		unlikely	Low	gas
80.5	80.5-2	gas station/ auto repair	1-story restaurant/retail building, suspended gas heat, built 1941, torn down 1962; replaced by 1-story service station, built in 1961, oil burner heat, "tune-up" area; 1-6000 gallon tank, 1-550 gallon tank, 2 hoists	1956, 1985 / 1989	1950, 1969	1 8-story condo hotel service, constructed in 2008 , heated by electric wall.	Yes	unlikely	Low	gas
80.5	80.5-3	gas station and auto repair	1-story gas station and repair shop, built in 1931, torn down 1942, stove heat, 2 pumps	1938		1 8-story condo hotel service, constructed in 2008 , heated by electric wall.		LOW	Low	gas
80.6	80.6-1	auto repair & body works	1-story body works garage, oil burner heat, built 1945, torn down 1969	1951, 1956, 1960, 1965	1950, 1969	1 1-story office building, constructed in 1945 , heated by heat pump.		unlikely	Low	pet

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
80.6	80.6-2	gas station	1-story gas station, stove heat, built 1936, removed 1954; grease shed, oil service on gravel area, 3 pumps	1938, 1940, 1943-44, 1951	1950	Commercial, parking lot		unlikely	Low	gas
80.6	80.6-3	gas station	1-story service station, built 1940, 2-2,000 gallon tanks, 4-1,500 gallon tanks, 1 hoist; 3 pumps, torn down in 1948			Commercial, parking lot		unlikely	Low	gas
80.6	80.6-4	gas station and auto repair	1926: 1-story auto repair service, built in 1926, 3-550 gallon tanks, 1 hydraulic lift, torn down by 1943; replaced with 1-story gas station built 1943, stove heat, hoist, 1-1,000 gallon tank, 1-2,000 gallon tank, 1-8,000 gallon tank; tanks & buildings removed 1951; new repair garage built 1961	1965, 1970, 1975, 1980, 1985, 1989	1950, 1969	1 1-story garage, service repair, constructed in 1961 , heated by space heaters.		unlikely	Low	pet
80.6	80.6-5	commercial property	One-story office building built 1931, gas heat			1 1-story office building, constructed in 1931 , heated by warmed and cooled air.	Yes	unlikely	Low	pet
120.6	120.6-1						Yes	unlikely		petroleum
120.6	120.6-2	1. paints (1950-51); 2. tin shop (1904-05)			1904-05, 1951			unlikely		solvents, metals
120.6	120.6-3	1.laundry/2. hydraulic equip./3.film developing (printers)/4. printers						unlikely		petroleum

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

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120.6	120.6-4	refrigeration machinery repairing			1951			unlikely		petroleum
120.6	120.6-5	Department of Ecology site					Yes	unlikely		petroleum
120.7	120.7-1	printing			1904-05			unlikely		solvents
120.8	120.8-1	gas station and auto repair	1-story service station, 3-1000 gallon tanks, 1-hoist, built ~1943, torn down 1972	1956, 1970	1949, 1969	not reviewed, not adjacent		unlikely	Low	gas
130.6	130.6-1	printers and lithographers	1-story factory, oil burner heat, built in 1930, printing business	1938, 1940, 1943-44, 1951, 1956, 1956, 1970, 1975	1905, 1949, 1969	not reviewed, not adjacent		unlikely	Moderate	solv/pet
130.6	130.6-2	printers			1905	not reviewed, not adjacent		unlikely	Low	solv/pet
130.6	130.6-3	fuel dealer	1-story 1-family dwelling, stove heat, built 1931, torn down 1949, comment: "Is used for fuel yard."	1940, 1943		not reviewed, not adjacent		unlikely	Moderate	pet
130.6	130.6-4	Department of Ecology site				not reviewed, not adjacent		unlikely	Moderate	solv, pet
130.7	130.7-1	gas station/parking lot	4-story rooming house, coal stoker heat, built in 1904, demolished 1962; replaced by 1-story office & used car lot, built in 1962, 1-1000(?) gallon tank; gas station noted, built 1941(?)	1940, 1943	1949	1 6-story mixed retail w/res. units, constructed in 2000 , heated by electric wall.	Yes	unlikely	Low	gas
130.7	130.7-2	1. gas station/2. auto repair, painting	1-story garage, built 1946, oil burner heat, 1-hoist listed	1. 1938	2. 1949, 1969	1 6-story mixed retail w/res. units, constructed in 2000 , heated by electric wall.		unlikely	Low	pet

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130.7	130.7-3	auto sales and service	1-story garage, built 1946, car repair area noted on drawing of building		1949, 1969	not reviewed, not adjacent		unlikely	Low	pet
130.8	130.8-1	dry cleaners/printer/ auto repair with fueling	garage and storage, 2-stories, built 1949-50, 2-1000 gallon tanks listed, no heat listed	1951 / 1965 / 1970	/ 1969 /	18-story apartment building, built 1949, hot water heat (site is located on undeveloped portion of property)		MODERATE	Moderate	solv, pet, gas
130.8	130.8-2	Department of Ecology site	18-story apartment building, built 1949 had 10,000-gallon Bunker C UST inside building. 2-buildings on block see 130.8-1				Yes		Low	pet
130.9	130.9-1	gas station	auto service/gas station built 1934, stove heat, 3-1,000 gallon tanks; 1959: station remodeled - oil burner heat, 4-4,000 gallon tanks, 1-1,000 gallon tank, 1-550 gallon tank, 2 hoists	1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970, 1975	1949, 1969	Commercial, parking lot	Yes	LOW	Low	gas
140.6	140.6-1	1.reprographics/ 2. chemical company	2-story rooming house with stove heat, built in 1890, torn down 1946; 2-story commercial building with 2 oil burners for heat, built 1947	1.1985/ 2. 1975, 1980, 1985		1 1-story retail store, constructed in 1947 , heated by hot water.		unlikely	Low	solv
140.6	140.6-2	printers/printers/painter		1975/1956/1938		not reviewed, not adjacent		unlikely	Low	solv
140.7	140.7-1	printers	1-story retail building, stove heat, built 1925	1970, 1975, 1980 / 1975	1969	1 6-story apartment, constructed in 1998 , heated by electric.		unlikely	Low	solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
140.7	140.7-2	gas station/auto repair/cleaner/Department of Ecology Site	1. 1-story gas station, stove heat, built in 1927-1928, 1-1,000 gallon tank, 1-550 gallon tank, 1-hydraulic hoist, torn down ~1960?	2. 1938/(1943-44) / <1951, 1956, 1965, 1970>/1990's	2. (1949)	1 6-story apartment, constructed in 1998 , heated by electric.	Yes	unlikely	Moderate	solv/gas
140.7	140.7-3	auto repair	1-story auto repair garage, stove heat, built 1914, torn down 1953	1938, 1940		1 6-story apartment, constructed in 1998 , heated by electric.		unlikely	Low	pet
140.7	140.7-4	printer/auto repair		1. 1940, 1943-44/2. 1980, 1985 /(1989-90)		1 6-story apartment, constructed in 1998 , heated by electric.		unlikely	Low	pet
140.7	140.7-5	gas station		1951		1 6-story apartment, constructed in 1998 , heated by electric.		unlikely	Low	gas
140.8	140.8-1	gas station		1938, 1940, 1943-44		1 3-story office building, constructed in 1947 , heated by complete hvac.		unlikely	Low	gas
140.8	140.8-2	newspaper plant	newspaper plant, built 1947-1948, oil burner heat, presses and ink storage		1949, 1969	1 3-story office building, constructed in 1947 , heated by complete hvac.	Yes	MODERATE	Moderate	solv
140.9	140.9-1	gas station and auto repair	1-story repair shop, built 1939, torn down 1971, stove heat, 1-hydraulic lift	1940, 1943, 1951, 1956, 1960, 1965	1949, 1969	Commercial, parking lot		unlikely	Low	pet/gas
141.1	141.1-1	car wash	Maxwell Motors, used car lot with 1-story office, built in 1938, stove heat; 1-story car wash added 1956	1938, 1940, 1951, 1956, 1960		1 1-story garage, service repair, constructed in 1956, no heat.	Yes	unlikely	Low	gas
141.2	141.2-1	gas station	2-story gas station, built 1934, no heat, 1-3,000 gallon tank, 3-3,000 gallon tanks, 4-1,500 gallon tanks, 1-hoist	1938, 1940		Commercial, parking lot		unlikely	Low	gas

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150.5	150.5-1	auto body shop and painting	2-story "garage", built in 1921, "paint spray room" noted on 2nd floor, steam heat	1951, 1956, 1960, 1965, 1970	1949, 1969	not reviewed, not adjacent		unlikely	Moderate	solv
150.5	150.5-2	1. film processing/2. film processing/3. photo/4. photo	1-story retail, built 1928, 2 oil burners for heat	2. 1975/3. 1985/4. 1985, 1989-90	1. 1949, 1969	1 1-story retail store, constructed in 1928 , heated by hot water.		unlikely	Moderate	solv
150.5	150.5-3	1. auto service/2. printers, typesetting	1-story garage, built 1907, no heat, signs denote "used cars", "service"; remodeled into offices 1971	1. 1938, 1940, 1943, 1951, 1956, 1960, 1980 / 1985, 1989/2. 1985	1949, 1969	1 1-story retail store, constructed in 1907 , heated by space heaters.	Yes	unlikely	Low	pet
150.5	150.5-4	auto repairs, auto rebuild	1-story garage, built 1926, stove heat, torn down 1947	1938, 1940, 1943		not reviewed, not adjacent		unlikely	Low	pet
150.5	150.5-5	film processing	1-story plant, built 1926, oil burner heat, torn down 1962, also a dance hall, church, and bowling alley		1949, 1969	1 5-story apartment, constructed in 1990 , heated by electric wall.		unlikely	Moderate	solv
150.5	150.5-6			1951		1 1-story open office, constructed in 1951 , heated by hot water-radiant.		unlikely	Low	solv
150.6	150.6-1	publishing company, printers/battery company	1-story warehouse, built 1924, stove heat, 1-6,000 gallon fuel oil tank, several businesses over time but predominantly news printing	1 (1960)/2.1960	1. 1949, 1969	1 7-story mixed retail w/res. units, constructed in 2007 , heated by electric.		unlikely	Low	solv

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150.6	150.6-2	gas station and auto repair/Department of Ecology	1-story building, built 1936, service station, then upholstery shop, 3 tanks in drawing from 1937, 2 tanks noted on card in year 1958	1938, 1940, 1943 / (1951, 1956, 1960, 1965)	1949, 1969	1 1-story storage warehouse, constructed in 1914 , heated by hot water.	Yes	unlikely	Low	gas
150.6	150.6-3	printers	1-story warehouse and store, oil burner heat, built 1914	1943-44, 1975, 1980, 1985		1 1-story storage warehouse, constructed in 1914 , heated by hot water.		unlikely	Moderate	solv
150.6	150.6-4	film processing/auto repair		1951/1970		1 2-story office building, constructed in 1918 , heated by heat pump.		unlikely	Low	solv/pet
150.6	150.6-5	1. photo/2. printers		1. 1951/2. 1980/(1985)		1 1-story retail store, constructed in 1946 , heated by forced air unit.		unlikely	Low	solv
150.7	150.7-1	cleaners	1-story retail with dry cleaners, built ~1925, steam heat			1 1-story retail store, constructed in 1924 , heated by space heaters.		unlikely	Moderate	solv
150.7	150.7-2	fire station-Department of Ecology Site		1938, 1940, 1943, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989	1949, 1969	1 2-story fire station (staffed), constructed in 1922 , heated by space heaters.	Yes	unlikely	Low	pet
150.7	150.7-3	oil burners, gas pumps	1-story store and warehouse, built 1913, 2 oil burners for heat	1943 / 1943		1 6-story office building, constructed in 2002 , heated by complete hvac.		unlikely	Low	gas, pet
150.7	150.7-4	auto repair, battery company	1-story garage, built 1915, stove heat			Commercial, vacant		unlikely	Low	pet
150.7	150.7-5	dry cleaners, oil burners, printers	1-story retail building, built 1926, stove heat	1938, 1940 / 1940 / 1970 / 1975		Commercial, vacant		unlikely	Moderate	solv
150.8	150.8-1	gas station	1-story office and car lot, stove heat, built 1945	1938, 1940		Commercial use, vacant land		unlikely	Low	gas

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150.8	150.8-2	auto sales and service-Department of Ecology Site				Commercial use, vacant land		unlikely	Low	pet
150.9	150.9-1	auto body repair/auto repair	1-story retail and service building, built 1936, oil burner heat; B.F. Goodrich sign denotes battery and brake service	1980 / 1989		1 1-story garage, service repair, constructed in 1936 , heated by space heaters.		unlikely	Low	pet
160.4	160.4-1	1.printers/2.printer /3.photo	2-story store and loft, oil burner heat, built 1930	1.1938, 1940, 1943-44, 1951, 1960, 1970, 1975, 1980, 1985, 1989-90/2.1938,1940/3.1980, 1985		1 2-story mixed use retail, constructed in 1930 , heated by space heaters.		unlikely	Moderate	solv
160.4	160.4-2	laundry	1-story retail building with stove heat, built 1920	1.1940, 1943-44, 1960/2. 1960, 1965, 1970	1905, 1949	1 1-story restaurant, table service, constructed in 1920 , heated by warmed and cooled air.		unlikely	Moderate	solv
160.4	160.4-3	printers	3-story hotel and retail building, oil burner heat, built 1909	1975, 1980		1 3-story hotel , constructed in 1909 , heated by hot water.		unlikely	Low	solv
160.4	160.4-4	printers	3-story hotel & retail building, oil burner heat, built 1910	1951		1 3-story mixed retail w/res. units, constructed in 1910 , heated by hot water.		unlikely	Low	solv
160.4	160.4-5	sheet metal works	2-story retail and rooms, stove heat, built 1910	1938, 1940		not reviewed, not adjacent		unlikely	Low	metals
160.4	160.4-6	1. printing/2. typesetting/2. photo	2-story retail and rooms, stove heat, built 1907	1. 1960, 1965/1970		1 2-story retail store, constructed in 1907 , heated by space heaters.		unlikely	Low	solv
160.4	160.4-7	laundry		1951, 1956, 1960, 1965		1 2-story open office, constructed in 1927 , heated by hot water.		unlikely	Low	solv

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160.5	160.5-1	1. auto repair/2. oil burner/3. auto repair	1-story warehouse/retail, built in 1924	1. 1951, 1956, 1960, 1965, 1970/2. 1938/ 3. 1938, 1940		1 1-story restaurant, table service, constructed in 1924 , heated by space heaters.		unlikely	Low	pet
160.5	160.5-2	auto repair/(sheet metal works)/<photo>	1-story garage, stove heat, built 1919; "sheet metal" sign noted in picture	1940 / (1943-33--44, 1956, 1960, 1965)/<1980>		1 1-story restaurant, table service, constructed in 1919 , heated by space heaters.		unlikely	Low	pet
160.5	160.5-3	1. machine shop/ 2.printers/ 3. auto repair	1-story café and garage, built 1924, stove heat	1. 1943-44 / 2. 1960	3. 1949	1 1-story restaurant, table service, constructed in 1924 , heated by space heaters.		unlikely	Low	solv, metals
160.5	160.5-4	gas station	1. 1-story gas station, stove heat, built in ~1911, demolished 1955, 3 pumps, 1-hydraulic lift, 1-550 gallon tank, new tanks noted in 1953	1. 1938, 1940, 1943, 1951	2. 1949	not reviewed, not adjacent		unlikely	Low	gas
160.5	160.5-5	auto repair	1-story garage, stove heat, built 1920	1940, 1943		1 27-story condo, constructed in 1979, heated by electric heat.		unlikely	Low	pet
160.5	160.5-6	auto repair			1949	1 1-story retail store, constructed in 1914 , heated by space heaters.		unlikely	Low	pet
160.5	160.5-7	sheet metal works		1938, 1940		1 2-story mixed use retail, constructed in 1923 , heated by hot water.		unlikely	Low	metals
160.5	160.5-8	1. photo/2. painter/(typesetter)		1. 1975/2. 1938/ (1970)		1 3-story mixed retail w/res. units, constructed in 1911 , heated by hot water.		unlikely	Low	solv
160.5	160.5-9	printer/typsetter		1985/ 1960		1 8-story condo/apartments plus commer		unlikely	Low	pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
160.5	160.5-10	typesetter		1970		1 27-story condo, constructed in 1979, he		unlikely	Low	solv
160.6	160.6-1	apartments-Department of Ecology Site				1 9-story apartment, constructed in 1925 , heated by electric wall.	Yes	unlikely	Low	pet
160.6	160.6-2	lithographer, printing	2-story office building, built 1929, oil heat	1956 / 1960	1949	1 1-story office building, constructed in 1929 , heated by space heaters.		unlikely	Low	solv
160.6	160.6-3	1. gas station/2. auto repair	1. 1-story gas station, stove heat, built 1926, torn down 1957, 1-250 gallon tank	2. 1938, 1940		1 13-story apartment, constructed in 1978 , heated by warmed and cooled air.		unlikely	Low	gas
160.6	160.6-4	1. gas station equipment, auto repair and painting/2. photo/(photo engravers)	1. 1-story garage, stove heat, built 1924, auto repair, auto painting	1. 1951, 1960/2. 1938, 1940/(1965, 1970, 1975)		1 1-story restaurant, table service, constructed in 1924 , heated by space heaters.		unlikely	Low	gas/solv
160.6	160.6-5	1. clothes pressers/(chem mfrs)/<printer>/2. cleaners/3. laundry	1-story retail building, built 1922, stove heat, laundry, sign shop; 2.5-story apartments in rear, oil burner heat, built 1900, torn down 1969	1. 1940/(1956)/<1985>/ 2. 1956, 1960, 1965/3. 1940		1 6-story apartment, constructed in 2001 , heated by electric.		unlikely	Moderate	solv
160.6	160.6-6	engraving		1951		parking lot		unlikely	Low	solv
160.6	160.6-7	auto repair		1938		1 6-story apartment, constructed in 2001 , heated by electric.		unlikely	Low	pet
160.7	160.7-1	elevator co., factory	1-story shop/factory, built 1923, steam heat		1949, 1969	1 1-story office building, constructed in 1923 , heated by warmed and cooled air.		unlikely	Low	pet
160.7	160.7-2	auto repair/oil company/painting company	1-story office/retail building	1938 / 1951 / 1985		1 1-story retail store, constructed in 1919 , heated by space heaters.		unlikely	Low	pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
160.7	160.7-3	sheet metal works	1-story office building, built 1946, oil burner heat	1956, 1960, 1965		1 1-story retail store, constructed in 1946 , heated by forced air unit.		unlikely	Low	metals
160.7	160.7-4	auto repair		1938, 1940, 1943-44	1949	1 1-story retail store, constructed in 1924 , heated by electric.		unlikely	Low	metals
160.7	160.7-5	gas station equipment		1940, 1943-44		1 1-story open office, constructed in 1924 , heated by forced air unit.		unlikely	Low	pet
160.8	160.8-1	construction company, used car lot	1-story office for used car lot, built 1947, stove heat			1 5-story motel full service, constructed in 1978 , heated by electric wall.	Yes	unlikely	Low	pet
160.8	160.8-2	mfr. of printing plates, engraving	2-story print shop, built 1948, electric heat	1975	1949, 1969	1 2-story open office, constructed in 1948 , heated by hot water.		unlikely	Moderate	metals
170.3	170.3-1	gas station/auto repair	1-story gas station built in 1930 with stove heat and 1 hydraulic hoist; 5-3000 gallon tanks, 1 grease pit, 3 auto pumps; 1 story auto repair shop with stove heat and 1-2-stem hydraulic lift; built in 1930	1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970 / 1975, 1980	1949, 1969	parking lot		unlikely	Low	gas
170.3	170.3-2	cleaners and dye works	1-story retail building with stove heat, built in ~1914	1951, 1960, 1965		33-story mixed use, built 1981, electric heat		unlikely	Moderate	solv
170.3	170.3-3	oil burner/manufacturer chemists	3 retail spaces in 1 story buildling, constructed in 1926, oil burner & steam heat	1938, 1940, 1943-44, 1951, 1960, 1965 / 1943-44		1 1-story retail store, constructed in 1926 , heated by hot water.		unlikely	Low	pet
170.3	170.3-4	auto repair	2-story repair garage built in 1902 (no heat)	1938		1 2-story mixed use retail, constructed in 1902 , heated by space heaters.	Yes	unlikely	Low	pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
170.3	170.3-5	auto repair	2-story auto repair warehouse built in 1923	1938		1 2-story mixed use retail, constructed in 1923 , heated by space heaters.		unlikely	Low	pet
170.3	170.3-6	sheet metal works	3-story hotel and retail building, built in 1903, steam heat	1938, 1940, 1943-44		3-story residential building, built 1901, hot water heat		unlikely	Low	metals
170.3	170.3-7	printers/metal manufacturing		1965/1965, 1970		1 33-story , condominium, built in 1981, electric heat.		unlikely	Low	solv
170.4	170.4-1	paint store/(laundry)/<laundry>	1-story retail building, built in 1925, stove heat	1938, 1940, 1960/(1970, 1975)/<1980>		1 1-story retail store, constructed in 1925 , heated by space heaters.		unlikely	Moderate	solv
170.4	170.4-2	cleaners	2-story retail building, stove heat, built in 1927	1938, 1940, 1943, 1951/1956		1 2-story mixed use retail, constructed in 1927 , heated by space heaters.		unlikely	Moderate	solv
170.4	170.4-3	1. printers/2. photo devl/(photo)/<photo fin>	3-story apartments and retail building, built in 1910, oil burner heat	2. 1940/(1980)/<1985>		1 3-story multiple residence (low rise), constructed in 1910 , heated by electric wall.		unlikely	Low	solv
170.4	170.4-4	gas station	parking lot with 1-story gas station, stove heat, built in 1926, 1 hydraulic hoist, 2-550 gallon tanks	1938, 1940	1949, 1969	parking lot		unlikely	Low	gas
170.4	170.4-5	auto repair/gas station/lubrication dept	1-story service station, built in 1917, oil burner heat, 2-5000 gallon tanks	1938, 1940, 1943 / 1960, 1965, 1970, 1975 / 1965	1949, 1969	1 12-story industrial light manufacturing, constructed in 1985 , heated by hot & chilled water.		unlikely	Low	gas
170.4	170.4-6	sheet metal works, laundry	2-story garage and store, stove heat, built 1920	1938 / 1938 / 1969		1 2-story mixed use retail, constructed in 1920 , heated by forced air unit.		unlikely	Low	pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
170.4	170.4-7	laundry		1940, 1943-44		1 1-story retail store, constructed in 1923 , heated by hot water.		unlikely	Low	solv
170.5	170.5-1	paint store	1-story, oil burner, 1-550 gallon tank-Date unknown	1951, 1956, 1960, 1965, 1970, 1975	1969	parking lot		unlikely	Moderate	solv
170.5	170.5-2	auto repair	2-story office, built 1919, heating: stove, garage converted to office space 1950 2-story office/storage bldg, built 1923, heating: stove date unknown	1938, 1940/(1943-44)		1 2-story office building, constructed in 1919 , heated by hot water.		unlikely	Low	pet
170.5	170.5-3	1. auto repair/2. printer	1. 1-story, auto repair garage, built 1926, remodeled 1945, heating:stove.	2.1989-90		1 1-story retail store, constructed in 1926 , heated by forced air unit.		unlikely	Low	pet
170.5	170.5-4	1.gas station/2.gas station	1.1-story gas station, built 1926, 3-550 gallon gas tanks, grease pit under entire building, used as antique store date unknown, heating: stove./2.	1.1938, 1940 / (1951)/2.1938, 1940, 1943	1.1969	1 1-story retail store, constructed in 1926 , heated by electric.		unlikely	Low	gas
170.5	170.5-5	printers	1-story, built 1918, blue print shop in 1949, remodeled in 1950, antique/art gallery 1977, heating: plant with electric booster		1969	commercial apartment		unlikely	Moderate	solv
170.5	170.5-6	auto repair	1-story, built 1926, remodeled 1947, converted to office space year unknown, heating: stove.	/(1938)		commercial apartment		unlikely	Low	pet

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170.5	170.5-7	1.metal works/2.cleaners/3. printers/4.cleaners/ (cleaners)	1-story, 4 shops, built 1923, 4th shop (Rudy's) cleaners-1937, 3rd shop printers as of 80's, rear parking garage and storage, heating:stove,	1.1940, 1943-44/3.1989/4.1940, 1943-44/(1951, 1956, 1960, 1965, 1970, 1975)		1 6-story apartment, constructed in 2007 , heated by electric.		unlikely	Moderate	solv, metals
170.5	170.5-8	auto repair	1-story, several shops, built 1924-8, auto repair, heating:stove, remodeled and auto repair removed as of 1980/(offices)	1938, 1940, 1943, 1951, 1956, 1960, 1970, 1975	1949, 1969	1 2-story office building, constructed in 1928 , heated by warmed and cooled air.		unlikely	Low	pet
170.6	170.6-1	1.gas station/auto repair/2.gas station/(gas station)/<auto repair>/3.cleaner/4. auto repair	1.1-story, built 1932, garage/gas station, new tank added '68(?), heating: stove 26-story condominium building, built 1973, heating:electric	1.1938, 1940, 1943-44,1951, 1956, 1960, 1965, 1970/2.1938/(1940, 1943)/<1956, 1960, 1965, 1970>/3.1989/4.	1.1949, 1969/4.1969	1-26 story building, built in 1973, electric heat		unlikely	Low	pet, solv
170.6	170.6-2	printers		1980		1-2 story building,condomimian, built in 1946, complete HVAC		unlikely	Low	solv
170.6	170.6-3	auto repair-Department of Ecology Site	2-story, building built 1914, garage and tire repair 1937, heating:stove, hydraulic freight elevator.	1943		1 2-story mixed use office, constructed in 1914 , heated by warmed and cooled air.	Yes	unlikely	Low	pet
170.6	170.6-4	gas station/(auto repair)	1-story auto repair built 1940, 1-550 gal , 1-675 gal, 1-1,000 gal , 1-3,000 gal USTs/ [1960]	1938, 1940, 1943-44, 1951/(1956)	1949	1 24-story office building, constructed in 1979 , heated by heat pump.		unlikely	Low	pet, gas
170.6	170.6-5	cleaners/(auto repair)	1- story building (Kohl's auto repair-1937) remodelled to bowling alley in 1946	1938, 1943-44		1 24-story office building, constructed in 1979 , heated by heat pump.		unlikely	Low	pet, solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
170.6	170.6-6	auto repair	1-story building constructed in 1918 - auto repair 1937, 1-550 gal gasoline UST			1 24-story office building, constructed in 1979 , heated by heat pump.		unlikely	Low	pet, gas
170.6	170.6-7	painters	see above	1951		1 24-story office building, constructed in 1979 , heated by heat pump.		unlikely	Low	solv
170.6	170.6-8	auto repair/(gas station and auto repair)	see above	1938	(1949)	1 24-story office building, constructed in 1979 , heated by heat pump.		unlikely	Low	pet, gas
170.6	170.6-9	gas station/ (auto repair)	(1-story garage, built in 1918, assessed in 1937, 2-250 gal UST)	1.1940/(1943-44)2.1938, 1940, 1951,/3. 1943	1. (1949)	1 24-story office building, constructed in 1979 , heated by heat pump.		unlikely	Low	pet, gas
170.7	170.7-1	gas station	1-story gas station, built 1941, 3-1000 gal UST/(no info)/[became theater 1962]	1940, 1943-44, 1951/(1956)	1949	1 1-story theater, cinema, constructed in 1962 , heated by warmed and cooled air.		unlikely	Low	gas
170.7	170.7-2	1. auto repair/(printers)/2. [printers]/ <auto repair>	1-story auto repair built 1929, assessed 1937, heating:stove/(Press in 1965,2 presses, assessed 1956,'57,'66,'71)	1. 1938, 1940, 1943-44, 1951/(1956)/2. [1956,1960]/<1980, 1985, 1989-90>	1. 1949	1 1-story garage, service repair, constructed in 1929 , heated by space heaters.		unlikely	Low	pet, solv
170.7	170.7-3	gas station	1-story gas/service station, built 1950, 2-2000 gal UST, demolished 1963/(parking lot)	1938, 1940, 1943, 1951, 1956, 1960	1949	Commercial, parking lot	Yes	unlikely	Low	pet, gas
170.7	170.7-4	auto radio/(auto repair)	1-story, built 1924, auto radio service in 1937/(unknown)/[Office 1970]/<extensivly remodeled 1972>	(1940, 1943, 1960)		1 2-story office building, constructed in 1924 , heated by heat pump.		unlikely	Low	pet
170.7	170.7-5	auto repair	1-story auto repair as of 1937, built 1924, heating:stove,	1938, 1940, 1943, 1951, 1956, 1960, 1970	1949, 1969	1 1-story open office, constructed in 1924 , heated by hot water.		unlikely	Low	pet

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
170.7	170.7-6	auto repair and gas station	1-story, built 1927,Assessed in 1937, 3-1000 gal UST and three pumps, heating:stove/(remodeled 1960 into offices)/[1982,1989 day care center]/<5-story apartment building with underground parking constructed in 1991	1938, 1940, 1943, 1956		1 6-story apartment, constructed in 1991 , heated by electric wall.		unlikely	Low	gas
180.3	180.3-1	gas station	1-story service station, built in the 1950s, stove heat, 3-6000 gallon tanks	1943-44	1969	not reviewed, not adjacent		unlikely	Low	gas
180.3	180.3-2	printers	1-story retail building with stove heat built in 1904	1970		not reviewed, not adjacent		unlikely	Low	solv
180.3	180.3-3	1. cleaners/2.(machinists)/[platin g compnay]/<Department of Ecology Site>	2-story apartments and shop, built in 1911?, no heat	1. 1938, 1940 /2. (1938, 1940) / [1956, 1960, 1965]		not reviewed, not adjacent	Yes	unlikely	Moderate	solv, metals, pet
180.3	180.3-4	laundry		1951		1 13-story office building, constructed in 1988 , heated by complete hvac.		unlikely	Low	solv
180.4	180.4-1	gas station and auto repair/gas station	2-story parking garage with gas & oil, built 1918, steam heat	1943-44 / 1940, 1943-44, 1951, 1960	1949 / 1969	1 3-story office building, constructed in 1918 , heated by warmed and cooled air.		unlikely	Low	gas
180.4	180.4-2	printers	6-story hotel and retail building, built in 1909, hot water heat	1943, 1951, 1956, 1960, 1965, 1970, 1980, 1989/1980, 1989-90		Commercial, parking lot		unlikely	Moderate	solv

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180.4	180.4-3	1. paint manufacturing/2.laundry/3. Department of Ecology Site	1-story retail building, built 1914, torn down 1968; 1 story retail building built in 1920, torn down 1953; 2-2,000 gallon tanks noted; gas station on Virginia St.	1.1938, 1940, 1943-44, 1951, 1960/ 2.1938, 1940, 1943-44/3.1994		One Pacific Towers Condomimium, 27 stories, built 1994, electric heat	Yes	unlikely	Low	gas
180.4	180.4-4	gas station	4-story hotel, built 1910, torn down 1972, oil burner and stove heat		1949	Commercial, parking lot		unlikely	Low	gas
180.5	180.5-1	auto repair	1-story auto repair garage, built 1924/became parking garage in ??	1938, 1940, 1943-44/(1951, 1956)/<1956>		1 1-story parking structure, constructed in 1924, no heat.		unlikely	Low	pet
180.5	180.5-2	1.electric motors & painters/2.paint manufacturer/(printers)/3.printers	1.1-story built 1925, heating:stove,	1.1940/2.1943/(1960, 1965, 1975, 1985)/3.1980, 1985, 1989-90		1 6-story apartment, constructed in 1999 , heated by electric wall.	Yes	unlikely	Moderate	solv
180.5	180.5-3	printers	Lot 1 and 4, 1-story built 1927, new building 1997	1938		1 6-story apartment, constructed in 1999 , heated by electric wall.	Yes	unlikely	Low	solv
180.5	180.5-4	printers/(printers)	see above	1960/(1938, 1940, 1943-44, 1951, 1956)	1969	1 6-story apartment, constructed in 1999 , heated by electric wall.	Yes	unlikely	Moderate	solv
180.5	180.5-5	auto repair/ (press)	2-story, built 1919, assessed 1937 auto repair/(remodeled 1946 to printers)			1 2-story mixed use retail, constructed in 1919 , heated by forced air unit.		unlikely	Low	pet
180.5	180.5-6	printers	1-story, built 1913, heating:2 boiler, remodeled 1922 and 1961/(as of 1974 office)	1940		1 1-story office building, constructed in 1913 , heated by hot water.		unlikely	Low	solv
180.5	180.5-7	engraving	1-story, built 1922, heating:coal stoker	1938, 1940		1 1-story open office, constructed in 1923 , heated by hot water.		unlikely	Low	solv

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180.5	180.5-8	auto repair	2-story, built 1919, mix use with auto repair and garage, 1-550 gal and 1-1000 gal UST,2-hydraulic hoists, heating:steam Western Oil burner/(Garage converted to mix use as of 1983)	1965, 1970, 1975		1 2-story office building, constructed in 1919 , heated by warmed and cooled air.		unlikely	Low	pet, gas
180.6	180.6-1	sign painter	1-story, 2-stores, built 1925, heating:steam-oil burner, purchased by drug store in 1945	1938, 1940		parking lot		unlikely	Low	solv
180.6	180.6-2	printers		1989		commercial, vacant		unlikely	Low	solv
180.6	180.6-3	printers		1938, 1940		7-story condomimium, built in 2003, complete HVAC		unlikely	Low	solv
180.6	180.6-4	printers and film processing/(cleaners)		1965/(1938, 1940, 1943-44, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989-90)		1 4-story open office, constructed in 1925 , heated by warmed and cooled air.		unlikely	Moderate	solv
180.6	180.6-5	paint store/[press]/(medicine manufacturer)		1943-44/[1938, 1940, 1943-44]/(1940)		1 4-story open office, constructed in 1925 , heated by warmed and cooled air.		unlikely	Low	solv
180.6	180.6-6	auto repair/ (auto repair)	1-story auto repair, built 1937, with 1-3000 gal tank and 2-1000 gal tank/(Minit lube as of 1970)/[Jiffy Lube as of 2001]	(1985, 1989-90)	1949, 1969	1 1-story garage, service repair, constructed in 1937 , heated by space heaters.	Yes	unlikely	Low	pet
180.6	180.6-7	film processing		1960, 1965, 1970		1 2-story convenience market, constructed in 1926 , heated by heat pump.		unlikely	Low	solv

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190.2	190.2-1	gas station	1-story gas station built in 1919 with 1-550 gallon tank	1938, 1940		not reviewed, not adjacent		unlikely	Low	gas
190.2	190.2-2	auto repair			1969	not reviewed, not adjacent		unlikely	Low	pet
190.2	190.2-3	printers		1956, 1960, 1951		not reviewed, not adjacent		unlikely	Low	solv
190.2	190.2-4	gas station, plating company	1-story gas station built in 1925, stove heat, 3-750-gallon tanks; located under current Alaskan Way Viaduct (the station was torn down to build the freeway); metal plating business formerly in adjacent retail building torn down for Viaduct.			not reviewed, not adjacent		unlikely	Moderate	metals/gas
190.3	190.3-1	fueling	parking lot with 1-550 gallon gas tank, built 1928		1949	1 8-story commercial building, built in 1978, electric heat.		unlikely	Low	gas
190.3	190.3-2	laundry/plating company	3-story hotel/retail, built in 1901, oil burner and steam heat, sign indicating tailor/dye shop	1960	1905	2 6-story apartment, constructed in 1901 , heated by electric wall.		unlikely	Moderate	solv
190.3	190.3-3	auto repair/gas station	1-story warehouse constructed in 1925, stove heat, 1-250 gallon gas tank	1938, 1940, 1943		1 1-story retail store, constructed in 1925 , heated by space heaters.		unlikely	Low	gas
190.3	190.3-4	printers	5-story hotel built in 1913-14 with oil burner heat in addition to steam	1956, 1960, 1965, 1970, 1975		1 1-story retail store, constructed in 1925 , heated by space heaters.		unlikely	Low	gas, solv
190.4	190.4-1	printers		1943-44, 1951		parking lot		unlikely	Low	solv
190.4	190.4-2	printers		1938		Second Avenue Parking garage, 3-story, built in 1926, space heaters.		unlikely	Low	solv

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190.4	190.4-3	Parking Facility	Parking and Service garage	1938, 1940, 1943, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989/1980	1969	1 3-story parking structure, constructed in 1926 , heated by space heaters.	Yes	unlikely	Low	gas
190.4	190.4-4	dye works/(clothes presser)	1-story retail building built 1908, torn down 1958	1938, 1940/(1943-44)		parking lot		unlikely	Moderate	solv
190.4	190.4-5	parking garage with fueling	1-story parking garage, signs for fuel service; built in 1909, torn down 1949			parking lot		unlikely	Low	gas
190.4	190.4-6	laundry/(gas station)	2-5,000 gallon storage tanks, built 1959, torn down 1970	1938, 1940, 1943-44, 1951, 1956		parking lot		unlikely	Low	gas
190.4	190.4-7	cleaners		1938, 1940, 1943-44, 1951, 1956		1 8-story apartment, constructed in 1909 , heated by steam without boiler.	Yes	unlikely	Moderate	solv
190.4	190.4-8	fueling			1969	parking lot		unlikely	Low	gas
190.4	190.4-9	cordage mfrs., textile mfrs.	11-story retail/display building, built 1923, steam heat	1940, 1943-44, 1951 / 1943-44 / 1951 / 1951 / 1960 / 1960, 1965, 1970 / 1965, 1970, 1975 / 1965/1970		1 11-story office building, constructed in 1923 , heated by steam without boiler.		unlikely	Moderate	solv
190.4	190.4-10	photocopy		1980. 1989-90		1 4-story mixed use office, constructed in 1911 , heated by hot & chilled water.		unlikely	Low	solv
190.4	190.4-11	laundry		1943		parking lot		unlikely	Low	solv
190.4	190.4-12	printer		1940, 1943-44		1 4-story open office, constructed in 1916 , heated by steam without boiler.		unlikely	Low	solv

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190.5	190.5-1	1.cleaners/2.cleaners	1.6-story, 11-stores, built 1907, heating:central steam	1.1951, 1956, 1960, 1965/2.1938, 1940, 1943-44		1 7-story hotel , constructed in 1908 , heated by steam without boiler.		unlikely	Moderate	solv
190.5	190.5-2	1.printers/2.printers	1.2-story, 8-stores, built 1916, Heating: central steam	1.1985/2.1938, 1940		1 2-story mixed use office, constructed in 1916 , heated by hot water.		unlikely	Low	solv
190.5	190.5-3	auto repair		1940		1 6-story mini warehouse, hi-rise, constructed in 1928, no heat.		unlikely	Low	pet
190.5	190.5-4	1.printers/2.cleaners	2.2-story, 3-stores, built 1914, heating:central steam	1.1943-44/2.1951, 1960, 1970, 1975, 1980, 1985, 1989		1 3-story office building, constructed in 1914 , heated by steam without boiler.	Yes	unlikely	Moderate	solv
200.1	200.1-1	cleaners/laundry/photo	3-story hotel and retail building constructed in 1909; stove heat	1951, 1956, 1960, 1965, 1975/1938,1940,1943-44/1989-90		1 7-story hotel , constructed in 1985 , heated by heat pump.		unlikely	Moderate	solv
200.2	200.2-1	cleaners	Lot 8 permit was obtained for a new oil burner and furnace.	1975		1 12-story office building, constructed in 1986 , heated by complete hvac.		unlikely	Moderate	solv
200.2	200.2-2	printers, cleaners	6-story hotel and retail, built in 1909, steam heat	1938 / 1938, 1940		1 6-story apartment, constructed in 1909 , heated by hot water.		unlikely	Moderate	solv
200.2	200.2-3	photo/printers		1985, 1989-90/ 1989-90		1 10-story office building, constructed in 1908 , heated by heat pump.		unlikely	Low	solv
200.3	200.3-1	1.hat shop/2.hat shop	1.(4-story, 5-stores, built 1907, 4 store fronts went to 2 store fronts by 1938, demolished 1960)/[parking]/2.	1.1938/2.1951, 1956, 1960		not reviewed, not adjacent		unlikely	Low	solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
200.3	200.3-2	paint manufacturer	(6-story, 5-stores, hotel type building, built 1906, heating:own plant, demolished 1969)/[parking lot built 1969]	1938		not reviewed, not adjacent		unlikely	Low	solv
200.3	200.3-3	auto repair	(2-story, 7 stores, built 1919, heating:central steam, demolished 1959)/Lots 2,3,6,7,10,11 demolished in 1959, parking and offices constructed		1969	1 9-story parking structure, constructed in 1959 , heated by warmed and cooled air.		unlikely	Low	pet
200.3	200.3-4	film processing	1-story, 3-stores, built 1920, heating:central steam, demolished 1959	1938, 1940		1 9-story parking structure, constructed in 1959 , heated by warmed and cooled air.		unlikely	Low	solv
200.3	200.3-5	cleaners	3-stories, 9-stores, bulit 1910, heating:steam own plant, demolished 1959	1938, 1940, 1943		1 9-story parking structure, constructed in 1959 , heated by warmed and cooled air.		unlikely	Low	solv
210.2	210.2-1	printers	7-story retail, loft, café built in 1915 with stove heat and suspended gas and 1 steam pipe	1965, 1970, 1975		not reviewed, not adjacent		unlikely	Low	solv
210.3	210.3-1	sheet metal works	1-story market, built 1908, (steam heat)	1938, 1940		1 4-story arcade, constructed in 1908 , heated by steam.		unlikely	Low	metals
210.4	210.4-1	clothes presser		1940, 1943-44		5-story condomimium, built in 1983, electric heat.		unlikely	Low	solv
210.5	210.5-1	hatter	printing, built 1922, torn down in 1962	1938		condomimium complex, built in 2008		unlikely	Low	solv
210.5	210.5-2	hat shop/auto repair	2-story office and retail building, steam heat	1951, 1956, 1960, 1965, 1970/1940		1 2-story mixed use retail, constructed in 1922 , heated by heat pump.		unlikely	Moderate	solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
210.5	210.5-3	printers/Department of Ecology Site	printing, built 1922, torn down in 1962			1 4-story office building, constructed in 1919 , heated by warmed and cooled air.	Yes	unlikely	Low	pet
210.5	210.5-4	hatter		1940		1 2-story retail store, constructed in 1923 , heated by steam without boiler.		unlikely	Low	solv
210.5	210.5-5	laundry		1960, 1965		parking lot		unlikely	Low	solv
210.6	210.6-1	1.gas station/2.hat shop	1.(6-story, 2-stores, store and offcies, built 1905, heating:steam PSPL, demolished 1963)/8-story, 2-stores, parking garage and stores, built 1963/2./3.	1.1965/ 1970, 1975, 1980, 1985/2.1940, 1943-44	1.1969	1 7-story parking structure, constructed in 1963, no heat.		unlikely	Low	pet, solv
210.6	210.6-2	cleaners	12-story, 8-stores, offices and stores, built 1929, heating:central steam	1975		not reviewed, not adjacent		unlikely	Low	solv
210.6	210.6-3	hat shop/cleaners (paint store)		1938/1940, 1943-44 (1943-44)		1 4-story office building, constructed in 1906 , heated by complete hvac.		unlikely	Low	solv
220.2	220.2-1	iron works/auto repair	1-story machine shop built in 1918: auto repair, electric blacksmithing, acetylene welding, machine work			#N/A		unlikely	Low	solv, metals, pet
220.2	220.2-2	oil company	1-story gas station with 1-300 gallon tank and 2-550 gallon tanks, stove heat inside, built 1932, torn down 1965			not reviewed, not adjacent		unlikely	Low	gas
220.2	220.2-3	truck service			1969	1 2-story storage warehouse, constructed in 1951, heated by space heaters.		unlikely	Low	pet

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
220.3	220.3-1	car wash		1938		6-story condominium, mixed use (residential and commercial) built 2005, forced air heat		unlikely	Low	pet
220.3	220.3-2	cleaners	4-story hotel built in 1910 with an oil burner for heat	1951		residential condominium complex, built 1985, electric heat		unlikely	Moderate	solv
220.3	220.3-3	photo/(clothes pressers)/[auto repair]/<hat shop>	1-story retail built in 1925 with heat described as "stove-suspended gas"	1943-44/(1956, 1960, 1965, 1970, 1975, 1980)/[1975]/<1975, 1980>		13 story-residential condominium complex, built 1985, electric heat		unlikely	Moderate	solv
220.3	220.3-4	printers			1905	1 2-story retail store, constructed in 1900 , heated by hot water.		unlikely	Low	solv
220.4	220.4-1	paint store	former building, oil burner/steam heat	1938, 1940, 1943-44, 1951		1 2-story retail store, constructed in 1916 , heated by steam.		unlikely	Low	solv
220.4	220.4-2	printers	5-story retail & loft building, built 1910	1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985	1969	1 5-story mixed use office, constructed in 1910 , heated by warmed and cooled air.		unlikely	Moderate	solv
220.4	220.4-3	cleaners		1989-90		1 5-story mixed use office, constructed in 1910 , heated by warmed and cooled air.		unlikely	Moderate	solv
220.5	220.5-1	1.printers/2.dye works/3.photo	1.4-story, 6-stores, built 1901, heating: central steam, demolished 1968/2./3.	2.1938, 1940/3.1938, 1940/(1951, 1956, 1960)	1.1905	not reviewed, not adjacent	Yes	unlikely	Moderate	solv
220.5	220.5-2	1.photo/(film processing)/2.printers		1.1960/(1980)/2.1938		not reviewed, not adjacent		unlikely	Low	solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
220.5	220.5-3	photo	2-story, 5-stores, with extensive basements, stores & theater, heating:central steam	1938/ (1940)/<1951>		1 2-story restaurant, table service, constructed in 1926 , heated by steam without boiler.		unlikely	Low	solv
220.5	220.5-4	1.film processing/2.film processing		1.1980/2.1938, 1940, 1943-44		1 3-story mixed use office, constructed in 1924 , heated by complete hvac.		unlikely	Low	solv
230.2	230.2-1	power company (steam plant)	1-story building with basement built in 1895 (fronts Western) also 1-story boiler house built in 1955 with "oil tank retention wall" noted in drawing (AST)	1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989-90		1 2-story industrial light manufacturing, constructed in 1900, heated by steam without boiler.	Yes	unlikely	Moderate	pet
230.2	230.2-2	power company (steam plant)	2-story coal pulverizing plant built in 1918			1 2-story industrial light manufacturing, constructed in 1900, heated by steam without boiler.		unlikely	Moderate	pet
230.2	230.2-3	truck service	1-story gas & service station built in 1950 with 3-3,000 gallon tanks, steam heat	1956, 1960, 1956, 1970	1969	not reviewed, not adjacent		unlikely	Low	gas
230.2	230.2-4	blacksmith & carriage painting			1905	1 2-story industrial light manufacturing, constructed in 1900, heated by steam without boiler.		unlikely	Moderate	solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
230.3	230.3-1	power company	2-story substation on lot 1 with steam heat, built 1912 (demolished 1971); 1-story fuel house, no heat, built 1922? (demolished 1971); 1-story shed with chimney (for heat?) (demolished 1965); 2-story open roof bunker built ~1922; tank in 1965; 1-story coal bunkers built 1940	1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989-90	1949, 1969	City Light Sub Station	Yes	unlikely	Moderate	pcbs/pet
230.3	230.3-2	auto repair	1-story parking garage & retail building, built 1928	1956, 1960		Four Seasons 20 story condomimian complex, built in 2006.	Yes	unlikely	Low	pet
230.3	230.3-3	cleaners		1965/1938, 1940, 1943-44		Four Seasons 20 story condomimian complex, built in 2006.		unlikely	Moderate	solv
230.3	230.3-4	firing range		1940, 1943-44, 1951, 1956, 1960		1 3-story retail store, constructed in 1900 , heated by forced air unit.		unlikely	Low	metals
230.3	230.3-5	ink manufacturer	4-story retail & loft built 1919	1951, 1956		1 16-story apartment, constructed in 2000 , heated by electric.		unlikely	Low	solv
230.3	230.3-6	printing plant		1960, 1965		1 16-story apartment, constructed in 2000 , heated by electric.		unlikely	Low	solv
230.3	230.3-7	printers		1938, 1940, 1943-44, 1951/ (1956, 1960, 1965)		1 16-story apartment, constructed in 2000 , heated by electric.		unlikely	Low	solv
230.3	230.3-8	printers	1-story retail, built 1909	1938, 1940, 1943-44, 1956, 1960, 1965		1 28-story apartment, constructed in 2000 , heated by electric.		unlikely	Moderate	solv
230.3	230.3-9	paints			1969	1 28-story apartment, constructed in 2000 , heated by electric.		unlikely	Low	metals/solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
230.3	230.3-10	1.photo/2.cleaners/ 3. shooting gallery		1. 1943-44/2. 1989-90/3. 1943-44		1 28-story apartment, constructed in 2000 , heated by electric.		unlikely	Low	solv
230.3	230.3-11	leather works	3-story retail/hotel, built 1890, renovated to 6-story garage with basement tunnel to department store in 1967	1938, 1940, 1943-44, 1951, 1956, 1960, 1965		1 3-story retail store, constructed in 1900 , heated by forced air unit.		unlikely	Moderate	solv
230.3	230.3-12	sheet metal works			1905	City Light Sub Station		unlikely	Moderate	solv, metals, gas
230.4	230.4-1	printers	6-story office & retail building, steam heat	1940, 1943-44, 1951, 1956		1 6-story museum, constructed in 1991 , heated by complete hvac.		unlikely	Low	solv
230.4	230.4-2	cleaners/photo		1938, 1940/1970,1975		1 6-story museum, constructed in 1991 , heated by complete hvac.		unlikely	Low	solv
230.4	230.4-3	paint store/(sign painter)/[sign painter]		1938, 1943-44/(1938)/[1940]		1 6-story museum, constructed in 1991 , heated by complete hvac.		unlikely	Low	solv
230.4	230.4-4	film processing		1989-90		42-story building, constructed in 2006, complete HVAC.		unlikely	Low	solv
230.5	230.5-1	leather works/(photo)	4-story, 4-stores, built 1903, heating:steam central	1938/(1956, 1960, 1965)		1 6-story theater, live stage, constructed in 1998 , heated by complete hvac.		unlikely	Low	solv
230.5	230.5-2	photo	3-story, 2-stores, built 1910, heating:steam central	1975		1 6-story theater, live stage, constructed in 1998 , heated by complete hvac.		unlikely	Low	solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
230.5	230.5-3	1.hatters/2.photo/3. leather works/4.photo	1.3-story, 8-stores, built 1900, heating:steam central/2./3./4.	1.1960, 1965/2.1938, 1940/(1943-44, 1951)/<1960, 1965, 1970, 1975, 1980, 1985>/3.1940, 1943-44/4.1980/ (1985)		1 6-story theater, live stage, constructed in 1998 , heated by complete hvac.		unlikely	RP	solv
230.5	230.5-4	film processing	7-story, 2-stores, built 1907, heating:steam central	1938, 1940, 1943-44		1 6-story theater, live stage, constructed in 1998 , heated by complete hvac.		unlikely	Low	solv
230.5	230.5-5	hatters	4-story, 1-store, built 1907, heating:steam central	1938, 1940, 1943-44		1 6-story theater, live stage, constructed in 1998 , heated by complete hvac.		unlikely	Low	solv
230.5	230.5-6	photo/(printers)	6-story, 7-stores, built 1926, heating:steam	1938, 1940/(1985, 1989-90)		not reviewed, not adjacent		unlikely	Low	solv
230.5	230.5-7					not reviewed, not adjacent	Yes	unlikely	Low	pet
240.2	240.2-1	machine shop	5-story warehouse built in 1918		1949, 1969	1 6-story laboratories, constructed in 1918, heated by complete hvac.		unlikely	Moderate	solv, metals, gas
240.2	240.2-2	metal works/ (machine shop)	6-story warehouse constructed in 1910 with oil burner heat	1940	-1905	1 7-story office building, constructed in 1910, heated by heat pump.	Yes	unlikely	Low	metals, pet
240.3	240.3-1	auto repair	4-story warehouse constructed in 1919 with steam heat	1938		1 17-story apartment, constructed in 1994, heated by electric wall.		unlikely	Low	pet
240.3	240.3-2	fertilizer manufacturer	3-story store & loft built in 1911	1960, 1965, 1970, 1975, 1980		no tax assessor records for this lot		unlikely	Moderate	metals
240.3	240.3-3	laundry	4-story retail/hotel built 1910, acid tank in basement	1940		1 25-story apartment, constructed in 1996 , heated by electric wall.		unlikely	Moderate	metals/solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

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240.3	240.3-4	plating company		1940, 1956, 1960, 1970, 1975	1949	1 25-story apartment, constructed in 1996 , heated by electric wall.		unlikely	Moderate	metals, solv
240.3	240.3-5	leather works	4-story office/loft, built 1901	1938, 1940	1969	1 25-story apartment, constructed in 1996 , heated by electric wall.		unlikely	Moderate	solv
240.3	240.3-6	photo		1951		1 25-story apartment, constructed in 1996 , heated by electric wall.		unlikely	Low	solv
240.4	240.4-1	1. laundry/2. printers/3. photo	4-story hotel & retail, built 1889, oil burner	1. 1938, 1940, 1943-44, 1985/2. 1951/3. 1989-90		1 4-story mixed retail w/res. units, constructed in 1900 , heated by steam.		unlikely	Moderate	solv
240.4	240.4-2	printers	5-story retail, built 1906		1969	1 2-story office building, constructed in 1900 , heated by steam.		unlikely	Low	solv
240.4	240.4-3	1. printers/2. film processing		1. 1938, 1940/2. 1970	1. 1949	1 2-story office building, constructed in 1900 , heated by steam.		unlikely	Low	solv
240.4	240.4-4	1. printers/(laundry)/ 2. clothes presser		1. 1938,(1943-44, 1951, 1956, 1960, 1965)/2. 1938,1940		Vacant lot, play yard		unlikely	Moderate	solv
240.5	240.4-5	textile/film processing		1956, 1960/1975		1 2-story office building, constructed in 1900 , heated by steam.		unlikely	Low	solv
240.5	240.5-1	1.film processing/(printers)/2.hatters/3.paint manufacturers (printers)	1.2-story, 4-stores, built 1017, heating:central steam/2./3.	1.1960/(1975, 1980, 1985)/2.1951, 1956/3.1943-44/(1980, 1985)		1 55-story office building, constructed in 1988 , heated by complete hvac.		unlikely	Low	solv
240.5	240.5-2	1.photo/(photo)/2. paint store	1.3-story, 3-stores, stores-hotel, built 1908, heating:central steam, demolished 1963/[built 1963 parking]/2.	1.1940, 1951, 1956/(1960)/2.1940		1 55-story office building, constructed in 1988 , heated by complete hvac.		unlikely	Low	solv

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240.5	240.5-3	auto repair	4-story, 2-stores and hotel, built 1915, heating:steam central	1938, 1940		1 55-story office building, constructed in 1988 , heated by complete hvac.		unlikely	Low	pet
240.5	240.5-4	1. gas station/2.film processing/3.laundry/4.hatter	1.(gas station as of 1943)in parking garage/[1966,1972, parking, 4-550 gal UST and 1-1000gal UST]/4.1-story, 6-stories, with basement as of 1937	1.1951, 1960, 1965, 1970/ 1975, 1980, 1985/2.1938, 1940/3.1938, 1940/4.1943-44	1.1949, 1969	1 55-story office building, constructed in 1988 , heated by complete hvac.		unlikely	Low	solv, gas
240.5	240.5-5	hatter		1938, 1940		1 55-story office building, constructed in 1988 , heated by complete hvac.		unlikely	Low	solv
250.2	250.2-1	fueling	4-3,000-gallon tanks installed in ~1962; 1-6,000 gallon tank installed in 1974; 11'x4'6" building with stove heat		1969	Surface parking lot		unlikely	Low	gas
250.2	250.2-2	blacksmith			1905	not reviewed, not adjacent		unlikely	Low	metals
250.2	250.2-3	junk shop			1905	not reviewed, not adjacent		unlikely	Low	pet, metals, PCBS
250.3	250.3-1	lithographer	4-story retail & loft constructed in 1907 with steam heat	1938, 1940, 1943-44, 1951, 1956, 1965	1949, 1969	1 4-story parking structure, constructed in 1983, no heat.		unlikely	Moderate	solv
250.3	250.3-2	blacksmith			1905	1 4-story parking structure, constructed in 1983, no heat.		unlikely	Moderate	solv, metals
250.4	250.4-1	sheet metal works	4-story hotel & retail, built 1906, steam heat	1943-44/ 1965		Colonial Grand Pacific 6 story Condomimium, built in 1902, electric		unlikely	Moderate	metals
250.4	250.4-2	1. cleaners/ printer/ 2.shooting gallery	4-story hotel & retail constructed in 1902 with oil heat	1. 1938/ 1985, 1989-90/2. 1943-44		Colonial Grand Pacific 6 story Condomimium, built in 1902, electric		unlikely	Moderate	solv

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250.4	250.4-3	sheet metal works		1938, 1940		Colonial Grand Pacific 6 story Condomimium, built in 1902, electric		unlikely	Low	metals
250.4	250.4-4	paint store	1-story retail building constructed in 1915, steam heat, corner of 1st and Spring	1940, 1943-44/(1951)		Watermark 22 story condomimium, built in 1983, HVAC heating system.		unlikely	Moderate	solv
250.4	250.4-5	printers		1940, 1956, 1960, 1965, 1975		Watermark 22 story condomimium, built in 1983, HVAC heating system.		unlikely	Moderate	solv
250.4	250.4-6	printers		1943-44, 1951, 1956, 1960, 1965, 1970, 1975, 1980		Watermark 22 story condomimium, built in 1983, HVAC heating system.		unlikely	Moderate	solv
250.4	250.4-7	hatters		1970, 1975		1 36-story office building, constructed in 1973 , heated by heat pump.		unlikely	Low	solv
250.5	250.5-1	cleaners/(photo)	1-story retail building, built 1914	1956/(1970, 1975, 1980, 1985		1 29-story office building, constructed in 1991 , heated by complete hvac.		unlikely	Low	solv
250.5	250.5-2	printers		1960, 1965, 1970, 1975	1969	1 29-story office building, constructed in 1991 , heated by complete hvac.		unlikely	Moderate	solv
250.5	250.5-3	1. printers/2. printers/(auto repair)/<photo>	6-story office & retail building, built 1903	1. 1938, 1940, 1943-44, 1951, 1956/2. 1938, 1940, 1943-44, 1951, 1956, 1960, 1965/(1938, 1940, 1943-44, 1951, 1956)/<1943-44>	2. 1969	1 29-story office building, constructed in 1991 , heated by complete hvac.		unlikely	Moderate	solv

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250.5	250.5-4	hatters/laundry	1-story retail building, built 1908, stove heat, torn down 1967, Building C, Laundry	1938, 1940, 1943-44, 1951, 1956, 1960, 1965/1938, 1940, 1943-44, 1951, 1956		1 8-story office building, constructed in 1968 , heated by heat pump.		unlikely	Moderate	solv
250.5	250.5-5	printers/typesetter/ typesetter	print shop, built 1911	1951, 1956, 1960, 1965		1 8-story office building, constructed in 1968 , heated by heat pump.		unlikely	Low	solv
250.5	250.5-6	printers	2-story bank, built 1908, torn down 1969	1938, 1940, 1943-44, 1951		1 8-story office building, constructed in 1968 , heated by heat pump.		unlikely	Low	solv
250.5	250.5-7	photo		1965		1 8-story office building, constructed in 1968 , heated by heat pump.		unlikely	Low	solv
250.6	250.6-1	photo	4-story, 1-store, built 1911, major remodel 1958, heating:cental steam,auto. own plant	1940, 1943-44, 1951, 1956		1 6-story office building, constructed in 1958 , heated by heat pump.		unlikely	Low	solv
250.6	250.6-2	1.printers/2.printer s/3.cleaners	1.new building in 1958, 6-story, offices, bank and printer in the basement	2.1940, 1938/3.1943-44, 1951, 1956	1.1969	1 6-story office building, constructed in 1958 , heated by heat pump.		unlikely	Low	solv
250.6	250.6-3	1.printers/cleaners/ 2.photo/3.printers/ 4.printers	1.3-story, 2-stores, buit 1889, heating:steam P.S., printer through 1954/2./3.3-story, 4-stores, built 1910, heating:steam central/4.	1.1938, 1940, 1943-44, 1951, 1956, 1960, 1965/1975/2.1960, 1965/3.1938, 1940, 1943/4.1938, 1940, 1943-44	1.1949, 1969	1 34-story office building, constructed in 1980 , heated by heat pump.		unlikely	Moderate	solv
250.6	250.6-4	1.cleaners/2.photoc opy	1.5-story, 2-stores, hotel, built 1910, heating:steam central, oil "Ray" own plant/2.	1.1956, 1965/2.1975		1 34-story office building, constructed in 1980 , heated by heat pump.		unlikely	Low	solv
250.6	250.6-5	1.cleaners/2.printer s	1.7-stories, 10-stores, hotel, built 1927, heating:central steam-oil burner /2.	1.1940/2.1940, 1938		1 34-story office building, constructed in 1980 , heated by heat pump.		unlikely	Low	solv

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
260.2	260.2-1	Department of Ecology site	2-story warehouse, built in 1909, demolished in 1962 and block converted to paved parking lot			13-story condominium building, built 1983, complete HVAC	Yes	unlikely	Low	metals
260.3	260.3-1	printers	6-story building (retail) constructed in 1905, covers entire block		1969	1 6-story department store, constructed in 1905, heated by steam.		unlikely	Low	solv
260.4	260.4-1	sheet metal works/painter	6-story hotel & retail with oil burner, paint store on first floor, built 1902	1938, 1940, 1943-44, 1951, 1956, 1970/ 1938, 1940		1 3-story hotel full service, constructed in 1901 , heated by package unit.		unlikely	Moderate	metals, solv
260.4	260.4-2	cleaners		1985, 1989-90		1 3-story hotel full service, constructed in 1901 , heated by package unit.		unlikely	Low	solv
260.4	260.4-3	sign painter/printers/photo	5-story building constructed in 1904 with oil heat	1938/ 1951/1985, 1989-90		1 5-story hotel full service, constructed in 1904 , heated by warmed and cooled air.		unlikely	Low	solv
260.4	260.4-4	photo		1943-44, 1951, 1956, 1960, 1965, 1970, 1975, 1980		1 5-story hotel full service, constructed in 1904 , heated by warmed and cooled air.		unlikely	Low	solv
260.5	260.5-1	printers	6-story retail/loft building, built 1908	1940		10-story mixed use (hotel, condos) building, built 2006, complete HVAC heating system		unlikely	Moderate	solv
260.5	260.5-2	1. press/hatters/2. photo/3. clothes presser		1. 1938/1970,1975/ 2. 1975/3. 1938, 1940		1 5-story office building, constructed in 1900 , heated by complete hvac.		unlikely	Low	solv
260.5	260.5-3	1. clothes presser/cleaners/2. photo		1. 1938, 1940/(1951, 1956)/2. 1985, 1989-90		1 29-story office building, constructed in 1991 , heated by complete hvac.		unlikely	Low	solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
260.5	260.5-4	photo		1943-44		1 8-story office building, constructed in 1968 , heated by heat pump.		unlikely	Low	solv
260.6	260.6-1	photo	9-story, 2-stores, built 1908, heating:central steam P.S., 2 hydraulic lifts	1940		1 41-story office building, constructed in 1986 , heated by heat pump.		unlikely	Low	solv
260.6	260.6-2	1.photos/2.laundry /(printers)/3.hatters	1.3/5-stories, built 1909, remodeled 1930, heating:central steam P.S.,	1.1980/2.1938/(1975)/3.1940		1 41-story office building, constructed in 1986 , heated by heat pump.		unlikely	Low	solv
260.6	260.6-3	1.printers/2.gas station	1.2/(3&11)-story, mulitple building section, built 1932,1957 & 1958, heat:central steam P.S./2.	1.1975/2.1943-44, 1951, 1956, 1960, 1965, 1970		1 13-story office building, constructed in 1998 , heated by warmed and cooled air.		unlikely	Low	solv
270.2	270.2-1	printers/printers/printers/chemical company	5-story warehouse with retail, built in 1910 covering entire block	1989-90 / 1938 / 1970/ 1951	1969	1 5-story office building, constructed in 1910, heated by heat pump.		unlikely	Moderate	solv
270.2	270.2-2	cleaners		1951, 1956, 1960, 1965		1 5-story office building, constructed in 1910, heated by heat pump.	Yes	unlikely	Moderate	solv
270.2	270.2-3	engine company		1938, 1940, 1943		1 5-story office building, constructed in 1910, heated by heat pump.		unlikely	Low	pet
270.2	270.2-4	motor car company		1938, 1940		1 5-story office building, constructed in 1910, heated by heat pump.		unlikely	Low	pet
270.2	270.2-5	cleaners		1938, 1940		1 5-story office building, constructed in 1910, heated by heat pump.		unlikely	Moderate	solv
270.4	270.4-1	printers/[clothes pressers]/<printers>	6-story retail & office, built 1890, oil burner heat, torn down 1971	1938, 1940/[1938,1940,1973-44,1951]/<1951,1956,1960, 1965>		1 36-story office building, constructed in 1973 , heated by heat pump.		unlikely	Low	solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
270.4	270.4-2	cleaners/cleaners	2-story retail, built 1914, torn down 1971	1951, 1956, 1960/1965, 1970		36-story commercial building, built 1973, heat pump		unlikely	Moderate	solv
270.4	270.4-3	hat shop		1938, 1940,1943-44		36-story commercial building, built 1973, heat pump		unlikely	Low	solv
270.5	270.5-1	printers	2-story, 5 to 1 stores, built 1919, remodeled to Bank all building(s) 1958, heating:steam central	1951		1 47-story office building, constructed in 1983 , heated by hot & chilled water.		unlikely	Low	solv
270.5	270.5-2	1.printers/2.printers/3.printers/4.gas station	1.2-story 9-stores, built 1909, heating:central steam, demolished 1959/2./3./4.	1.1938, 1940, 1943-44, 1951/2.1943-44, 1951/3.1940/4.1960, 1965, 1970, 1975, 1980	4.1969	1 47-story office building, constructed in 1983 , heated by hot & chilled water.		unlikely	Low	solv, gas
280.2	280.2-1	lithographer	Constructed 1906, 4-story commercial with steam heat	1970		1 3-story office building, constructed in 1906, heated by steam without boiler.		unlikely	Low	solv
280.2	280.2-2	gas station/Department of Ecology Site	Constructed 1906, first floor of 4-story building described in 1936 as service station - "gasoline equipment" listed but no tanks listed	1938, 1940	1949, 1969	parking lot	Yes	unlikely	Low	gas
280.2	280.2-3	gas station	half of printing building torn down to leave lot 4 with 1-story gas station built in 1942; stove heating, 3 pumps listed in 1967; tanks: 3-1000-gallon & 1-550-gallon	1975, 1980, 1985, 1989-90				unlikely	Low	gas
280.2	280.2-4	Parking Facility				1 3-story office building, constructed in 1906, heated by steam without boiler.	Yes	unlikely	Low	pet

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
280.3	280.3-1	auto repair	one 4 story building on entire block, built 1890	1951		parking lot		unlikely	Low	pet
280.3	280.3-2	cleaners		1938, 1940, 1943-44				unlikely	Low	solv
280.3	280.3-3	printers		1951, 1956, 1960, 1965				unlikely	Low	solv
280.3	280.3-4	metal works and tin shop		1938, 1943-44				unlikely	Low	metals
280.5	280.5-1	cleaners	3-story hotel & retail building, built 1890, steam heat, torn down 1955	1938, 1940		1 17-story office building, constructed in 1958 , heated by heat pump.		unlikely	Moderate	solv
280.5	280.5-2	auto repair	16-story office & retail building, built 1959	1960/ (1965)/ <1975>		1 17-story office building, constructed in 1958 , heated by heat pump.		unlikely	Low	pet
280.5	280.5-3	machine shop			1905/ (1905)	17 story commercial building, built 1958, heat pump		unlikely	Low	pet/solv
290.2	290.2-1	printers	Constructed 1910, 6-story commercial/retail building	1960	1969	1 6-story office building, constructed in 1910, heated by steam without boiler.		LOW	Low	solv
290.2	290.2-2	ink manufacturer			1969	1 6-story office building, constructed in 1910, heated by steam without boiler.		LOW	Low	solv
290.2	290.2-3	printers		1938,1940,1944-45,1951, 1956, 1960, 1965, 1970/[1956, 1960, 1965]/ <1970, 1975, 1980, 1985>		1 6-story office building, constructed in 1910, heated by steam without boiler.		MODERATE	Moderate	gas, pet, solv

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Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
290.2	290.2-4	gas station, auto repair	Constructed 1938, 1-story, automotive repair building,,possible fueling - pumps observed in photo; 2 hydraulic lifts, stove heat, demolished 1966 for parking lot	1938 / 1940, 1943-44, 1951, 1956, 1960, 1965	1949	surface parking lot		LOW	Low	gas
290.2	290.2-5	warehouse				1 6-story loft, constructed in 1910, heated by steam without boiler.		unlikely	Low	gas, metals
290.3	290.3-1	printers	4-story buidling, built 1914	1938, 1940	/ 1969	1 4-story office building, constructed in 1914, heated by steam without boiler.		unlikely	Moderate	solv, metals
290.3	290.3-2	mfg. chemists	office building	1938, 1940, 1944-45, 1951, 1956, 1960, 1965, 1970, 1975, 1980		1 4-story office building, constructed in 1914, heated by steam without boiler.		unlikely	Low	solv
290.3	290.3-3	electric company/power company	2 buildings: 1901 3-story brick powerhouse with 1-14,000 gallon tank (under Post St.?); 1911 1-story garage with steam heat	1940, 1943-44	1969	1 3-story industrial light manufacturing, constructed in 1901, heated by steam.		unlikely	Moderate	pcbs
290.3	290.3-4	oil clarifier distributors	3-story hotel constructed in 1913-14 with steam heat	1940 / 1951		3-story residential building, built 1913, electric heat		unlikely	Low	pet
290.3	290.3-5	power machine works/welding company		1938, 1940, 1943-44, 1956, 1960, 1965, 1970 / 1956, 1965	1969	1 3-story industrial light manufacturing, constructed in 1901, heated by steam.		unlikely	Moderate	solv, metals
290.3	290.3-6	steam plant				1 3-story industrial light manufacturing, constructed in 1901, heated by steam.	Yes	unlikely	Moderate	pcbs, pet

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290.4	290.4-1	tailors and cleaners	6-story office & retail building, built 1908, steam heat	1951/(1960)		1 9-story parking structure, constructed in 1970, no heat.		unlikely	Low	solv
290.4	290.4-2	smelter	6-story office & retail building, built 1897, steam heat	1940		1 6-story office building, constructed in 1900, heated by warmed and cooled air.		unlikely	Moderate	metals
290.4	290.4-3	cleaner		1938, 1940, 1943-44		1 2-story mixed use retail, constructed in 1908, heated by steam without boiler.		unlikely	Low	solv
290.5	290.5-1	auto repair, gas station	building constructed 1958, stove heat, 4-1,000 gallon tanks, 1-500 gallon tank			1 3-story parking structure, constructed in 1958, no heat.		unlikely	Low	gas
290.5	290.5-2	printers	16-story retail & office building, steam heat	1938/(1989-1990)		1 17-story office building, constructed in 1911 , heated by heat pump.		unlikely	Low	solv
290.5	290.5-3	dye works/(cleaners and tailors)		1940, 1943-44, 1951, 1956, 1960, 1985 /(1965)/[1960]		1 3-story office building, constructed in 1903 , heated by steam without boiler.		unlikely	Moderate	solv
290.5	290.5-4	fueling/ Department of Ecology Site		1938, 1940, 1943-44/ 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985/1989-90		Condominium, 20-story condominium building, built 2000, Complete HVAC		unlikely	Low	metals, gas
300.1	300.1-1	printers	10-story office/retail building, steam heat, built 1906	1940 / 1970		Courtyard by Marriott, commercial, 15 story building constructed in 1904, warmed and cooled air.		unlikely	Moderate	solv
300.1	300.1-2	printers	2-story office/retail building, built 1894, 2 oil burners	1940, 1943-44		not reviewed, not adjacent		unlikely	Low	solv

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300.1	300.1-3	paints	6-story retail/loft building, built 1889, steam heat		1969	Courtyard by Marriott, commercial, 15 story building constructed in 1904, warmed and cooled air.		unlikely	Low	solv
300.1	300.1-4	clothes pressers and cleaners	6-story retail/office building, built 1890, steam heat	1940, 1943-44, 1951, 1956, 1965, 1970 / 1938, 1940		Hartfor Buildeing, commercial building , 2 story building constructed in 1929, steam without boiler		unlikely	Moderate	solv
300.1	300.1-5	printers	1-story office building, built ~1927?, steam heat	1943, 1951, 1960, 1965		not reviewed, not adjacent		unlikely	Low	solv
300.1	300.1-6	clothes cleaners/parking garage	2-story retail building & garage, built 1903, no heat	1951, 1956, 1960, 1965, 1970, 1975		not reviewed, not adjacent	Yes	unlikely	Low	gas
300.1	300.1-7	1. hatters/2. photo/(printer)		1. 1943-44/2. 1951/(1951)		1 3-story office building, constructed in 1902 , heated by steam without boiler.		unlikely	Low	solv
310.1	310.1-1	fueling, dying	5-story hotel/retail building, built 1890, 2 oil burners, torn down 1961; 4-level parking garage built in 1961-1962	1938, 1940, 1943-44, 1951, 1956, 1960	1969	1 3-story parking structure, constructed in 1961, heated by no heat.		unlikely	Moderate	solv, gas
320.1	320.1-1	clothes cleaners and dyers	3-story hotel/retail building, built 1911	1938, 1940, 1943-44, 1951		1 3-story office building, constructed in 1911, heated by complete hvac.		MODERATE	Moderate	solv
320.1	320.1-2	lithographer		1943-44, 1951, 1956, 1960/(1951)		1 4-story hotel , constructed in 1914 , heated by electric wall.		LOW	Low	solv
320.1	320.1-3	steel company and storage, machine shop and metal stamping	6-story factory and loft building, built 1902		1969	1 6-story mixed use office, constructed in 1902 , heated by space heaters.		MODERATE	Moderate	solv, metals

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320.1	320.1-4	mfg. chemists, print shop, mimeo department	3-story loft and print shop, built 1908	1938 / 1951, 1956, 1960, 1965, 1970, 1975, 1980	1969	1 3-story office building, constructed in 1900 , heated by space heaters.		MODERATE	Moderate	solv
320.1	320.1-5	cleaners		1951, 1956, 1960, 1965/(1943-44)/[1980]		1 4-story hotel , constructed in 1914 , heated by electric wall.		unlikely	Moderate	solv
320.1	320.1-6	printers		1938, 1940, 1943-44, 1951, 1956, 1960, 1965, 1970, 1975, 1980/1985, 1989-90	1950, 1969	1 3-story office building, constructed in 1900 , heated by space heaters.		unlikely	Moderate	solv
320.1	320.1-7	printers/lithographer		1938, 1940, 1943-44, 1951, 1956, 1960, 1965/ 1951, 1956, 1960, 1965/ 1951, 1956	1950, 1969	1 5-story office building, constructed in 1900 , heated by hot water.		unlikely	Moderate	solv
320.1	320.1-8	engine works	2-story shop building, built 1918, stove heat		1916	1 4-story hotel , constructed in 1914 , heated by electric wall.		unlikely	Low	solv, metals
320.2	320.2-1	cleaners		1938		1 4-story loft, constructed in 1900 , heated by steam without boiler.		unlikely	Moderate	solv
320.2	320.2-2	dry cleaners		1943, 1956		1 4-story office building, constructed in 1900 , heated by electric wall.		unlikely	Moderate	solv
320.2	320.2-3	laundry, clothes cleaners		1940 / 1951 / 1960		1 1-story restaurant, table service, constructed in 1900 , heated by warmed and cooled air.		unlikely	Moderate	solv
320.2	320.2-4	clothes cleaners/printers		1938/(1938,1940,1943-44, 1956, 1960, 1965, 1970)/[1989-90]/<1989-90>		1 3-story retail store, constructed in 1900 , heated by electric wall.		unlikely	Moderate	solv

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330.1	330.1-1	gas station		1938, 1940		1 2-story storage warehouse, constructed in 1901, heated by space heaters.		LOW	Low	gas
330.2	330.2-1	laundry			1949	1 2-story storage warehouse, constructed in 1950 , heated by electric wall.		LOW	Low	solv
330.2	330.2-2	laundry/cleaners		1943-44/(1951, 1956)		1 3-story office building, constructed in 1900 , heated by electric wall.		LOW	Low	solv
330.3	330.3-1	lithographers, bank printers	5-story store and loft building, built 1903, lithographing business	1940, 1943, 1951		1 5-story mixed use office, constructed in 1903 , heated by complete hvac.		unlikely	Low	solv
340.1	340.1-1	parking garage with fueling	2-story garage, built 1909, oil burner, 3 gas tanks, automotive and truck steam cleaning	1938, 1940, 1943-44, 1951, 1956, 1960/ 1970/ 1975, 1980, 1985/ 1989-90	1969	1 3-story parking structure, constructed in 1909, no heat.	Yes	MODERATE	Low	gas, pet
340.1	340.1-2	printing and lithograph company	4-story store & warehouse, built 1900	1951, 1956, 1960	1916 / 1950	5-story residential (condos) built 1900, electric heat		unlikely	Moderate	solv
340.1	340.1-3	printing company	4-story hotel/manufacturing, built 1900	1943, 1956, 1965	1950	1 4-story office building, constructed in 1900, heated by forced air unit.		unlikely	Moderate	solv
340.1	340.1-4	textile mfr.	3-story hotel/retail, built 1898, stove heat	1938, 1940, 1943-44, 1951, 1956, 1960, 1965	1916	1 3-story office building, constructed in 1900 , heated by forced air unit.		unlikely	Moderate	metals, solv
340.2	340.2-1	rubber company	4-story store/loft, built in 1898, stove heat	1940		1 4-story office building, constructed in 1900, heated by steam without boiler.		unlikely	Low	metals
340.2	340.2-2	machine shop	3-story hotel/warehouse, built 1890, stove heat		1916	3-story condomimium building , built in 1900, warmed and cooled aire		unlikely	Low	solv, met

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340.2	340.2-3	textile company/metal works	4-story store/loft, built 1902	1938, 1940 / 1970, 1975		1 4-story office building, constructed in 1902, heated by steam without boiler.		unlikely	Low	metals, solv
340.2	340.2-4	printers			1916	1 3-story office building, constructed in 1900, heated by steam without boiler.		unlikely	Low	solv
350.1	350.1-1	repair workshop	1-story shop, built in 1967, repair workshop		1916	Pier 46, marine/commercial/fish terminal		LOW	Low	gas, pet
350.1	350.1-2	gas station	1-story warehouse, built 1963-64, inventory is listed in tank section, a portion of the inventory is covered by photo	1938, 1940	1950	1 3-story office building, constructed in 2005, heated by complete hvac.	Yes	LOW	Low	gas, pet
350.1	350.1-3	welding			1950	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	metals
350.1	350.1-4	gas station			1916	1 3-story office building, constructed in 2005, heated by complete hvac.	Yes	LOW	Low	gas
350.1	350.1-5	plating company and machine shop, sheet metal works			1950 / 1916	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Moderate	solv, metals
350.2	350.2-1	gas station	1-story gas station, built 1937, stove heat	1938	1950	1 3-story parking structure, constructed in 1984, no heat.		LOW	Low	gas, pet
350.3	350.3-1	paint co.		1980		6-story commercial building, constructed in 1900, complete HVAC		unlikely	Low	solv

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350.3	350.3-2	scientific supplies/(fueling)	2-story warehouse/loft/retail building, built 1902	(1938, 1940, 1943-44, 1951)		5-story commercial building, constructed in 1900, heat pump.		unlikely	Low	solv, pet
350.3	350.3-3	printer		1938, 1940, 1943-44		7-story commercial building, built in 1907, heat pump.		unlikely	Low	solv
360.1	360.1-1	plating company, boiler works, brass foundry, tin shop, blacksmith, machine shops, fueling			1916 / 1950	1 1-story basement, unfinished, constructed in 1970, no heat.		MODERATE	Moderate	solv, metals, gas, pet
360.1	360.1-2	copper works, machine shop			1916	1 3-story office building, constructed in 2005, heated by complete hvac.	Yes	MODERATE	Moderate	solv, met
360.1	360.1-3	sheet metal works, gas station, brass foundry, boiler works, plating company machine shop	1-story metal shop/restaurant/office building, built in 1890, stove heat	1938, 1940 /1940 /	/ 1950 / 1916	1 3-story office building, constructed in 2005, heated by complete hvac.		MODERATE	Moderate	solv, met, gas
360.1	360.1-4	dock with tank	dock, built 1964-65, 2,000 gallon tank			1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	pet
360.1	360.1-5	machine shop, fueling, repair shop	1-story scale house, built 1923, stove heat		1916 / 1950 / 1969	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	solv, met, gas

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360.1	360.1-6	railroad	1-story office/dock building, built 1943, inventory is listed in tank section, a portion of the inventory covered by photo		1916 / 1950	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Moderate	solv, metals
360.1	360.1-7	repair shop			1969	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Moderate	metals, pet
360.1	360.1-8	gasoline and service station	1-story service station, unknown construction date, stove heat, 4x14 grease pit	1938, 1940, 1951, 1956, 1960	1950	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	gas
360.1	360.1-9	construction and dry dock company			1916	Port of Seattle Terminal - no building information		LOW	Moderate	solv, pet, metals
360.1	360.1-10	machine & steel shops, oil house	2-story machine shop/office building, built 1945, 3 oil burners		1950, 1969	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	solv, pet, metals
360.1	360.1-11	boat shop	2-story boat shop, construction date unknwon, stove heat			1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	pet, metals
360.1	360.1-12	locomotive repairing			1950 / 1969	1 3-story office building, constructed in 2005, heated by complete hvac.		LOW	Low	pet, met
360.1	360.1-13					#N/A	Yes	MODERATE		gas, PAHs, metals
360.15	360.15-1	sheet metal works/Ecology site	1-single story freight depot, built 1931, stove heat		1916	Surface parking lot	Yes	MODERATE	Moderate	pet, metals

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360.2	360.2-1	paint mfrs.	No Records Available	1951		1 7-story office building, constructed in 1904, heated by warmed and cooled air.		LOW	Low	solv, gas
360.2	360.2-2	fuel company	No Records Available	1938, 1940		1 7-story office building, constructed in 1904, heated by warmed and cooled air.		LOW	Low	pet
360.2	360.2-3	automobile service	No Records Available	1938, 1940	1950	1 7-story office building, constructed in 1904, heated by warmed and cooled air.		LOW	Low	gas, pet
360.2	360.2-4	painters, sign co.	No Records Available	1951		1 7-story office building, constructed in 1904, heated by warmed and cooled air.		LOW	Low	solv
360.3	360.3-1	machine works, tool manufacturer	No Records Available	1938/1940		1 6-story office building, constructed in 1910, heated by warmed and cooled air.		unlikely	Low	solv, metals
360.3	360.3-2	sawmill machinery	No Records Available	1940		6-story residential building, built 1909, electric heat		unlikely	Low	metals
360.3	360.3-3	machinery mfrs.	No Records Available	1938, 1940, 1951		6-story residential building, built 1909, electric heat		unlikely	Low	metals, pet
360.3	360.3-4	oils & lubricants	No Records Available	1938, 1940, 1951		6-story residential building, built 1909, electric heat		unlikely	Low	metals, pet
360.3	360.3-5	sheet metal works	No Records Available	1989		6-story residential building, built 1909, electric heat		unlikely	Low	metals
360.3	360.3-6	oil & gas burning equipment	No Records Available	1956		1 4-story office building, constructed in 1904, heated by complete hvac.		unlikely	Low	pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
360.3	360.3-7	chemical company	No Records Available	1970		1 7-story open office, constructed in 1909, heated by space heaters.		unlikely	Low	solv
360.3	360.3-8	printers	No Records Available	1970, 1975		1 7-story open office, constructed in 1909, heated by space heaters.		unlikely	Low	solv
360.3	360.3-9	tools mfrs.	No Records Available	1938		1 6-story office building, constructed in 1909, heated by package unit.		unlikely	Low	metals
370.1	370.1-1	gas station		1938, 1940, 1943		1 2-story warehouse, distribution, constructed in 1939, heated by space heaters.		MODERATE	Low	gas
370.1	370.1-2	rail yard				1 1-story transit warehouse, constructed in 1912, heated by steam without boiler.	Yes	LOW	Low	pet
370.2	370.2-1	gas station	No Records Available	1938, 1940, 1943	1950	No parcel, part of roadway		unlikely	Low	gas
370.2	370.2-2	pattern works		1938, 1943	1916, 1950	Commercial Parking Lot		unlikely	Moderate	metals
370.2	370.2-3	brass works		1938, 1943				unlikely	Low	solv, metals
370.2	370.2-4	pattern and model works, machine works	2-story machine shop, built 1890, stove heat	1938, 1940, 1943 / 1938, 1940, 1943				unlikely	Moderate	solv, metals
370.2	370.2-5	chemical manufacturer		1960		1 2-story basement, unfinished, constructed in 1920, heated by space heaters.		unlikely	Low	solv
370.2	370.2-6	warehouse/Department of Ecology Site	2-story retail/warehouse building, built 1920, oil burner & stove			1 2-story basement, unfinished, constructed in 1920, heated by space heaters.	Yes	unlikely	Low	metals, pet

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
370.2	370.2-7	fuel co. and iron wire rope mfrs.	4-story warehouse, built 1904, 2 oil burners	1965		1 2-story basement, unfinished, constructed in 1920, heated by space heaters.		unlikely	Low	metals, pet
370.2	370.2-8	aluminum company		1965, 1970		1 4-story office building, constructed in 1904, heated by hot water.		unlikely	Low	metals, pet
370.2	370.2-9	copper and brass works	1-story store, built 1927			1 1-story storage warehouse, constructed in 1927, heated by space heaters.		unlikely	Moderate	metals
370.2	370.2-10	copper and brass works, wire and cable co.	1-story store, built 1929, oil burner		1916	1 1-story industrial light manufacturing, constructed in 1929, heated by space heaters.		unlikely	Low	solv, metals
370.2	370.2-11	electric company	1-story store, built 1903			Commercial, parking lot		unlikely	Moderate	pcbs
370.2	370.2-12	electric motors and chains	1-story store, date built unknown, oil burner.			1 6-story mixed use office, constructed in 1910, heated by thru-wall heat pump.		unlikely	Moderate	metals
370.2	370.2-13	machinery mfrs.	1-story store/office building, built 1918, oil burner			1 1-story restaurant, table service, constructed in 1918, heated by complete hvac.		unlikely	Low	metals
370.2	370.2-14	paint manufacturer/oil company/battery and chemical company		1940, 1943 / 1940, 1943 / 1951 / 1960 / 1960	/ 1969	1 6-story mixed use office, constructed in 1910, heated by thru-wall heat pump.		unlikely	Low	solv, metals, pcbs
370.2	370.2-15	paint company	4-story warehouse building, built 1909, oil burner			1 4-story storage warehouse, constructed in 1909, heated by space heaters.		unlikely	Low	solv, metals

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
370.2	370.2-16	machinery and equipment co.	2-story warehouse building, built 1900, stove heat			1 1-story warehouse showroom store, constructed in 1900, heated by space heaters.		unlikely	Low	metals
370.2	370.2-17	machine shop			1950	1 4-story storage warehouse, constructed in 1909, heated by space heaters.		unlikely	Low	solv, metals
370.2	370.2-18	junk company	1-story warehouse/store/office building, built 1920, oil burner		1916	Commercial, parking lot		unlikely	Moderate	pet, metals, PCBs
370.2	370.2-19	gas station	1-story gas station, built 1942, stove heat; 6-1,000 gallon tanks; repair garage, built 1946	1943, 1951, 1956, 1960, 1965, 1970, 1975, 1980, 1985, 1989	1950, 1969	1 9-story hotel full service, constructed in 2005, heated by warmed and cooled air.	Yes	unlikely	Low	gas
380.1	380.1-1	Pier 37/Gasoline Station	gas station, built 1922, stove heat, torn down 1944; garage remodeled in 1939 for tire room; rear structure on property: grease shed with gas station.	1938, 1940 (gas station)	1950, 1969 / 1950, 1969	1 1-story storage warehouse, constructed in 1970, no heat.	Yes	unlikely	Moderate	gas, pet, metals, solv
380.1	380.1-2	junk yard			1916	1 3-story office building, constructed in 2005, heated by complete hvac.		unlikely	Low	pet, metals, PCBs
380.1	380.1-3	coal briquette plant			1916	1 3-story office building, constructed in 2005, heated by complete hvac.		unlikely	Low	pet, gas
380.1	380.1-4	automotive service (Terminal 37)	garage/service station, built 1914, stove heat, fuel pumps			1 3-story office building, constructed in 2005, heated by complete hvac.	Yes	unlikely	Low	gas

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
380.1	380.1-5	Terminals 37, 42 ,47	2 buildings, built 1920s, both stove heat, one torn down 1943, the other torn down 1961			1 3-story office building, constructed in 2005, heated by complete hvac.		unlikely	Low	pet
380.2	380.2-1	fuel company	Building listed as office	1938, 1940		1 2-story industrial light manufacturing, constructed in 1914, heated by hot water.		MODERATE	Low	pet
380.2	380.2-2	machine works/foundry	1-story iron works/foundry, built 1902, no heat, torn down 1949	1938, 1940, 1943-44	1916	1 2-story industrial light manufacturing, constructed in 1914, heated by hot water.		MODERATE	Moderate	solv, metals
380.2	380.2-3	junk yard	built 1903, oil burner, torn down 1951		1916	1-2 story, Storage Warehouse, constructed 1938, space heaters.		MODERATE	Moderate	met, pet, PCBs
380.2	380.2-4	can company	warehouse, built 1902, stoker heat		1916	Commercial, vacant	Yes	MODERATE	Low	metals, pet
380.3	380.3-1	cleaning products		1938, 1940, 1943-44		1 2-story industrial light manufacturing, constructed in 1914, heated by hot water.		MODERATE	Low	solv
380.3	380.3-2	junk company	built 1954, stove heat		1916	1 2-story industrial light manufacturing, constructed in 1914, heated by hot water.		unlikely	Moderate	metals, pet, PCBs
380.3	380.3-3	truck sales & service	1-story garage/sales, built 1938, oil burner, 2 sumps, pumps, gas tanks	1956	1950, 1969	1 2-story storage warehouse, constructed in 1938, heated by space heaters.		unlikely	Low	gas
380.4	380.4-1	auto repairs and gas station	service station, built 1939, stove heat; tanks: 2-2,000; 1-1,000; 1-550; and 2-300 gallon	1940, 1943, 1956, 1960	1950, 1969	Sport Facility		unlikely	Low	gas
380.4	380.4-2	machine shop	warehouse/office/loft, built 1917, oil burner		1916	Sport Facility		unlikely	Low	solv, metals

Exhibit D-1 Historical Land Uses of Sites (See Exhibit 4-1 for location)

Block	Site No.	Type of Business/ Reference Name	Description (Archive)	Polk Directory Years	Sanborn Map Years	2010 Assessor Record (from July 2009 GIS file)	Listed Site 2009	Likely to Impact RANK 2010	Risk to Environment	Primary Contaminant(s)
380.4	380.4-3	auto supply company/paint warehouse	warehouse, built 1904		1969	Sport Facility		unlikely	Low	solv
380.4	380.4-4	oil & gas co.	warehouse, built 1910	1938, 1940		Sport Facility		unlikely	Low	pet
380.4	380.4-5	automotive supply	warehouse, built 1926, oil burner; sign indicates automotive supply (i.e.batteries, tires), photo likely taken in 1937			Sport Facility		unlikely	Low	pet

Notes:

1 Site Listed in Environmental Records (databases)

2 RP = Reasonably Predictable; SC = Substantially Contaminated

3 Site Listed in Environmental Records; however this site is not identified on Exhibit 4-1 because it encompasses sediments from Block 220.05 to 290.1.

4 Site Listed in UST database only, installed prior to 1980; no known release.

Blank cells in Polk Directory, Sanborn Map, Description Archive, and Listed Site columns indicate there was no environmental problem identified

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ATTACHMENT E

Windshield Survey

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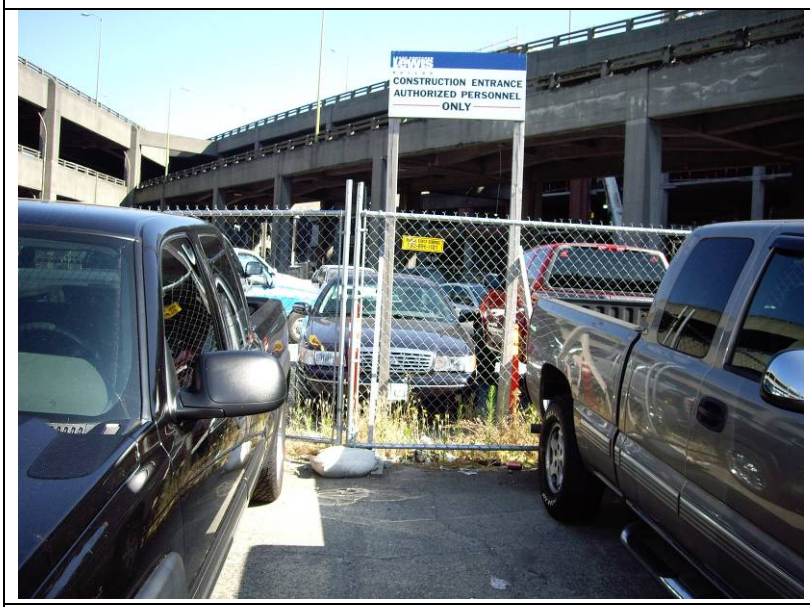
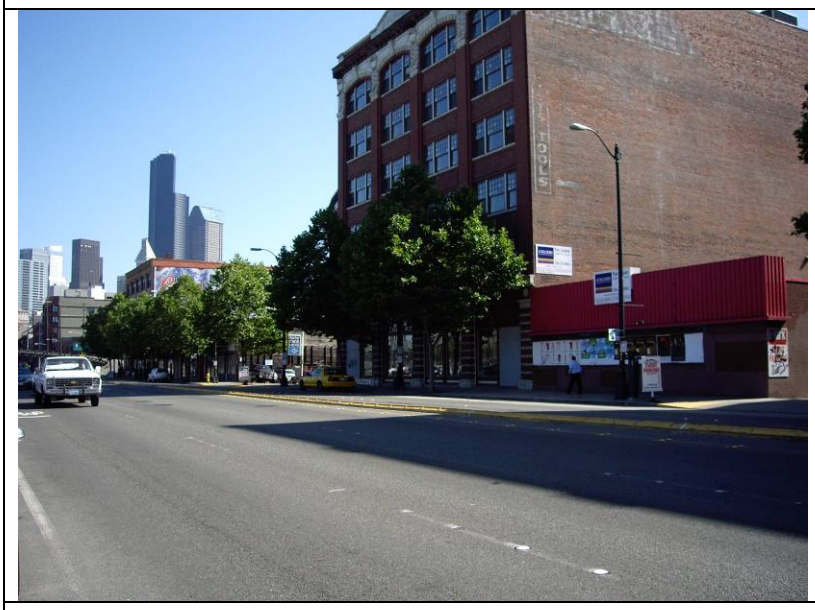
BLOCK NO. 360.1	**Bounding Streets:** Terminal 46 (S. King Street), Alaskan Way S., S. Royal Brougham Way, and Elliott Bay.
	Property Description: The block is occupied by Terminal 46. The administrative building is located at approximately Site 360.1-4. An entrance is located across from S. Dearborn Street. The site is paved and used as a container terminal. A single-track rail line is located between the sidewalk on the west side of Alaskan Way S. and the terminal fence. Storm drains are visible on the east side of the tarmac. <u>Acquisition Plan:</u> No. The block is located adjacent to and west of Alaskan Way S. A tieback would be installed along Alaskan Way S.
Photo Description: Looking southwest at railroad track and containers at Terminal 46.	

BLOCK NO. 360.15	**Bounding Streets:** Railroad Way S., S. Dearborn Street, and Alaskan Way S.
	**Property Description:** The south end of the block is unpaved and used as a parking lot. The north end of the block, which is partially paved and fenced, is used as a laydown area for the construction site located across the street (directly east of the block; Sites 360.2-2, -3, -4). Ecology blocks, pipe, spools of wire, and timbers were observed in the fenced area. <u>Acquisition Plan:</u> The block has been acquired by WSDOT. A Phase I ESA was conducted before the property was purchased.
Photo Description: Looking north at fenced parking lot.	

BLOCK NO. 360.2	**Bounding Streets:** S. King Street, First Avenue S., and Railroad Way S.
	Property Description: A multistory building is under construction in this block. <u>Acquisition Plan:</u> No. Tiebacks would be installed in the right-of-way along the east and north sides of the block. Block 360.2 is located adjacent to the WSDOT property (Block 360.15).
Photo Description: Looking northeast at construction area.	

BLOCK NO. 360.3	**Bounding Streets:** S. King Street, Occidental Avenue S., Railroad Way S., and First Avenue S.
	Property Description: Block 360.3 is located northeast of the intersection of S. Dearborn Street and First Avenue S. It is a mix of newer and old buildings (four stories). Good housekeeping practices were evident outside these buildings. <u>Acquisition Plan:</u> Tiebacks would be installed in the right-of-way along the west and north sides of the block.
Photo Description: Looking southeast at mix of new and old brick buildings, retail, and residential.	

BLOCK NO. 370.1	**Bounding Streets:** S. Dearborn Street, First Avenue S., S. Royal Brougham Way, and East Frontage Road.
 Photo Description: Looking northwest at asphalt patches (2008). **Photo Description:** Looking northeast at area of known petroleum contamination (2009).	**Property Description:** Formerly known as the WOSCA and Gerry Sportswear sites. Unpaved and paved parking areas are located in the west and middle portions of the block. One building is located along the east side of the block adjacent to First Avenue S. Rail lines that trend north-south are located on the west edge of the property. A fenced area approximately midblock along the western edge of the property is used to store investigation-derived waste from the project's geotechnical exploration program. The northeast area of the block was fenced and could not be directly observed. The following information is from a 2008 survey performed before the removal of the WOSCA warehouse formerly in the northeastern part of the block. Storm drains trending north-south are located in the parking area west of the (former) buildings. Monitoring wells for the project are located in the parking area. A monitoring well that did not appear to be associated with the project was located about 50 feet west of the (former) WOSCA warehouse, approximately midblock. Asphalt patches trend north-south and appear to be a result of subsidence along a utility line. <u>Acquisition Plan:</u> Full. WSDOT has acquired the property for the project. Phase I and Phase II ESAs were conducted before acquisition. Localized petroleum contamination has been documented at the northwest end of the Gerry Sportswear Building (see Section 3.7, Environmental Site Assessments and Hazardous Material Survey).

BLOCK NO. 370.2	**Bounding Streets:** Railroad Way S., Occidental Avenue S., S. Royal Brougham Way, and First Avenue S.
	**Property Description:** The block is a mix of new buildings and older brick buildings. Good housekeeping practices were evident outside of the buildings. <u>Acquisition Plan:</u> No. The block is located one block east of the project area.
Photo Description: Looking north-northeast at older brick buildings.	

BLOCK NOS. 370.1–380.2 (West Side of Blocks)	**Bounding Streets:** S. Dearborn Street, First Avenue S., S. Atlantic Street, and Alaskan Way S.
	Property Description: A bike path is located directly east of Alaskan Way S.; farther east is a rail line. Three observation wells for the project are located along the bike path. Storm drains are located on the west side of East Frontage Road located beneath the elevated section of the viaduct. The area underneath the viaduct is used for parking, and numerous small stains were observed, most likely associated with oil dripping from parked cars. Storm drain pipes from the upper roadway are attached to support columns and penetrate the ground surface. It is assumed that they connect with the storm drainage system. <u>Acquisition Plan:</u> Right-of-way is owned by WSDOT and/or the City.
Photo Description: Looking south along the west fence line of Block 370.1.	

BLOCK NOS. 370.1–380.2 (West Side of Blocks) [continued]	**Bounding Streets:** S. Dearborn Street, S. Atlantic Street, and Alaskan Way S.
Photo Description: Looking south at unpaved area under the viaduct, adjacent to the west rail line.	**Photo Description:** Looking south at paved area under the viaduct, adjacent to the west rail line.

BLOCK NO. 380.1	**Bounding Streets:** Terminal 46 (S. Royal Brougham Way), Alaskan Way S., Terminal 46 (S. Atlantic Street), and Elliott Bay.
	Property Description: The block is occupied by Terminal 46, a paved container terminal. A single-track rail line is located between the sidewalk on the west side of Alaskan Way S. and the terminal fence. Storm drains are visible on the east side of the tarmac. <u>Acquisition Plan:</u> No. The block is located adjacent to the west side of the project area.
Photo Description: Looking south-southwest at container transfer area.	

BLOCK NOS. 380.2 AND 380.3	**Bounding Streets:** S. Royal Brougham Way, First Avenue S., S. Atlantic Street, and railroad tracks.
	Property Description: The east side of the property (Block 380.3) is occupied by buildings for Great Floors and the Pyramid Ale House. Good housekeeping practices were evident outside of these buildings. The area west of these building is paved. A warehouse is located on the south end of Block 380.2. Paved and unpaved areas west of the warehouse have been leased by a construction company. Two rail lines are located between the parking lot and Alaskan Way S. <u>Acquisition Plan:</u> Partial. WSDOT has acquired the west side of Block 380.2. An additional strip of land through the central portion (north-south) of Block 380.2 would be acquired.
Photo Description: Looking north-northeast at construction laydown yard west of warehouse (Block 380.2).	

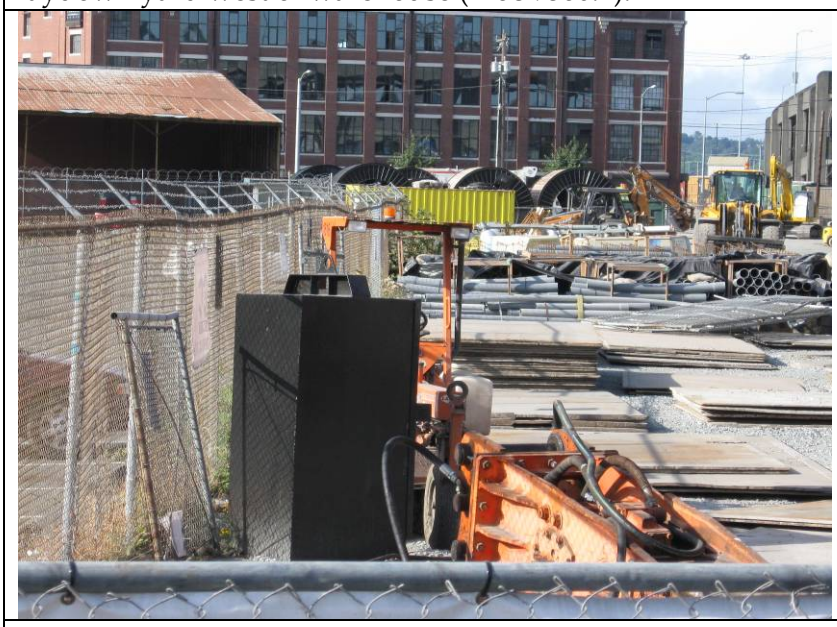



Photo Description: Looking south at construction laydown yard west of warehouse (Block 380.2).	

BLOCK NO. 40.1	**Bounding Streets:** Mercer Street, Aurora Avenue, Republican Street, and Sixth Avenue N.
	Property Description: A metal building is located in the northeastern part of the block, and the rest of the block is part of a large multi-building construction project that also encompasses Blocks 40.05, 50.02, and 50.05. <u>Acquisition Plan:</u> Partial acquisition and permanent tieback easement. Different acquisitions would apply to the Sixth Avenue N. options. A strip of land in the far northeast part of the block, adjacent to Aurora Avenue, would be acquired for the Curved Sixth Avenue option. A straight segment that aligns with Sixth Avenue N. would be acquired for the Straight Sixth Avenue option.
Photo Description: Looking southwest at vacant land in far northeast area of Block 40.1.	

BLOCK NO. 40.2	**Bounding Streets:** Mercer Street, Dexter Avenue N., Republican Street, and Aurora Avenue.
	Property Description: The west half of the block, from south to north, is occupied by a multistory building (School of Visual Concepts), a paved parking lot, and a small park. The parking lot has a large patched area, possibly indicating a previous excavation. Two stores in buildings on the east side of the block have vent pipes on the west building walls, indicating the likely presence of USTs. <u>Acquisition Plan:</u> A permanent tieback easement would be acquired along Republican Street.
Photo Description: Looking north along the west side of Block 40.2 at the School of Visual Concepts building.	

BLOCK NO. 40.2 (continued)	

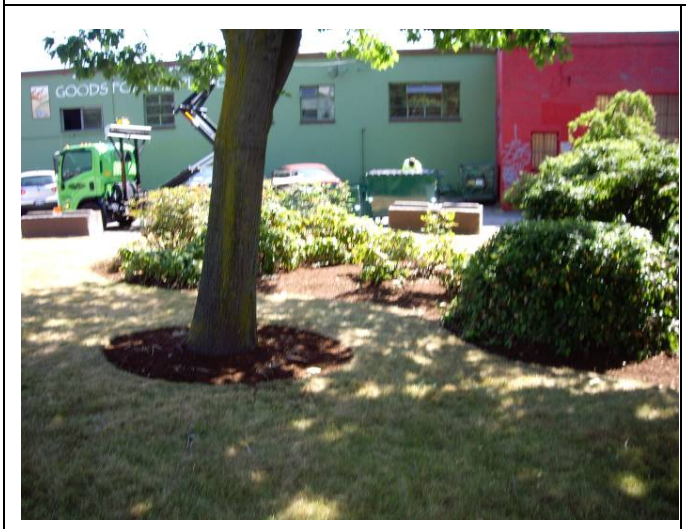
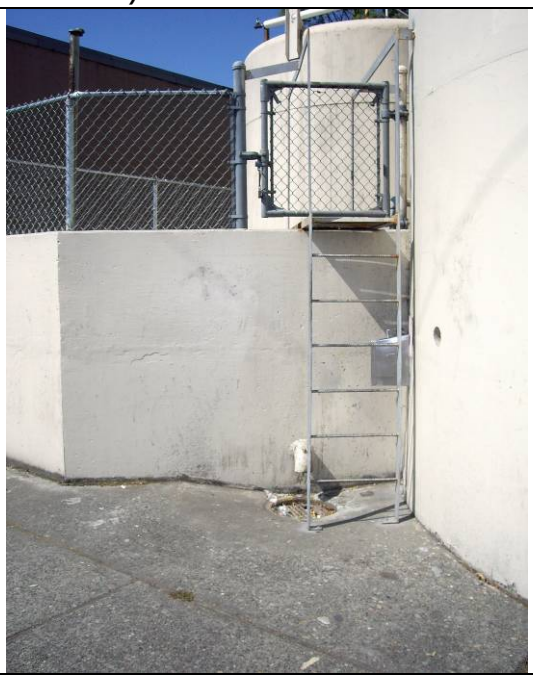



Photo Description: Looking east across park in northwest block area toward store facing Dexter Avenue N. Vent pipe on west wall (green building) is near the middle of the photo.	**Photo Description:** Looking east-northeast across parking lot north of school, showing patched area in asphalt paving.

BLOCK NO. 50.05	**Bounding Streets:** Broad Street and Harrison Street.
	Property Description: Construction of future Gates Foundation building. <u>Acquisition Plan:</u> No. Block 50.05 is located adjacent to the west side of the project area.
Photo Description: Looking northwest at construction of Gates Foundation building.	

BLOCK NO. 50.1	**Bounding Streets:** Republican Street, Aurora Avenue, Harrison Street, and Sixth Avenue N.
	Property Description: An unpaved, fenced parking area occupies the southern part of the block, and the north area is used by Seattle Department of Transportation for materials storage (e.g., sand, gravel, and broken concrete pavement). An equipment storage shed is located in the northeastern area. <u>Acquisition Plan:</u> The entire block would be acquired. Block 50.1 is currently owned by the City. Retained cuts for ramps are planned.
Photo Description: Looking northeast at storage area for road maintenance materials.	

BLOCK NO. 50.2	**Bounding Streets:** Republican Street, Dexter Avenue N., Harrison Street, and Aurora Avenue N.
	Property Description: Hostess Bakery occupies most of the north half of the block. A parking lot and office building occupy the southwestern area. A printing company occupies a building in the southeastern area (toward Dexter Avenue N.). <u>Acquisition Plan:</u> No. Block 50.2 is located adjacent to the east side of the project area. The northwest corner may require a temporary tieback. Based on historical land use, no site has been identified in the area that would have the tieback.
Photo Description: Looking north-northeast across a paved parking lot toward an office building in the southwestern part of the block.	

BLOCK NO. 50.2 (continued)	
	
Photo Description: Two aboveground storage tanks in secondary containment on east side of Hostess building (toward Dexter Avenue N.).	**Photo Description:** Apparent overflow pipe from secondary containment to a drain.

BLOCK NO. 60.2	**Bounding Streets:** Harrison Street, Sixth Avenue N., Thomas Street, and Taylor Avenue N.
Property Description: Seattle City Light building (northeast corner of block) and substation facility. <u>Acquisition Plan:</u> A temporary tieback easement would be acquired along the east side of the block adjacent to Sixth Avenue N.	
Photo Description: Looking west across Sixth Avenue N. at Seattle City Light building.	**Photo Description:** Looking southeast at substation.

BLOCK NO. 60.3	**Bounding Streets:** Harrison Street, Aurora Avenue N. Thomas Street, and Sixth Avenue N.
	Property Description: The following were observed on this block: Northeast: Seattle Pacific Hotel (former Vagabond Inn). Southeast: Temporary fire station. Southwest: Paved parking lot. Northwest: Multistory office building. The former Vagabond Inn site has known solvent contamination in soil and groundwater. It is unknown whether contaminants have migrated off site. The owner is pursuing a Brownfields loan through the EPA (2009) to install a remediation system. <u>Acquisition Plan:</u> The west half of the block would be acquired for the project; a temporary tieback easement encompassing the east half of the block would be acquired, including the former Vagabond Inn site.
Photo Description: Looking southeast at Seattle Pacific Hotel (former Vagabond Inn); two monitoring wells are shown in the parking area. Another is in Harrison Street north of where this photo was taken.	
Photo Description: Looking northeast at temporary fire station.	

BLOCK NO. 60.3 (continued)

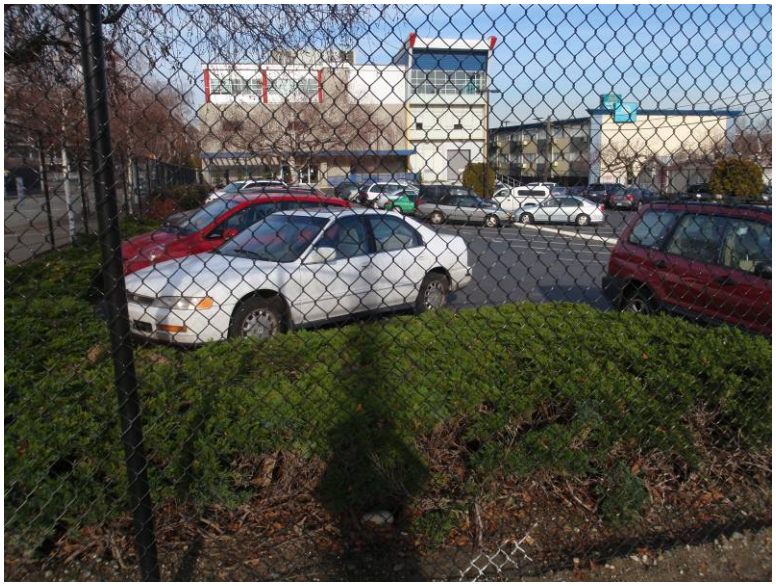


Photo Description: Looking north at parking lot on southwest corner of Block 60.3.

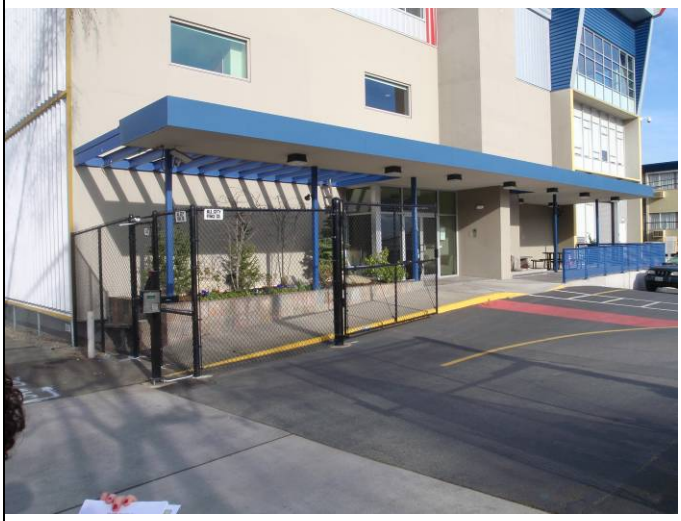


Photo Description: Looking northeast at multistory office building.

Photo Description: Looking south at emergency generator on north end of multistory office building property.

BLOCK NO. 60.4	**Bounding Streets:** Harrison Street, Dexter Avenue N., Thomas Street, and Aurora Avenue.
	Property Description: The block is occupied by a large building (King Broadcasting Company). Two vent pipes, typically associated with USTs or aboveground storage tanks, protrude through the building's west wall. <u>Acquisition Plan:</u> A permanent tieback easement would be acquired. The block is located on the east side of the project area.
Photo Description: Vent pipes through west building wall.	

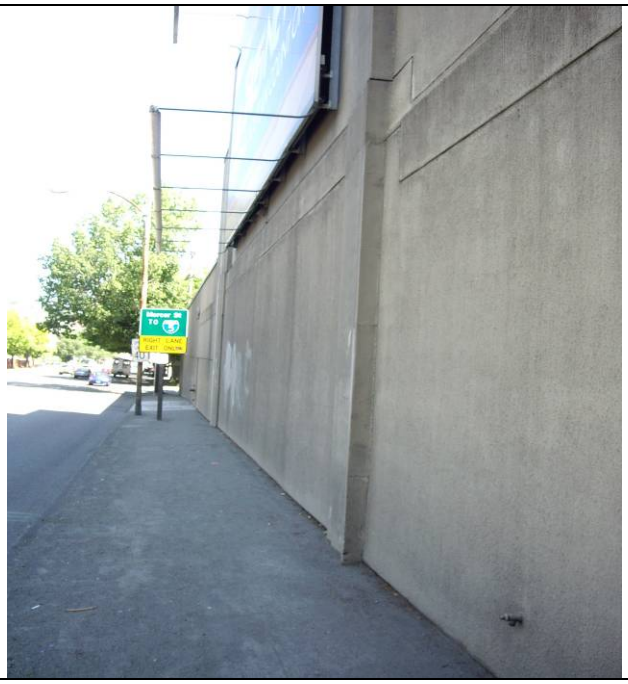



Photo Description: Looking north along west building wall; Aurora Avenue is to the left.	

BLOCK NO. 70.3	**Bounding Streets:** Thomas Street, Sixth Avenue N., John Street, and Taylor Avenue N.
  Photo Description: Looking south at the Best Western Hotel on the northwest corner of Block 70.3.	**Property Description:** Two multistory office buildings and associated parking lots were observed on the east half of the block. One capped vent pipe, typically associated with USTs, was observed south of the multistory office building on the southeast corner of Block 70.3. The Best Western Hotel building, outbuilding, and parking lot were observed on the west half of the block. The outbuilding on the south boundary of the Best Western property may house a boiler room/large heating system. <u>Acquisition Plan:</u> A subsurface easement would be acquired in the southeastern part of the block. Block 70.3 is located adjacent to the west side of the project area.
  Photo Description: Looking northeast at Best Western Hotel from the southeast corner of Block 70.3.	

BLOCK NO. 70.3 (continued)

Photo Description: Looking southeast at the outbuilding from Best Western parking lot.

Photo Description: Looking north at capped vent pipe on southwest corner of the office building on the southeast corner of Block 70.3.

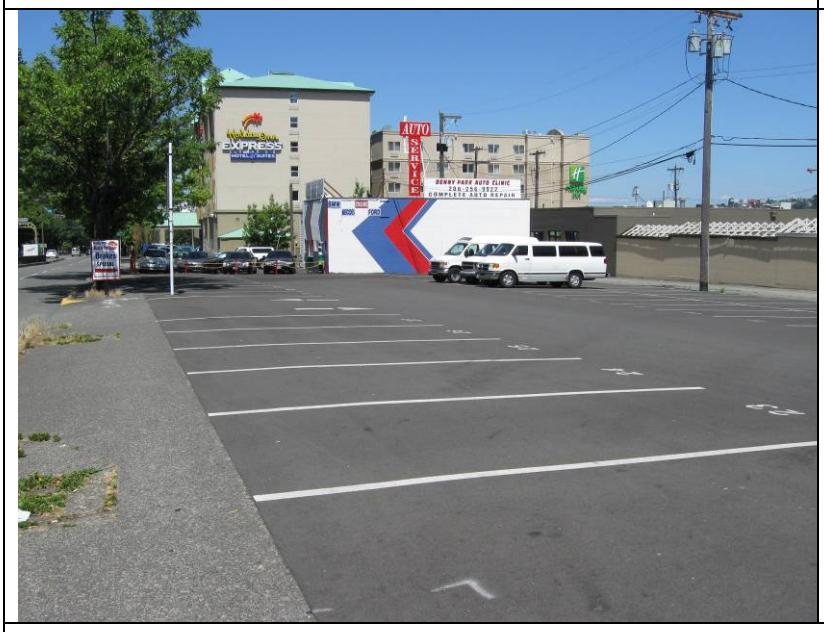
Photo Description: Looking northwest at the office building on the southeast corner of Block 70.3 (tenant: Space Needle Corporation).

Photo Description: Looking southwest at the office building on the northeast corner of Block 70.3 (tenant: Arc of King County).

BLOCK NO. 70.4	**Bounding Streets:** Thomas Street, Aurora Avenue, John Street, and Sixth Avenue N.
	Property Description: Quality Inn occupies the entire east half of the block. Land uses on the west half of the block, south to north, include a parking lot, Travelodge hotel, a law office/restaurant, and an apartment building. <u>Acquisition Plan:</u> Subsurface easements would be acquired below the west half of the block; temporary construction and tieback easements would be acquired in the northwest area. Block 70.4 is located on the east side of the project area.
Photo Description: Looking north along the east side of Quality Inn.	
Photo Description: Looking east at law office/restaurant building on the northwest corner of Block 70.4 (from across Sixth Avenue N.). The multistory apartment building is in the background.	**Photo Description:** Looking northeast at the Travelodge hotel on the southwest corner of Block 70.4 (from across Sixth Avenue N.).

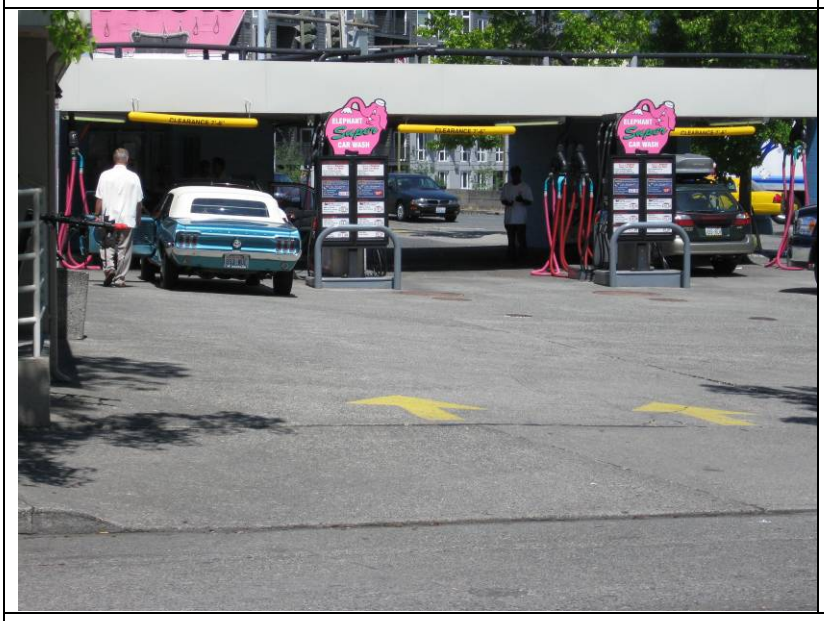
BLOCK NO. 70.5	**Bounding Streets:** Thomas Street, Dexter Avenue N., John Street, and Aurora Avenue.
	Property Description: Holiday Inn Express occupies most of the block (middle section). Businesses on the northeast and northwest parcels are occupied by Speedy Glass and Publishers Mailing Service, respectively. <u>Acquisition Plan:</u> No. The block is located east of Aurora Avenue.
Photo Description: Looking east-northeast at an office building on the southeast corner of the block.	

BLOCK NO. 80.5	**Bounding Streets:** John Street, Aurora Avenue, Denny Way, and Sixth Avenue N.
	Property Description: Land uses observed (starting at the southeast corner and proceeding clockwise) include a Shell station, a multistory building under construction (Hyatt Place), a multistory office building, and a multistory apartment building (Marcelle Apartments). <u>Acquisition Plan:</u> No. The block is located adjacent to the east side of the project area.
Photo Description: Looking northeast at Shell station on the southeast corner of the block; the Marcelle Apartments building is in the background.	

BLOCK NO. 80.6	**Bounding Streets:** John Street, Dexter Avenue N., Denny Way, and Aurora Avenue.
	**Property Description:** Businesses on this block include Denny Park Auto Clinic (northwest) and Willamette Dental (east). <u>Acquisition Plan:</u> No. The block is located east of Aurora Avenue.
Photo Description: Looking north across parking lot (location of a temporary construction easement).	
Photo Description: Looking south at Denny Park Auto Clinic.	

BLOCK NO. 130.9	**Bounding Streets:** Denny Way, Wall Street, and Sixth Avenue.
	Property Description: A paved parking lot occupies the triangular block. The asphalt surfacing has numerous patches, and drummed drill cuttings are stored at the northwest corner of the block. <u>Acquisition Plan:</u> No. The block is located adjacent to the east side of the project area.
Photo Description: Looking east across parking lot; drummed drill cuttings are in the foreground.	

BLOCK NO. 140.9	**Bounding Streets:** Aurora Avenue, Sixth Avenue, and Wall Street.
	Property Description: The block is a triangular parcel adjacent to (west of) the merging of Battery Street and Aurora Avenue. A paved parking lot occupies the south area. Features observed across the north end of the block include a concrete drive and a monitoring well. <u>Acquisition Plan:</u> No. The block is located east of the project area.
Photo Description: Looking south across parking lot.	

BLOCK NO. 141.1	**Bounding Streets:** Seventh Avenue, Battery Street, and Aurora Avenue.
	**Property Description:** The block is a triangular parcel adjacent to (east of) the merging of Battery Street and Aurora Avenue. The Elephant Car Wash and a (former) gas station occupy the block. <u>Acquisition Plan:</u> No. The block is located east of the project area.
Photo Description: Looking northwest at car wash; three sets of covers in the driveway appear to be associated with USTs.	

BLOCK NO. 141.2	**Bounding Streets:** Denny Way, Dexter Avenue, and Seventh Avenue.
	Property Description: The block is a triangular parcel adjacent to (east of) the project area. A paved parking lot is presently at this location. <u>Acquisition Plan:</u> No.
Photo Description: Looking north at parking lot.	

ATTACHMENT F

Analytical Data

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Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

Boring	Depth	Sample ID	Date Sampled	Metals EPA 6000 and 7000 series	PAHs EPA 8270CSIM	PCBs EPA 8082	Hydrocarbon Identification NWTPH-HCID	Diesel and Oil NWTPH-Dx	Gasoline NWTPH-Gx	TCLP Metals TCLP-EPA 6010	VOCs EPA 8260B
South Portal Area											
AH-11	9	AH-11-R1-9	6/14/2007	X		X		X	X	X	X
AH-13	10	AH-13-R1-10	6/15/2007	X		X		X	X		X
AH-14	8	AH-14-R1-8	6/18/2007	X	X	X		X	X	X	X
AH-16	9.5	AH-16-R1-9.5	6/19/2007	X	X	X		X	X		X
AH-18	8	AH-18-R1-8	6/19/2007	X	X	X					
AH-20	9	AH-20-R1-9	6/20/2007	X	X	X		X			
AH-22	9	AH-22-R1-9	6/21/2007	X	X		X	X			X
AH-22	18.5	AH-22-R2-18.5	7/11/2007	X	X			X	X	X	X
AH-23	17	AH-23-R2-17	6/22/2007		X	X	X	X			X
AH-28	9	AH-28-R2-9	5/14/2007	X	X				X		X
AH-28	20.5	AH-28-R3-20.5	5/14/2007	X	X				X		X
AH-29	6.5	AH-29-R1-6.5	5/16/2007	X	X			X	X		X
AH-3	9	AH-3-R1-9	6/8/2007	X		X		X			X
AH-30	10	AH-30-R1-10	5/16/2007	X			X	X			
AH-31	8.5	AH-31-R1-8.5	5/16/2007	X	X			X	X		X
AH-33	8.5	AH-33-R1-8.5	5/23/2007	X		X		X			
AH-35	7	AH-35-R1-7	5/18/2007	X		X		X			
AH-37	6.5	AH-37-R1-6.5	5/17/2007	X		X		X			
AH-38	10	AH-38-R2-10	6/6/2007	X	X	X		X	X		X
AH-39	8.5	AH-39-R1-8.5	5/22/2007						X		X
AH-41	9	AH-41-R1-9	5/21/2007	X		X		X	X		X
AH-5	7	AH-5-R1-7	6/11/2007	X		X		X		X	X
AH-7	10.5	AH-7-R2-10.5	6/12/2007	X		X		X		X	X
AH-9	10	AH-9-R2-10	6/13/2007	X		X		X		X	X
CB-109	3.7	CB-109-S2-3.7	8/2/2006	X			X	X			
CB-109	7.5	CB-109-S4-7.5	8/2/2006	X			X	X			X
CB-109	25	CB-109-S11-25	8/3/2006	X			X	X			

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
CB-109	37.5	CB-109-S15-37.5	8/3/2006	X			X	X			
CB-110	3	CB-110-S1-3.0	9/15/2006	X		X	X	X			
CB-110	28	CB-110-S10-28.0	9/18/2006	X			X	X			
CB-110	32	CB-110-S11-32.0	9/18/2006	X			X	X			
CB-27A	5	CB-27A-S3A-5	2/18/2005					X			
CB-27A	7.5	CB-27A-S1-7.5	2/23/2005	X			X	X			X
CB-27A	12.5	CB-27A-S3-12.5	2/23/2005	X			X	X			X
CB-27A	17.5	CB-27A-S5-17.5	2/23/2005	X			X	X			X
CB-30A	10	CB-30A-S2-10	11/30/2004	X							
CB-31	2.5	CB-31-S1B-2.5	3/3/2005	X						X	
CB-31	22.5	CB-31-S7-22.5	3/9/2005	X							
CB-34A	2.5	CB-34A-S1A-2.5	12/1/2004	X						X	
CB-34A	10	CB-34A-S2-10	12/6/2004	X							
CB-34A	20	CB-34A-S6-20	12/6/2004	X							
CB-34A	25	CB-34A-S7-25	12/6/2004	X							
CB-35A	2.5	CB-35A-S1A-2.5	2/17/2005	X						X	X
CB-35A	8	CB-35A-S1-8	2/18/2005	X							X
CB-35A	12.5	CB-35A-S3-12.5	2/18/2005	X							
CB-36A	2.5	CB-36A-S1A-2.5	3/3/2005	X						X	X
CB-36A	10	CB-36A-S2-10	3/4/2005	X	X					X	X
CB-37A	2.5	CB-37A-S1A-2.5	2/15/2005	X							X
CB-37A	8	CB-37A-S1-8	2/17/2005	X				X	X	X	X
CB-37A	15	CB-37A-S4-15	2/17/2005	X				X			
CB-37A	20	CB-37A-S6-20	2/17/2005	X							
CB-38A	2.5	CB-38A-S1A-2.5	12/2/2004	X							
CB-38A	3	CB-38A-S1B-3	12/2/2004	X							
CB-38A	10	CB-38A-S1-10	12/9/2004	X							
CB-38A	17.5	CB-38A-S4-17.5	12/9/2004	X							

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
CB-40A	2.5	CB-40A-S1A-2.5	2/21/2005	X						X	
CB-40A	3	CB-40A-S1A-3	2/21/2005	X							
CB-40A	10	CB-40A-S2-10	3/22/2005	X							
CB-40A	15	CB-40A-S4-15	3/22/2005	X							
CB-40A	25	CB-40A-S7-25	3/22/2005	X							
CB-40A	30	CB-40A-S8-30	3/22/2005	X							
CB-41A	2.5	CB-41A-S1A-2.5	3/3/2005	X							X
CB-41A	7.5	CB-41A-S1-7.5	3/7/2005	X						X	X
CB-42A	2.5	CB-42A-S1A-2.5	12/14/2004	X							
CB-42A	10	CB-42A-S1-10	12/14/2004	X							
CB-43A	2.4	CB-43A-S1A-2.4	2/15/2005	X						X	X
CB-43A	10	CB-43A-S2-10	2/15/2005	X							X
EB-16A	6.5	EB-16A-S2-6.5	3/27/2002	X			X				
EB-16A	7	EB-16A-S2-7	3/27/2002	X			X				
EB-16A	20	EB-16A-S9-20	3/27/2002	X			X				
EB-16B	37	EB-16B-S11-37	4/1/2002	X							
GP-310	9.5	GP-310-R3-9.5	8/21/2007	X	X		X	X			X
GP-311	1	GP-311-R1-1	8/21/2007	X	X		X	X		X	X
GP-312	9.5	GP-312-R3-9.5	8/21/2007	X	X		X	X			X
GP-313	6	GP-313-R2-6	8/21/2007	X	X		X	X			X
GP-314	2	GP-314-R1-2	8/21/2007	X	X	X	X	X		X	X
GP-315	8	GP-315-R3-8	8/21/2007	X	X		X	X			X
GP-316	12.5	GP-316-R4-12.5	8/23/2007	X	X		X	X			X
GP-317	7	GP-317-R2-7	8/23/2007	X	X		X	X			X
GP-318	6	GP-318-R2-6	8/23/2007	X	X	X	X	X			X
GP-319	9	GP-319-R3-9	8/23/2007	X	X		X	X			X
GP-320	6.5	GP-320-R2-6.5	8/23/2007	X	X		X	X			X
GP-321	6	GP-321-R2-6	8/23/2007	X	X	X	X	X		X	X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
GP-322	6.5	GP-322-R2-6.5	8/23/2007	X	X		X	X			X
GP-5	7	GP-5-S2-7.0	1/23/2006	X				X			
GP-6	5	GP-6-S2-5.0	1/24/2006	X				X			
GP-7	5.5	GP-7-S2-5.5	1/24/2006	X				X			
GP-7	9	GP-7-S3-9.0	1/24/2006					X			X
IB-1	2	IB-1-S1B-2	1/24/2006	X							
IB-1	10	IB-1-S1-10	2/2/2005	X							
IB-106	9	IB-106-S3-9.0	6/22/2006	X			X	X			
IB-200	10.5	IB-200-S1-10.5	5/21/2008	X	X		X				X
IB-200	22	IB-200-S2-22	5/22/2008	X	X		X				X
IB-201	0.8	IB-201-S1-0.8	5/8/2008	X	X	X	X	X		X	X
IB-201	10	IB-201-S5-10	5/23/2008	X	X		X				X
IB-201	22.5	IB-201-S10-22.5	5/23/2008	X	X		X				X
IB-202	20	IB-202-S6-20	3/27/2008	X	X		X				X
IB-202	30	IB-202-S9-30	3/27/2008	X	X		X				X
IB-203	10	IB-203-S1-10	5/8/2008	X	X		X				X
IB-203	20	IB-203-S2-20	5/8/2008	X	X		X				X
IB-204	10	IB-204-S1-10	5/7/2008	X	X		X				X
IB-204	20	IB-204-S2-20	5/7/2008	X	X		X				X
IB-205	23	IB-205-S9-23	3/25/2008	X	X		X				X
IB-205	31	IB-205-S11-31	3/25/2008	X	X		X				X
IB-206	9	IB-206-S3-9	3/21/2008	X	X		X				X
IB-206	24	IB-206-S9-24	3/21/2008	X	X		X				X
IB-207	10	IB-207-S4-10	3/19/2008	X	X		X				X
IB-207	23	IB-207-S9-23	3/19/2008	X	X		X				X
IB-208	10	IB-208-S4-10	3/17/2008	X	X		X				X
IB-208	20	IB-208-S8-20	3/17/2008	X	X		X				X
IB-209	9	IB-209-S3-9	3/12/2008	X	X		X				X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
IB-209	28	IB-209-S11-28	3/12/2008	X	X		X				X
IB-210	11	IB-210-S4-11	3/11/2008	X	X		X				X
IB-210	19	IB-210-S7-19	3/11/2008	X	X		X				X
IB-211	30	IB-211-S11-30	3/7/2008	X	X		X				X
IB-212	16	IB-212-S6-16	3/4/2008	X	X		X	X			X
IB-212	23	IB-212-S9-23	3/4/2008	X	X		X				X
IB-224	9.5	IB-224-10	3/20/2008	X	X		X				X
IB-224	24.5	IB-224-25	3/20/2008	X	X		X				X
IB-225	9.5	IB-225-10	3/20/2008	X	X		X				X
IB-225	22.5	IB-225-23	3/20/2008	X	X		X				X
IB-226	11.5	IB-226-12	3/17/2008	X	X		X				X
IB-226	17	IB-226-17.5	3/17/2008	X	X		X				X
IB-227	9.5	IB-227-10	3/17/2008	X	X		X				X
IB-227	19.5	IB-227-20	3/17/2008	X	X		X				X
IB-228	9.5	IB-228-10	3/17/2008	X	X		X				X
IB-228	19.5	IB-228-20	3/17/2008	X	X		X				X
IB-229	7.5	IB-229-8	3/17/2008	X	X		X				X
IB-229	19.5	IB-229-20	3/17/2008	X	X		X				X
IB-2A	6	IB-2A-S1A-6	12/20/2004	X							
IB-2A	6.5	IB-2A-S2A-6.5	12/20/2004	X							
IB-2A	10	IB-2A-S1-10	1/7/2005	X							X
IB-2A	17.5	IB-2A-S4-17.5	1/7/2005	X							
PW-250	1.8	PW-250:1.8	7/13/2009	X	X			X	X		X
PW-250	8.5	PW-250:8.5	7/13/2009	X	X			X	X		X
PW-252	7.5	PW-252:7.5	7/13/2009	X				X	X		X
TB-100	3	TB-100:3:1	3/10/2009	X				X	X	X	X
TB-100	3	TB-100:3:2	3/10/2009	X				X	X	X	X
TB-100	7.5	TB-100:7.5	3/30/2009	X				X	X	X	

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-100	20	TB-100:20.0	3/31/2009	X	X			X	X		
TB-100	35	TB-100:35.0	3/31/2009	X				X	X		
TB-101	1.1	TB-101:1.1	3/13/2009	X	X			X	X	X	
TB-101	2	TB-101:2	3/10/2009	X	X			X	X		X
TB-101	10	TB-101:10.0	3/23/2009	X	X			X	X		X
TB-101	17.5	TB-101:17.5	3/23/2009	X				X	X		
TB-101	30	TB-101:30.0	3/23/2009	X				X	X		
TB-102	3.5	TB-102:3.5	3/10/2009	X	X			X	X		X
TB-102	10	TB-102:10.0	3/25/2009	X	X			X	X		X
TB-102	22.5	TB-102:22.5	3/25/2009	X	X		X				
TB-102	32.5	TB-102:32.5	3/25/2009	X			X				
TB-200	7.7	TB-200:7.7	6/24/2009	X	X			X	X		X
TB-200	12.5	TB-200:12.5	7/13/2009	X				X	X		X
TB-200	17.5	TB-200:17.5	7/13/2009	X				X	X		X
TB-200	22.5	TB-200:22.5	7/13/2009	X				X	X		X
TB-201	2.5	TB-201:2.5	6/24/2009	X	X			X	X		X
TB-201	7.3	TB-201:7.3	6/24/2009	X	X			X	X		X
TB-201	10	TB-201:10	7/20/2009	X			X				X
TB-201	25	TB-201:25	7/20/2009	X	X		X				X
TB-201	35	TB-201:35	7/20/2009	X			X				X
TB-202	3	TB-202:3	6/15/2009	X	X			X	X		X
TB-202	8.5	TB-202:8.5	6/15/2009	X	X			X	X		X
TB-202	12.5	TB-202:12.5	7/1/2009	X				X	X		X
TB-202	30	TB-202:30	7/1/2009	X				X	X		X
TB-202	40	TB-202:40	7/1/2009	X				X	X		X
TB-202	50	TB-202:50	7/1/2009	X				X	X		X
TB-202	60	TB-202:60	7/1/2009	X				X	X		X
TB-203	5.5	TB-203:5.5	6/16/2009	X	X			X	X	X	X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-203	15	TB-203:15	7/6/2009	X				X	X		X
TB-203	25	TB-203:25	7/6/2009	X				X	X		X
TB-203	35	TB-203:35	7/6/2009	X				X	X		X
TB-204	6.2	TB-204:6.2	6/24/2009	X	X			X	X		X
TB-204	15	TB-204:15	7/21/2009	X	X			X	X		X
TB-204	25	TB-204:25	7/21/2009					X	X		X
TB-204	37	TB-204:37	7/21/2009					X	X		X
TB-205	2.7	TB-205:2.7	6/16/2009	X	X			X	X		X
TB-205	9.3	TB-205:9.3	6/16/2009	X				X	X		X
TB-205	12.5	TB-205:12.5	7/1/2009	X				X	X		X
TB-205	25	TB-205:25	7/1/2009	X				X	X		X
TB-205	35	TB-205:35	7/1/2009	X				X	X		X
TB-205	45	TB-205:45	7/1/2009	X				X	X		X
TB-206	7.7	TB-206:7.7	7/7/2009	X			X	X	X		X
TB-206	10	TB-206:10	7/21/2009	X				X	X		X
TB-206	17.5	TB-206:17.5	7/21/2009	X				X	X		X
TB-206	25	TB-206:25	7/21/2009	X				X	X		X
TB-206	37.5	TB-206:37.5	7/21/2009	X				X	X		X
TB-207	9.3	TB-207:9.3	6/15/2009	X	X			X	X		X
TB-207	15	TB-207:15	7/8/2009	X			X				X
TB-207	25	TB-207:25	7/8/2009	X	X			X	X		X
TB-207	35	TB-207:35	7/8/2009	X			X				X
TB-208	7.5	TB-208:7.5:1	7/8/2009	X			X				X
TB-208	7.5	TB-208:7.5:2	7/8/2009	X			X				X
TB-208	12.5	TB-208:12.5	7/16/2009	X			X				X
TB-208	20	TB-208:20	7/16/2009								X
TB-208	20	TB-208:20	7/16/2009	X			X				X
TB-208	37.5	TB-208:37.5	7/16/2009	X			X				X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-208	45	TB-208:45	7/16/2009	X			X				X
TB-208	55	TB-208:55	7/16/2009	X			X				X
TB-208	65	TB-208:65	7/16/2009	X			X				X
TB-209	7.5	TB-209:7.5:1	7/8/2009	X			X				X
TB-209	7.5	TB-209:7.5:2	7/8/2009	X			X				X
TB-209	10	TB-209:10	7/10/2009	X				X	X		X
TB-209	27.5	TB-209:27.5	7/10/2009	X				X	X		X
TB-209	37.5	TB-209:37.5	7/10/2009	X				X	X		X
TB-209	50	TB-209:50	7/10/2009	X			X				X
TB-209	60	TB-209:60	7/10/2009	X			X				X
TB-210	8	TB-210:8:1	7/10/2009	X				X	X		X
TB-210	8	TB-210:8:2	7/10/2009	X				X	X		X
TB-210	14.5	TB-210:14.5	7/15/2009	X			X				X
TB-210	24.5	TB-210:24.5	7/15/2009	X			X				X
TB-210	28	TB-210:28	7/15/2009	X			X				X
TB-210	31	TB-210:31	7/15/2009	X			X				X
TB-210	44.5	TB-210:44.5	7/15/2009	X			X				X
TB-210	59	TB-210:59	7/16/2009	X			X				X
TB-210	74.5	TB-210:74.5	7/16/2009	X			X				X
TB-211	5.3	TB-211:5.3	7/24/2009	X				X	X		X
TB-211	15	TB-211:15	8/3/2009	X			X				X
TB-211	22.5	TB-211:22.5	8/3/2009	X	X		X				X
TB-211	32.5	TB-211:32.5	8/3/2009	X			X				X
TB-211	40	TB-211:40	8/3/2009	X			X				X
TB-211	55	TB-211:55	8/3/2009	X			X				X
TB-211	65	TB-211:65	8/4/2009	X							X
TB-211	75	TB-211:75	8/4/2009	X							X
TB-211	75	TB-211:75	8/4/2009							X	

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-212	4.5	TB-212:4.5	7/22/2009	X			X				X
TB-212	7.5	TB-212:7.5	7/27/2009	X			X				X
TB-212	25	TB-212:25	7/27/2009	X	X		X				X
TB-212	37.5	TB-212:37.5	7/27/2009	X			X				X
TB-212	72.5	TB-212:72.5	7/28/2009	X							X
UB-1	8.5	UB-1-S4-8.5	12/1/2006	X			X	X			X
UB-100	20	UB-100-S8-20.0	10/9/2007	X	X		X	X			X
UB-100	70	UB-100-S19-70.0	10/10/2007	X	X		X	X			X
UB-101	7.5	UB-101-S3-7.5	9/14/2007	X	X		X	X			X
UB-101	72.5	UB-101-S21-72.5	9/17/2007	X	X		X	X			X
UB-112	7.5	UB-112-S3-7.5	8/30/2007	X	X	X		X	X		X
UB-2	18.5	UB-2-S6-18.5	11/30/2006	X			X	X			X
UB-203	10	UB-203-S4-10.0	8/27/2007	X	X		X	X			X
UB-203	40	UB-203-S12-40.0	8/27/2007	X	X		X	X			X
UB-204	10	UB-204-S4-10.0	8/27/2007	X	X		X	X			X
UB-204	40	UB-204-S12-40.0	8/27/2007	X	X		X	X			X
UB-205	7.5	UB-205-S3-7.5	8/28/2007	X	X		X	X			X
UB-205	40	UB-205-S12-40.0	8/28/2007	X	X		X	X			X
Tunnel											
BST-14	22.5	BST-14-S9-22.5	5/23/2006	X			X	X			X
BST-15	22.5	BST-15-S9-22.5	5/30/2006				X	X			
BST-15	22.5	BST-15-S9-22.5	5/31/2006	X							X
CB-106	3.5	CB-106-S1-3.5	10/2/2006	X			X	X		X	
CB-106	13	CB-106-S2-13.0	10/2/2006	X		X	X	X			
CB-106	19	CB-106-S3-19.0	10/2/2006	X			X	X			X
CB-106	29	CB-106-S4-29.0	10/2/2006	X			X	X			
CB-106	39	CB-106-S5-39.0	10/2/2006	X			X	X			
CB-107	3	CB-107-S1-3.0	9/21/2006	X			X	X			

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
CB-107	11	CB-107-S2-11.0	9/21/2006	X		X	X	X			
CB-107	17	CB-107-S3-17.0	9/21/2006	X			X	X			
CB-107	26	CB-107-S6-26.0	9/21/2006	X			X	X			
CB-107	38	CB-107-S9-38.0	9/21/2006	X			X	X			
CB-108	3	CB-108-S1-3.0	9/26/2006	X		X	X	X			
CB-108	13	CB-108-S2-13.0	9/27/2006	X							
CB-108	18	CB-108-S3-18.0	9/27/2006	X							
CB-108	21	CB-108-S4-21.0	9/27/2006	X							
CB-108	30	CB-108-S5-30.0	9/27/2006	X							
CB-112	3	CB-112-S1-3.0	9/12/2006	X			X	X			
CB-112	11	CB-112-S3-11.0	9/12/2006	X			X	X			X
CB-112	22.5	CB-112-S4-22.5	9/12/2006	X			X	X			
CB-112	27.5	CB-112-S4-27.5	9/12/2006	X		X	X	X		X	
CB-16A	7.5	CB-16A-S1-7.5	3/15/2005	X							X
CB-16A	17.5	CB-16A-S5-17.5	3/15/2005	X						X	X
CB-19A	10	CB-19A-S2-10	11/18/2004	X							X
CB-19A	14	CB-19A-S4-14	11/18/2004	X							X
CB-19A	35	CB-19A-S9-35	11/19/2004	X							X
CB-21A	15	CB-21A-S4-15.0	1/31/2005	X							
CB-21A	20	CB-21A-S7-20	1/31/2005	X						X	
CB-22A	3	CB-22A-S1A-3	3/23/2005	X						X	
CB-22A	10	CB-22A-S2-10	3/11/2005	X							X
CB-22A	17.5	CB-22A-S5-17.5	3/11/2005	X						X	X
CB-23A	10	CB-23A-S2-10	11/30/2004	X							
CB-23A	20	CB-23A-S6-20	11/30/2004	X							
CB-24A	7.5	CB-24A-S1-7.5	3/9/2006	X							
CB-24A	10	CB-24A-S2-10	3/9/2006	X						X	
CB-24A	20	CB-24A-S6-20	3/9/2006	X							

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
CB-25A	7.5	CB-25A-S1-7.5	11/23/2004	X							X
CB-25A	20	CB-25A-S6-20	11/23/2004	X							
CB-26A	12.5	CB-26A-S3-12.5	3/2/2005	X			X	X	X		X
CB-26A	17.5	CB-26A-S5-17.5	3/2/2005	X			X	X			
CB-28A	7.5	CB-28A-S1-7.5	11/30/2004	X							
CB-28A	15	CB-28A-S4-15	11/30/2004	X							
EB-10A	6	EB-10A-S1-6	3/19/2002	X			X			X	
EB-10A	9	EB-10A-S3-9	3/19/2002	X			X			X	X
EB-10A	26	EB-10A-S8-26	3/19/2002	X			X			X	X
EB-10B	47.5	EB-10B-S15-47.5	3/20/2002	X			X				
EB-18A	8.5	EB-18A-S2-8.5	4/5/2002	X			X				
EB-18A	20	EB-18A-S7-20	4/5/2002	X		X				X	
EB-18B	25	EB-18B-S10-25	4/8/2002	X				X			
GP-10	6.5	GP-10-S3-6.5	1/27/2006					X			X
GP-10	9.5	GP-10-S5-9.5	1/27/2006	X				X		X	X
GP-100	3	GP-100-S1-3.0	11/16/2006	X			X	X			X
GP-100	15	GP-100-S6-15.0	11/17/2006	X			X	X			X
GP-11	5	GP-11-S3-5.0	1/26/2006					X			X
GP-11	9	GP-11-S5-9.0	1/26/2006	X				X			X
GP-12	5.5	GP-12-S3-5.5	1/27/2006	X				X			X
GP-12	10	GP-12-S5-10.0	1/27/2006					X			X
GP-13	6	GP-13-S3-6.0	1/26/2006	X		X		X			X
GP-13	10	GP-13-S5-10.0	1/26/2006					X			X
GP-201	5.5	GP-201-S2-5.5	5/11/2007	X	X	X		X	X		X
GP-202	5.5	GP-202-S2-5.5	5/11/2007	X	X	X		X	X		X
GP-203	6.1	GP-203-S2-6.1	5/11/2007	X	X	X		X	X		X
GP-204	5.7	GP-204-S2-5.7	5/11/2007	X	X	X		X	X		X
GP-205	6	GP-205-S2-6	5/10/2007	X	X	X		X	X		X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
GP-206	6.5	GP-206-S2-6.5	5/10/2007	X	X	X		X	X		X
GP-207	6	GP-207-S2-6	5/10/2007	X	X	X		X	X		X
GP-208	9.1	GP-208-S2-9.1	5/10/2007	X	X	X		X	X		X
GP-8	5.5	GP-8-S2-5.5	1/24/2006					X			X
GP-8	11	GP-8-S5-11.0	1/24/2006	X				X			X
GP-9	5	GP-9-S3-5.0	1/25/2006	X				X			X
GP-9	13	GP-9-S7-13.0	1/25/2006					X			X
TB-107	177	TB-107:177	4/3/2009	X			X				X
TB-107	198	TB-107:198	4/3/2009	X							X
TB-107	220	TB-107:220	4/6/2009	X							X
TB-108	190	TB-108:190	4/8/2009	X							X
TB-108	225	TB-108:225	4/9/2009	X							X
TB-109	223	TB-109:223	4/17/2009	X							X
TB-109	264	TB-109:264	4/23/2009	X							X
TB-110	235	TB-110:235	4/7/2009	X							X
TB-111	242	TB-111:242	3/13/2009	X							X
TB-111	273.8	TB-111:273.8:1	3/13/2009	X							X
TB-111	273.8	TB-111:273.8:2	3/13/2009	X							X
TB-220	114.8	TB-220:114.8:1	10/6/2009	X							X
TB-220	114.8	TB-220:114.8:2	10/6/2009	X							X
TB-220	144.8	TB-220:144.8	10/7/2009	X							X
TB-221	7	TB-221:7	7/6/2009								X
TB-221	15	TB-221:15	8/4/2009								X
TB-221	25	TB-221:25	8/4/2009								X
TB-221	85	TB-221:85	8/6/2009	X							X
TB-221	155	TB-221:155	8/13/2009	X							X
TB-222	14.6	TB-222:14.6	9/11/2009								X
TB-222	24.5	TB-222:24.5	9/11/2009								X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-222	134.6	TB-222:134.6	9/15/2009	X							X
TB-222	150	TB-222:150.0	9/16/2009	X							X
TB-223	13	TB-223:13	8/11/2009								X
TB-223	21	TB-223:21	8/11/2009								X
TB-223	154.8	TB-223:154.8	8/17/2009	X							X
TB-223	199.5	TB-223:199.5	8/21/2009	X							X
TB-224	20	TB-224:20	2/16/2010								X
TB-224	30	TB-224:30	2/16/2010								X
TB-224	198.5	TB-224:198.5	2/23/2010	X							X
TB-224	237.5	TB-224:237.5:1	2/25/2010	X							X
TB-224	237.5	TB-224:237.5:2	2/25/2010	X							X
TB-225	9.5	TB-225:9.5	9/21/2009								X
TB-225	38	TB-225:38	9/21/2009								X
TB-225	193	TB-225:193	9/24/2009	X							X
TB-225	214.5	TB-225:221:2	9/25/2009	X							X
TB-225	221	TB-225:221:1	9/25/2009	X							X
TB-226	189.5	TB-226:189.5	9/17/2009	X							X
TB-226	230.5	TB-226:230.5	9/19/2009	X							X
TB-227	12.5	TB-227:12.5	8/31/2009	X				X	X		X
TB-227	22.5	TB-227:22.5	8/31/2009				X				X
TB-227	214.9	TB-227:214.9	9/3/2009	X							X
TB-227	234.9	TB-227:234.9	9/3/2009	X							X
TB-305	20.5	TB-305:20.5	12/15/2009								X
TB-305	30	TB-305:30	12/15/2009								X
TB-305	89.5	TB-305:89.5	12/15/2009	X							X
TB-305	109.8	TB-305:109.8	12/16/2009	X							X
TB-306	25	TB-306:25	12/8/2009								X
TB-306	35	TB-306:35	12/8/2009								X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-306	100	TB-306:100	12/11/2009	X							X
TB-306	122.5	TB-306:122.5	12/14/2009	X							X
TB-307	46.5	TB-307:46.5	1/4/2010				X				X
TB-307	57	TB-307:57	1/4/2010								X
TB-307	109.7	TB-307:109.7	1/5/2010	X			X				X
TB-307	189.8	TB-307:189.8	1/7/2010	X							X
TB-308	20	TB-308:20.0	1/14/2010				X				X
TB-308	30	TB-308:30.0	1/14/2010								X
TB-308	115	TB-308:115	1/18/2010	X							X
TB-308	170	TB-308:170	1/21/2010	X							X
TB-309	14.5	TB-309:14.5	1/7/2010				X				X
TB-309	24.5	TB-309:24.5	1/7/2010								X
TB-309	119.5	TB-309:119.5	1/11/2010	X			X				X
TB-309	189.5	TB-309:189.5:1	1/14/2010	X							X
TB-309	189.5	TB-309:189.5:2	1/14/2010	X							X
TB-310	15	TB-310:15	1/27/2010								X
TB-310	25	TB-310:25	1/27/2010				X				X
TB-310	132.5	TB-310:132.5	1/29/2010	X							X
TB-310	182.5	TB-310:182.5	2/2/2010	X							X
TB-310	195	TB-310:195	2/3/2010	X							X
TB-311	21.5	TB-311:21.5	2/2/2010								X
TB-311	31.5	TB-311:31.5	2/2/2010								X
TB-311	149.5	TB-311:149.5:1	2/4/2010	X							X
TB-311	149.5	TB-311:149.5:2	2/4/2010	X							X
TB-311	204.5	TB-311:204.5	2/5/2010	X							X
TB-312	25	TB-312:25	1/11/2010								X
TB-312	40	TB-312:40	1/12/2010								X
TB-312	150	TB-312:150	1/15/2010	X							X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-312	187.5	TB-312:187.5	1/19/2010	X							X
TB-313	29.8	TB-313:29.8	1/12/2010								X
TB-313	39.8	TB-313:39.8	1/12/2010								X
TB-313	129.8	TB-313:129.8	1/13/2010								X
TB-313	169.8	TB-313:169.8	1/13/2010	X							X
TB-313	259.8	TB-313:259.8	1/19/2010	X							X
TB-314	6.3	TB-314:6.3	1/21/2010								X
TB-314	20	TB-314:20	2/1/2010								X
TB-314	225	TB-314:225	2/12/2010	X							X
TB-314	257.5	TB-314:257.5	2/16/2010	X							X
TB-315	15.5	TB-315:15.5	1/22/2010								X
TB-315	25.5	TB-315:25.5	1/22/2010								X
TB-315	119.5	TB-315:119.5:1	1/26/2010	X							X
TB-315	119.5	TB-315:119.5:2	1/26/2010	X							X
TB-315	189.5	TB-315:189.5	1/27/2010	X							X
TB-316	10	TB-316:10	1/26/2010								X
TB-316	30	TB-316:30	1/27/2010								X
TB-316	117.5	TB-316:117.5:1	2/1/2010	X							X
TB-316	117.5	TB-316:117.5:2	2/1/2010	X							X
TB-316	197.5	TB-316:197.5	2/8/2010	X							X
TB-317	12.5	TB-317:12.5	1/20/2010								X
TB-317	31.5	TB-317:31.5	1/20/2010								X
TB-317	124.5	TB-317:124.5	1/21/2010	X							X
TB-317	174.5	TB-317:174.5	1/22/2010	X							X
TB-318	30	TB-318:30	2/9/2010								X
TB-318	126	TB-318:126	2/15/2010	X							X
TB-318	172.5	TB-318:172.5	2/17/2010	X							X
TB-319	7.2	TB-319:7.2	1/27/2010				X				X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-319	9.5	TB-319:9.5	1/28/2010								X
TB-319	100	TB-319:100	1/29/2010	X							X
TB-319	149.5	TB-319:149.5	1/29/2010	X							X
TB-320	10	TB-320:10	2/9/2010	X	X		X				X
TB-320	30	TB-320:30	2/9/2010	X	X						X
TB-320	102.5	TB-320:102.5	2/12/2010	X							X
TB-320	146	TB-320:146:1	2/16/2010	X						X	X
TB-320	146	TB-320:146:2	2/16/2010	X						X	X
TB-320	157.5	TB-320:157.5	2/16/2010	X							X
TB-321	7	TB-321:7	1/27/2010				X				X
TB-321	40	TB-321:40	2/22/2010	X			X				X
TB-321	95	TB-321:95	2/24/2010	X							X
TB-321	117	TB-321:117	2/25/2010	X							X
TB-321	135	TB-321:135	2/26/2010	X							X
TB-322	7.5	TB-322:7.5	1/28/2010								X
TB-322	7.5	TB-322:7.5	1/28/2010	X	X		X				
TB-322	22.5	TB-322:22.5	2/3/2010	X	X		X			X	X
TB-322	34.5	TB-322:34.5	2/3/2010	X			X				X
TB-322	54.5	TB-322:54.5	2/3/2010	X			X				X
TB-322	84.5	TB-322:84.5	2/4/2010	X							X
TB-322	124.5	TB-322:124.5	2/4/2010	X							X
TB-323	25	TB-323:25	2/24/2010	X			X				X
TB-323	35	TB-323:35	2/24/2010		X						
TB-323	35	TB-323:35	2/25/2010	X			X				X
TB-323	75	TB-323:75	2/25/2010	X							X
TB-323	115	TB-323:115	2/26/2010	X							X
TB-324	8	TB-324:8.0	2/2/2010	X	X		X				X
TB-324	22.5	TB-324:22.5	2/2/2010	X			X				X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-324	22.5	TB-324:22.5	2/2/2010		X						
TB-324	69.5	TB-324:69.5	2/4/2010	X							X
TB-324	119.7	TB-324:119.7	2/8/2010	X							X
TB-325	2.7	TB-325:2.7	2/5/2010	X	X					X	X
TB-325	9.5	TB-325:9.5	2/9/2010	X	X		X			X	X
TB-325	19	TB-325:19	2/9/2010	X	X						X
TB-325	29	TB-325:29	2/9/2010	X							X
TB-325	44.5	TB-325:44.5	2/9/2010	X							X
TB-325	84.5	TB-325:84.5	2/9/2010	X							X
TB-326	9.5	TB-326:9.5	2/11/2010	X	X			X	X		X
TB-326	22.3	TB-326:22.3	2/12/2010	X	X			X	X		X
TB-326	22.3	TB-326:22.3	2/12/2010			X					
TB-326	27	TB-326:27.5:1	2/11/2010	X	X			X	X		X
TB-326	27	TB-326:27.5:2	2/11/2010	X	X			X	X		X
TB-326	39.5	TB-326:39.5	2/11/2010	X	X			X	X		X
TB-326	49.5	TB-326:49.5	2/11/2010	X							X
TB-326	65	TB-326:65	2/11/2010	X							X
TB-326	79.5	TB-326:79.5	2/11/2010	X							X
TB-326	90	TB-326:90	2/12/2010	X							X
UB-102	10	UB-102-S3-10.0	9/20/2007	X	X						X
UB-102	75	UB-102-S19-75.0	9/21/2007								X
UB-103	9	UB-103-R1-9	9/4/2007	X	X	X	X	X	X		X
UB-103	76	UB-103-R10-76	9/4/2007	X	X		X	X			X
UB-104	15	UB-104-S4-15.0	9/26/2007					X	X		X
UB-104	70	UB-104-S18-70	9/26/2007			X		X	X		
UB-106	7.5	UB-106-S3-7.5	10/1/2007					X			
UB-106	75	UB-106-S23-75	10/2/2007					X			
UB-107	11	UB-107-R2-11	9/11/2007	X	X		X	X		X	X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
UB-107	74	UB-107-R8-74	9/11/2007	X	X						X
UB-108	10	UB-108-S4-10.0	9/6/2007	X	X			X	X		X
UB-108	52.5	UB-108-S15-52.5	9/7/2008	X	X			X	X		X
UB-3	18.5	UB-3-S5-18.5	11/8/2006	X	X			X		X	X
UB-4	17.5	UB-4-S5-17.5	11/14/2006	X			X	X			X
UB-5	13.5	UB-5-S4-13.5	11/10/2006	X			X	X			X
UB-6	18.5	UB-6-S7-18.5	11/15/2006	X			X	X		X	X
UB-7	28.5	UB-7-S7-28.5	11/21/2006	X			X	X			X
UB-8	33.5	UB-8-S8-33.5	11/17/2006	X			X	X			X
UB-9	23	UB-9-S6-23	11/16/2006	X			X	X		X	X
North Portal Area											
AB-2	5	AB-2-S2-5	1/0/1900								X
AB-2	10	AB-2-S2-10	5/24/2005	X							X
AB-2	15	AB-2-S4-15	5/24/2005								X
AB-2	20	AB-2-S6-20	5/24/2005								X
AB-2	25	AB-2-S7-25	5/24/2005	X							X
AB-2	35	AB-2-S9-35	5/24/2005								X
AB-21	2.5	AB-21-S1-2.5	8/2/2006	X			X	X			X
AB-21	3.5	AB-21-S1-3.5	8/2/2006	X			X	X			X
AB-21	7.5	AB-21-S3-7.5	8/2/2006	X			X	X			X
AB-21	15	AB-21-S6-15.0	8/2/2006	X			X	X			X
AB-21	20	AB-21-S8-20.0	8/2/2006	X			X	X			X
AB-21	22.5	AB-21-S9-22.5	8/2/2006	X			X	X			X
AB-22	5	AB-22-S2-5	7/27/2006	X			X	X			X
AB-22	10	AB-22-S4-10	7/27/2006	X		X	X	X			X
AB-22	15	AB-22-S6-15	7/27/2006	X			X	X			X
AB-23	5	AB-23-S2-5	8/2/2006	X			X	X			X
AB-23	10	AB-23-S4-10	8/2/2006	X			X	X			X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
AB-23	15	AB-23-S6-15	8/2/2006	X			X	X			X
AB-24	1.5	AB-24-S1-1.5	8/4/2006	X		X	X	X			
AB-24	5	AB-24-S3-5.0	8/4/2006	X			X	X			
AB-24	10	AB-24-S5-10.0	8/4/2006	X			X	X			
AB-24	15	AB-24-S7-15.0	8/4/2006	X			X	X			
AB-24	17.5	AB-24-S8-17.5	8/4/2006	X			X	X			
AB-24	22.5	AB-24-S10-22.5	8/4/2006	X			X	X			
AB-24	27.5	AB-24-S11-27.5	8/4/2006	X			X	X			
AB-24	32.5	AB-24-S12-32.5	8/4/2006	X			X	X			
AB-24	37.5	AB-24-S13-37.5	8/4/2006	X			X	X			
AB-24	47.5	AB-24-S15-47.5	8/4/2006	X			X	X			
AB-26	5	AB-26-S2-5	7/31/2006				X	X			X
AB-26	10	AB-26-S4-10	7/31/2006				X	X			X
AB-26	15	AB-26-S6-15	7/31/2006				X	X			X
AB-26	20	AB-26-S8-20	7/31/2006				X	X			X
AB-26	27.5	AB-26-S10-27.5	7/31/2006				X	X			X
AB-26	32.5	AB-26-S11-32.5	7/31/2006				X	X			X
AB-26	37.5	AB-26-S12-37.5	7/31/2006				X	X			X
AB-26	42.5	AB-26-S13-42.5	7/31/2006				X	X			X
AB-26	47.5	AB-26-S14-47.5	7/31/2006				X	X			X
AB-26	52.5	AB-26-S15-52.5	7/31/2006				X	X			X
AB-3	5	AB-3-S2A-5	1/0/1900								X
AB-3	10	AB-3-S2-10	5/20/2005	X							X
AB-3	15	AB-3-S4-15	5/20/2005								X
AB-3	20	AB-3-S6-20	5/20/2005	X							X
AB-3	25	AB-3-S7-25	5/20/2005								X
AB-3	30	AB-3-S8-30	5/20/2005								X
AB-3	35	AB-3-S9-35	5/20/2005								X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

Boring	Depth	Sample ID	Date Sampled	Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
				EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
AB-3	40	AB-3-S10-40	5/20/2005								X
AB-4	3	AB-4-S1A-3	5/25/2005								X
AB-4	5	AB-4-S2A-5	5/25/2005	X							X
AB-4	10	AB-4-S2-10	5/25/2005								X
AB-4	20	AB-4-S6-20	5/25/2005								X
AB-4	30	AB-4-S8-30	5/25/2005	X							X
AB-4	40	AB-4-S10-40	5/25/2005								X
GP-523	5.5	GP-523:5.5	8/24/2009								X
GP-523	10.8	GP-523:10.8	8/24/2009								X
GP-523	22	GP-523:22	8/24/2009								X
GP-523	30	GP-523:30	8/24/2009								X
GP-524	5	GP-524:5	8/24/2009								X
GP-524	9	GP-524:9	8/24/2009								X
GP-524	20.5	GP-524:20.5	8/24/2009								X
GP-524	26.5	GP-524:26.5	8/24/2009								X
GP-525	5	GP-525:5	8/24/2009								X
GP-525	8.5	GP-525:8.5	8/24/2009								X
GP-525	20	GP-525:20	8/24/2009								X
GP-525	27.5	GP-525:27.5	8/24/2009								X
GP-526	6	GP-526:6	8/24/2009								X
GP-526	10	GP-526:10	8/24/2009								X
GP-526	21	GP-526:21	8/24/2009								X
GP-527	5	GP-527:5	8/26/2009								X
GP-527	8.5	GP-527:8.5	8/26/2009								X
GP-527	20	GP-527:20	8/26/2009								X
GP-528	5	GP-528:5	8/26/2009								X
GP-528	10	GP-528:10	8/26/2009								X
GP-529	4	GP-529:4	8/26/2009								X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
GP-529	8.5	GP-529:8.5	8/26/2009								X
GP-529	20	GP-529:20	8/26/2009								X
GP-529	26.5	GP-529:26.5	8/26/2009								X
GP-530	17	GP-530:17	8/25/2009	X							X
GP-530	27.5	GP-530:27.5	8/25/2009	X							X
GP-531	5.5	GP-531:5.5	8/25/2009	X							X
GP-531	27.5	GP-531:27.5	8/25/2009	X							X
GP-532	10	GP-532:10	8/25/2009	X							X
GP-532	18.5	GP-532:18.5	8/25/2009	X							X
GP-533	8	GP-533:8	8/27/2009	X							X
GP-533	22	GP-533:22	8/27/2009	X							X
GP-534	5	GP-534:5	8/27/2009	X							X
GP-534	14	GP-534:14	8/27/2009	X							X
GP-535	5	GP-535:5	9/1/2009	X				X	X		X
GP-535	11	GP-535:11	9/1/2009	X				X	X		X
GP-536	4.5	GP-536:4.5	9/1/2009	X				X	X		X
GP-536	18	GP-536:18	9/1/2009	X				X	X		X
GP-537	12.5	GP-537:12.5	9/1/2009	X				X	X		X
GP-537	22	GP-537:22	9/1/2009	X				X	X		X
GP-538	5	GP-538:5	9/1/2009	X				X	X		X
GP-538	12	GP-538:12	9/1/2009	X				X	X		X
GP-542A	6	GP-542A:7.5:1	10/21/2009								X
GP-542A	7	GP-542A:7.5:2	10/21/2009								X
GP-543	8.5	GP-543:8.5	10/23/2009								X
GP-543	18.5	GP-543:18.5	10/23/2009								X
GP-544	11	GP-544:11	10/23/2009								X
GP-544	18.5	GP-544:18.5	10/23/2009								X
GP-545	6	GP-545:6	10/23/2009	X							X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
GP-545	14.5	GP-545:14.5	10/23/2009	X							X
GP-545	15	GP-545:17.5:1	10/23/2009	X							X
GP-545	15	GP-545:17.5:2	10/23/2009	X							X
GP-546	5	GP-546:5	10/23/2009	X							X
GP-546	10	GP-546:10	10/23/2009	X							X
GP-546	14.5	GP-546:14.5	10/23/2009	X							X
GP-547	5	GP-547:5	10/21/2009	X							X
GP-547	9.5	GP-547:9.5	10/21/2009	X							X
GP-548	4	GP-548:4	10/21/2009	X							X
GP-548	7.6	GP-548:7.6	10/21/2009	X							X
TB-245	3	TB-245:3	6/19/2009	X			X				X
TB-245	12.5	TB-245:12.5	8/5/2009	X				X	X		X
TB-245	20	TB-245:20	8/5/2009	X				X	X		X
TB-245	30	TB-245:30	8/5/2009	X				X	X		X
TB-245	45	TB-245:45	8/5/2009	X				X	X		X
TB-245	60	TB-245:60	8/6/2009	X				X	X		X
TB-245	75	TB-245:75	8/6/2009	X				X	X		X
TB-245	85	TB-245:85	8/6/2009	X				X	X		X
TB-247	6.9	TB-247:6.9	6/18/2009	X			X				X
TB-247	12	TB-247:12	7/13/2009	X				X	X		X
TB-247A	17.5	TB-247A:17.5:1	8/24/2009	X				X	X	X	X
TB-247A	17.5	TB-247A:17.5:2	8/24/2009	X				X	X	X	X
TB-247A	25.5	TB-247A:25.5	8/24/2009	X				X	X		X
TB-247A	37.5	TB-247A:37.5	8/24/2009	X				X	X		X
TB-247A	48.5	TB-247A:48.5	8/24/2009	X				X	X		X
TB-249	8.5	TB-249:8.5	7/24/2009	X				X	X		X
TB-249	17.5	TB-249:17.5	7/24/2009	X				X	X		X
TB-249	25	TB-249:25	7/24/2009	X				X	X		X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-249	40	TB-249:40	7/24/2009	X				X	X		X
TB-300	1.5	TB-300:1.5	12/14/2009	X			X				X
TB-300	1.5	TB-300:1.5	12/14/2009			X		X			
TB-300	14.8	TB-300:14.8	12/19/2009	X			X				X
TB-300	29.8	TB-300:29.8	12/19/2009	X			X				X
TB-301	8	TB-301:8	12/14/2009	X			X				X
TB-301	17.5	TB-301:17.5	1/4/2010	X			X				X
TB-301	22.5	TB-301:22.5	1/4/2010	X			X				X
TB-301	35	TB-301:35:1	1/4/2010	X			X				X
TB-301	35	TB-301:35:2	1/4/2010	X			X				X
TB-301	45	TB-301:45	1/4/2010	X			X				X
TB-302	6.8	TB-302:6.8	12/9/2009	X		X	X				X
TB-302	15	TB-302:15	12/17/2009	X			X				X
TB-302	25	TB-302:25	12/17/2009	X			X				X
TB-302	32.5	TB-302:32.5	12/17/2009	X			X				X
TB-302	45	TB-302:45	12/17/2009	X			X				X
TB-302	55	TB-302:55	12/18/2009	X			X				X
TB-302	65	TB-302:65	12/18/2009	X			X				X
TB-303	2.8	TB-303:2:1	12/8/2009	X		X	X				X
TB-303	2.8	TB-303:2:2	12/8/2009	X		X	X				X
TB-303	12.5	TB-303:12.5	1/7/2010	X			X				X
TB-303	22.5	TB-303:22.5	1/8/2010	X			X				X
TB-303	32.5	TB-303:32.5	1/8/2010	X			X				X
TB-303	42.5	TB-303:42.5	1/8/2010	X			X				X
TB-303	52.5	TB-303:52.5	1/8/2010	X			X				X
TB-303	62.5	TB-303:62.5	1/8/2010	X			X				X
TB-303	72.5	TB-303:72.5	1/11/2010	X			X				X
TB-303	82.5	TB-303:82.5	1/11/2010	X			X				X

Exhibit F-1 Summary of Soil Analyses for Bored Tunnel Alternative

				Metals	PAHs	PCBs	Hydrocarbon Identification	Diesel and Oil	Gasoline	TCLP Metals	VOCs
Boring	Depth	Sample ID	Date Sampled	EPA 6000 and 7000 series	EPA 8270CSIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	TCLP-EPA 6010	EPA 8260B
TB-303	92.5	TB-303:92.5	1/11/2010	X			X				X
TB-303	102.5	TB-303:102.5	1/11/2010	X							X
TB-304	5.5	TB-304:5.5	12/8/2009	X			X				X
TB-304	14.5	TB-304:14.5	12/8/2009	X			X				X
TB-304	24.5	TB-304:24.5	12/8/2009	X			X				X
TB-304	34.5	TB-304:34.5	12/8/2009	X			X				X
TB-304	44.5	TB-304:44.5	12/9/2009	X			X				X
TB-304	54.5	TB-304:54.5	12/9/2009	X			X				X
TB-304	64.5	TB-304:64.5	12/9/2009	X			X				X
TB-304	74.5	TB-304:74.5	12/9/2009	X			X				X
TB-304	84.5	TB-304:84.5	12/9/2009	X			X				X

Notes:
EPA = U.S. Environmental Protection Agency
NWTPH-Dx = Northwest total petroleum hydrocarbons- diesel extended
NWTPH-Gx = Northwest total petroleum hydrocarbons- gasoline
HCID = hydorcarbon identification
PAHs= polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
SVOCs = semivolatile organic compounds
TCLP = toxicity characteristic leaching procedure
VOCs = volatile organic compounds

Exhibit F-2 Summary of Groundwater Analyses for Bored Tunnel Alternative

Boring	Depth of Water Sample	Group	Cyanide	Metals	Methane	Organo-chlorine Pesticides	PAHs	PCBs	Petroleum Identification	Diesel and Oil	Gasoline	SVOCs	VOCs	Water Quality
		Method Sample ID	SM4500-CNC	EPA 200.8	RSK- 175	EPA 8081	EPA 8270C-SIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	EPA 8270C	EPA 8260	various
South Portal Area														
AH-28	30.4	AH-28-GW-1		X						X	X		X	X
AH-33	23	AH-33-GW-1		X						X	X		X	X
CB-27A	11.5	CB-27A-GW-1		X	X					X	X		X	X
CB-30A	10.5	CB-30A-GW-1		X					X					X
CB-34A	12.4	CB-34A-GW-1		X	X									X
CB-35A	11.6	CB-35A-GW-1		X						X	X		X	X
CB-40A	10.7	CB-40A-GW-1		X										X
EB-16A	15	EB-16A-GW-1		X			X			X	X	X	X	X
EB-16B	57.5	EB-16B-GW-1		X					X				X	X
GP-312	<10	GP-312-GW		X					X				X	
GP-316	<10	GP-316-GW		X					X				X	
GP-5	<10	GP-5-W		X			X			X	X		X	
IB-2A	12.6	IB-2A-GW-1		X	X					X				X
PW-252	100.7	PW-252:GW:1	X	X	X		X			X	X	X	X	X
PW-252	100.7	PW-252:GW:3	X	X	X		X			X	X	X	X	X
PW-252	100.7	PW-252:GW:4	X	X	X		X			X	X	X	X	X
TB-100	13.2	TB-100:GW:1		X	X		X			X	X		X	X
TB-101	80.5	TB-101:GW:1	X	X	X		X			X	X		X	X
TB-102	15.3	TB-102:GW:1	X	X	X		X			X	X		X	X
TB-200A	29.5	TB-200A:GW:1		X	X		X			X	X		X	X
TB-201	25.2	TB-201:GW:1		X	X		X			X	X		X	X
TB-202A	25.7	TB-202A:GW:1		X	X		X			X	X		X	X
TB-203	69.8	TB-203:GW:1		X	X		X			X	X		X	X
TB-203	69.8	TB-203:GW:2		X	X		X			X	X		X	X
TB-204	30.1	TB-204:GW:1		X	X		X			X	X		X	X
TB-205	25.5	TB-205:GW:1	X	X	X	X	X	X		X	X		X	X

Exhibit F-2 Summary of Groundwater Analyses for Bored Tunnel Alternative

		Group	Cyanide	Metals	Methane	Organo-chlorine Pesticides	PAHs	PCBs	Petroleum Identification	Diesel and Oil	Gasoline	SVOCs	VOCs	Water Quality
Boring	Depth of Water Sample	Method Sample ID	SM4500-CNC	EPA 200.8	RSK- 175	EPA 8081	EPA 8270C-SIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	EPA 8270C	EPA 8260	various
TB-205	25.5	TB-205:GW:2	X	X	X	X	X	X		X	X		X	X
TB-206	26.7	TB-206:GW:1		X	X		X			X	X		X	X
TB-207	31.4	TB-207:GW:1		X	X		X			X	X		X	X
TB-208	35	TB-208:GW:1		X	X		X			X	X		X	X
TB-209A	63.4	TB-209A:GW:1	X	X	X	X	X	X		X	X		X	X
TB-209A	63.4	TB-209A:GW:3	X											X
TB-210	80.2	TB-210:GW:1	X	X	X	X	X	X		X	X		X	X
TB-212	102.9	TB-212:GW:1		X	X		X			X	X		X	X
UB-101	140.1	UB-101-GW-1		X					X			X	X	X
UB-112	110.4	UB-112-GW-1		X					X			X	X	X
UB-203	15.6	UB-203-GW-1		X					X				X	X
UB-204	16.4	UB-204-GW-1		X					X				X	X
UB-205	15.5	UB-205-GW-1		X					X				X	X
Tunnel														
B-102	198.9	B-102-GW-1		X					X				X	X
B-102	198.9	B-102-GW-2											X	
CB-16A	12	CB-16A-GW-1		X	X				X					X
CB-16A	12	CB-16A-GW-1-Dup		X					X					X
CB-19A	12.5	CB-19A-GW-1		X	X								X	X
CB-22A	13	CB-22A-GW-1		X										X
CB-25A	12.7	CB-25A-GW-1		X			X		X				X	X
CB-26A	13.1	CB-26A-GW-1		X	X					X	X		X	X
CB-28A	12.8	CB-28A-GW-1		X	X		X			X				X
EB-10A	14.8	EB-10A-GW-1		X			X			X	X	X	X	X
EB-10A	14.8	EB-10A-GW-2		X			X			X	X	X	X	X
EB-10B	58.1	EB-10B-GW-1		X					X				X	X
EB-10B	58.1	EB-10B-GW-2			X									

Exhibit F-2 Summary of Groundwater Analyses for Bored Tunnel Alternative

Boring	Depth of Water Sample	Group	Cyanide	Metals	Methane	Organo-chlorine Pesticides	PAHs	PCBs	Petroleum Identification	Diesel and Oil	Gasoline	SVOCs	VOCs	Water Quality
		Method Sample ID	SM4500-CNC	EPA 200.8	RSK- 175	EPA 8081	EPA 8270C-SIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	EPA 8270C	EPA 8260	various
EB-18A	15.3	EB-18A-GW-1		X			X			X	X	X	X	X
EB-18B	111.3	EB-18B-GW-1		X	X				X				X	X
EB-3	141.4	EB-3-GW-1		X					X				X	X
GP-201	<10	GP-201-GW		X						X	X		X	X
GP-202	<10	GP-202-GW		X						X	X		X	X
GP-203	<10	GP-203-GW		X						X	X		X	X
GP-204	<10	GP-204-GW		X						X	X		X	X
GP-205	<10	GP-205-GW		X						X	X		X	X
GP-206	<10	GP-206-GW		X						X	X		X	X
GP-207	<10	GP-207-GW		X						X	X		X	X
GP-208	<10	GP-208-GW		X						X	X		X	X
TB-107	176.6	TB-107:GW:1		X	X					X			X	X
TB-108	226.3	TB-108:GW:1		X	X					X			X	X
TB-109	215.9	TB-109:GW:1		X	X					X			X	X
TB-111	290.2	TB-111:GW:1		X	X					X			X	X
TB-220	175.8	TB-220:GW:1		X	X					X	X		X	X
TB-221	177.5	TB-221:GW:1		X	X					X			X	X
TB-221	177.5	TB-221:GW:2		X	X					X			X	X
TB-222	215.5	TB-222:GW:1		X	X					X			X	X
TB-224	223.6	TB-224:GW:1		X	X					X	X		X	X
TB-225	276.1	TB-225:GW:1		X	X					X	X		X	X
TB-226	285.8	TB-226:GW:1		X	X					X			X	X
TB-307	165.5	TB-307:GW:1		X	X					X	X		X	X
TB-308	186.2	TB-308:GW:1		X	X					X	X		X	X
TB-309	195.9	TB-309:GW:1		X	X					X	X		X	X
TB-312	170	TB-312:GW:1		X	X					X	X		X	X
TB-313	224.1	TB-313:GW:1		X	X					X	X		X	X

Exhibit F-2 Summary of Groundwater Analyses for Bored Tunnel Alternative

		Group	Cyanide	Metals	Methane	Organo-chlorine Pesticides	PAHs	PCBs	Petroleum Identification	Diesel and Oil	Gasoline	SVOCs	VOCs	Water Quality
Boring	Depth of Water Sample	Method Sample ID	SM4500-CNC	EPA 200.8	RSK- 175	EPA 8081	EPA 8270C-SIM	EPA 8082	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	EPA 8270C	EPA 8260	various
TB-315	196.6	TB-315:GW:1		X	X					X	X		X	X
TB-316	191.7	TB-316:GW:1		X	X					X	X		X	X
TB-317	190	TB-317:GW:1		X	X					X	X		X	X
TB-318	178	TB-318:GW:1		X	X					X	X		X	X
TB-319	178.2	TB-319:GW:1		X	X					X	X		X	X
TB-319	178.2	TB-319:GW:2		X	X					X	X		X	X
TB-321	161.6	TB-321:GW:1		X	X		X			X	X		X	X
TB-323	65.1	TB-323:GW:1		X	X		X			X	X		X	X
TB-324	100.7	TB-324:GW:1		X	X		X			X	X		X	X
TB-324	100.7	TB-324:GW:2		X	X		X			X	X		X	X
TB-325	99.9	TB-325:GW:1		X	X		X			X	X		X	X
TB-326	115.7	TB-326:GW:1		X	X		X			X	X		X	X
UB-102	87.5	UB-102-GW-1		X					X			X	X	X
UB-102	87.5	UB-102-GW-2		X					X			X	X	X
UB-103	69.8	UB-103-GW-1		X					X			X	X	X
UB-104	93.6	UB-104-GW-1		X					X			X	X	X
UB-106	86.9	UB-106-GW-1		X					X			X	X	X
AB-4	6	AB-4-GW-1		X					X				X	X
North Portal Area														
TB-245	85.8	TB-245:GW:1		X	X					X	X		X	X
TB-247A	14.5	TB-247A:GW:1		X	X					X	X		X	X
TB-249	45.6	TB-249:GW:1		X	X					X	X		X	X
TB-300	15.2	TB-300:GW:1		X	X		X			X	X		X	X
TB-301	15.6	TB-301:GW:1		X	X					X	X		X	X
TB-302	59	TB-302:GW:1		X	X					X	X		X	X
TB-303	116.1	TB-303:GW:1		X	X					X	X		X	X
TB-304	69.2	TB-304:GW:1		X	X					X	X		X	X

Exhibit F-2 Summary of Groundwater Analyses for Bored Tunnel Alternative

QUALIFIERS AND ABBREVIATIONS -GROUNDWATER

1. Method Acronyms: NWTPH= Northwest Total Petroleum Hydrocarbons Northwest Total Petroleum Hydrocarbons;
   Environmental Protection Agency = EPA; Standard Method = SM; SW = Solid Waste, Selective Ion Method = SIM.
2. Analyte Group Acronyms:
   PAHs = polycyclic aromatic hydrocarbons
   PCBs = polychlorinated biphenyls
   SVOC = semi-volatile organic compounds
   VOCs = volatile organic compounds
2. Analytical Methods for Water Quality:

Water Quality Analyte(s)		
Salinity	SM2520	
Sulfate	SW300	
Sulfide	SM4500S42E	
Total Sulfur	SW300mod	
Ammonia (NH3) as Nitrogen (N)	SM4500NH3G	
Biochemical Oxygen Demand	SM5210B	
Chemical Oxygen Demand	SM5220D	
Chloride	SW300	
Cyanide	SM4500CNC	
Hardness	SW6020/SM2340B	
Total Dissolved Solids (TDS)	SM2540C	
Total Residual Chlorine	SM4500CL	
Total Suspended Solids (TSS)	SM2540D	

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

		Point	AH-11	AH-13	AH-14	AH-20	AH-22	AH-22	AH-23	AH-28	AH-29	AH-31	AH-35	AH-37	AH-38	AH-41	AH-5
		Client ID	AH-11-R1-9	AH-13-R1-10	AH-14-R1-8	AH-20-R1-9	AH-22-R1-9	AH-22-R2-18.5	AH-23-R2-17	AH-28-R3-20.5	AH-29-R1-6.5	AH-31-R1-8.5	AH-35-R1-7	AH-37-R1-6.5	AH-38-R2-10	AH-41-R1-9	AH-5-R1-7
Analyte	**Method**																
Petroleum (mg/kg)																	
Total Petroleum Hydrocarbons-Heavy Fraction/Oil	NWTPH-HCID																
Diesel Range Organics	NWTPH-Dx								340 Y						74 Y,N		
Lube Oil	NWTPH-Dx				130 Y				1400 Y		230 Y		220 Y	250 Y	280 Y,N	81 Y	
Gasoline	NWTPH-GX							58 T							5.6 Z		
Volatile Organic Compound (mg/kg)																	
1,2,4-Trichlorobenzene	SW8260B								0.0011								
1,3,5-Trimethylbenzene	SW8260B								0.002								
2-Butanone	SW8260B		0.0048	0.0027	0.0039		0.0075	0.098	0.02	0.019		0.02					0.0043
Benzene	SW8260B																
Carbon Disulfide	SW8260B						0.0012	0.018	0.0034	0.0044							
Ethylbenzene	SW8260B																
Isopropylbenzene (Cumene)	SW8260B																
m, p-Xylene	SW8260B																
Naphthalene	SW8260B								0.043								
n-Butylbenzene	SW8260B																
n-Propylbenzene	SW8260B																
o-Xylene	SW8260B																
p-Isopropyltoluene	SW8260B		0.00075				0.017	3.1	0.00095						0.64	0.0023	0.0029
Sec-Butylbenzene	SW8260B																
Toluene	SW8260B															0.0013	
Total Xylenes	SW8260B																
Trichloroethene	SW8260B																
Semivolatile Organic Compounds (mg/kg)																	
1,4-Dichlorobenzene	SW8270C																
1-Methylnaphthalene	SW8270C																
4-Nitrophenol	SW8270C																
Acenaphthylene	SW8270C																
Anthracene	SW8270C																
Benz[a]anthracene	SW8270C																
Benzo(a)pyrene	SW8270C																
Benzo(b)fluoranthene	SW8270C																
Benzo(ghi)perylene	SW8270C																
Benzo(k)fluoranthene	SW8270C																
Chrysene	SW8270C																
Dibenzo(a,h)anthracene	SW8270C																
Fluoranthene	SW8270C																
Fluorene	SW8270C																
Indeno(1,2,3-cd)pyrene	SW8270C																
Naphthalene	SW8270C																
N-Nitrosodi-n-propylamine	SW8270C																
Phenanthrene	SW8270C																
Pyrene	SW8270C																
Polynuclear Aromatic Hydrocarbons (mg/kg)																	
1-Methylnaphthalene	SW8270CSIM				0.011			0.041	0.71						0.0095		

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

		Point	AH-11	AH-13	AH-14	AH-20	AH-22	AH-22	AH-23	AH-28	AH-29	AH-31	AH-35	AH-37	AH-38	AH-41	AH-5
		Client ID	AH-11-R1-9	AH-13-R1-10	AH-14-R1-8	AH-20-R1-9	AH-22-R1-9	AH-22-R2-18.5	AH-23-R2-17	AH-28-R3-20.5	AH-29-R1-6.5	AH-31-R1-8.5	AH-35-R1-7	AH-37-R1-6.5	AH-38-R2-10	AH-41-R1-9	AH-5-R1-7
2-Methylnaphthalene	SW8270CSIM				0.016			0.044	0.65						0.012		
Acenaphthene	SW8270CSIM				0.0081			0.14	3.2								
Acenaphthylene	SW8270CSIM							0.042	0.062								
Anthracene	SW8270CSIM				0.012			0.34	5.8								
Benz[a]anthracene	SW8270CSIM				0.026	0.0091		0.63	10	0.018					0.013		
Benzo(a)pyrene	SW8270CSIM				0.02	0.0094		0.67	11	0.016					0.014		
Benzo(b)fluoranthene	SW8270CSIM				0.027	0.0094		0.64	11	0.013	0.0095	0.014			0.014		
Benzo(ghi)perylene	SW8270CSIM				0.02			0.44	7.3	0.012					0.015		
Benzo(k)fluoranthene	SW8270CSIM				0.018			0.2	2.5	0.014					0.0087		
Chrysene	SW8270CSIM				0.038	0.012		0.87	12	0.02					0.035		
Dibenzo(a,h)anthracene	SW8270CSIM							0.13	2								
Fluoranthene	SW8270CSIM				0.067	0.018		1.1	25	0.048	0.011	0.016			0.022		
Fluorene	SW8270CSIM							0.15	2.4								
Indeno(1,2,3-cd)pyrene	SW8270CSIM				0.016			0.4	6.3								
Naphthalene	SW8270CSIM				0.017			0.092	1								
Phenanthrene	SW8270CSIM				0.049	0.0087		1.1	20	0.065	0.0085				0.026		
Pyrene	SW8270CSIM				0.054	0.019		1.2	26	0.038	0.011	0.018			0.031		

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

	AH-9 AH-9-R2-10	CB-109 CB-109-S4-7.5	CB-110 CB-110-S1-3.0	CB-27A CB-27A-S3-12.5	CB-27A CB-27A-S5-17.5	CB-35A CB-35A-S1-8	CB-35A CB-35A-S1A-2.5	CB-36A CB-36A-S2-10	CB-37A CB-37A-S1-8	CB-37A CB-37A-S1A-2.5	CB-37A CB-37A-S4-15	CB-41A CB-41A-S1-7.5	CB-43A CB-43A-S1A-2.4	GP-311 GP-311-R1-1	GP-313 GP-313-R2-6	GP-314 GP-314-R1-2
Analyte																
Petroleum (mg/kg)																
Total Petroleum Hydrocarbons-Heavy Fraction/Oil																
Diesel Range Organics			140 Y								56 Y					660 Y
Lube Oil			1200 Y						240 Y		530 Y					1800 Y
Gasoline																
Volatile Organic Compound (mg/kg)																
1,2,4-Trichlorobenzene										0.0023						
1,3,5-Trimethylbenzene										0.0022						
2-Butanone		0.0045			0.0072	0.017 J	0.0099			0.0084 J		0.023		0.017		0.02
Benzene							0.0024									
Carbon Disulfide							0.0034					0.0059				
Ethylbenzene																
Isopropylbenzene (Cumene)				0.0031												
m, p-Xylene																
Naphthalene													0.004			
n-Butylbenzene				0.0015												
n-Propylbenzene				0.0042												
o-Xylene																
p-Isopropyltoluene	0.1									0.0022						
Sec-Butylbenzene				0.0019						0.0018						0.0083 J
Toluene																
Total Xylenes																
Trichloroethene																
Semivolatile Organic Compounds (mg/kg)																
1,4-Dichlorobenzene																
1-Methylnaphthalene																
4-Nitrophenol																
Acenaphthylene																
Anthracene																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Fluoranthene																
Fluorene																
Indeno(1,2,3-cd)pyrene																
Naphthalene																
N-Nitrosodi-n-propylamine																
Phenanthrene																
Pyrene																
Polynuclear Aromatic Hydrocarbons (mg/kg)																
1-Methylnaphthalene								0.018						0.02		0.29

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

	AH-9 AH-9-R2-10	CB-109 CB-109-S4-7.5	CB-110 CB-110-S1-3.0	CB-27A CB-27A-S3-12.5	CB-27A CB-27A-S5-17.5	CB-35A CB-35A-S1-8	CB-35A CB-35A-S1A-2.5	CB-36A CB-36A-S2-10	CB-37A CB-37A-S1-8	CB-37A CB-37A-S1A-2.5	CB-37A CB-37A-S4-15	CB-41A CB-41A-S1-7.5	CB-43A CB-43A-S1A-2.4	GP-311 GP-311-R1-1	GP-313 GP-313-R2-6	GP-314 GP-314-R1-2
2-Methylnaphthalene								0.022						0.023		0.29
Acenaphthene																0.16
Acenaphthylene																0.053
Anthracene														0.0085		0.19
Benz[a]anthracene								0.028						0.044		0.3
Benzo(a)pyrene								0.032						0.062		0.36
Benzo(b)fluoranthene								0.036						0.086		0.9
Benzo(ghi)perylene								0.028						0.056		0.46
Benzo(k)fluoranthene														0.019		0.21
Chrysene								0.039						0.068		0.71
Dibenzo(a,h)anthracene														0.016		0.13
Fluoranthene								0.042						0.076	0.014	1.2
Fluorene																0.34
Indeno(1,2,3-cd)pyrene								0.021						0.045		0.41
Naphthalene														0.018		0.12
Phenanthrene								0.053						0.055	0.011	0.75
Pyrene								0.051						0.085	0.014	0.75

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

	GP-316 GP-316-R4-12.5	GP-317 GP-317-R2-7	GP-318 GP-318-R2-6	GP-321 GP-321-R2-6	GP-7 GP-7-S3-9.0	IB-201 IB-201-S1-0.8	IB-210 IB-210-S4-11	IB-212 IB-212-S6-16	IB-226 IB-226-12	IB-227 IB-227-10	TB-100 TB-100:3:1	TB-100 TB-100:3:2	TB-100 TB-100:7.5	TB-101 TB-101:1.1	TB-101 TB-101:2	TB-102 TB-102:3.5
Analyte																
Petroleum (mg/kg)																
Total Petroleum Hydrocarbons-Heavy Fraction/Oil						Detect		Detect								
Diesel Range Organics				230 Y												
Lube Oil			250 Y	2800 Y		290		190								
Gasoline																
Volatile Organic Compound (mg/kg)																
1,2,4-Trichlorobenzene				0.0027 J												
1,3,5-Trimethylbenzene																
2-Butanone				0.027	0.036 J											
Benzene																
Carbon Disulfide	0.0028			0.0059												
Ethylbenzene																
Isopropylbenzene (Cumene)																
m, p-Xylene																
Naphthalene																
n-Butylbenzene																
n-Propylbenzene																
o-Xylene				0.003												
p-Isopropyltoluene	0.0051															
Sec-Butylbenzene																
Toluene					0.0027 J				0.05	0.05						
Total Xylenes																
Trichloroethene																
Semivolatile Organic Compounds (mg/kg)																
1,4-Dichlorobenzene													0.1 J			
1-Methylnaphthalene														0.09		
4-Nitrophenol											0.5 J	0.5 J	0.5 J			
Acenaphthylene														0.1		
Anthracene														0.09		
Benz[a]anthracene														0.22		
Benzo(a)pyrene														0.22		
Benzo(b)fluoranthene														0.2		
Benzo(ghi)perylene														0.19		
Benzo(k)fluoranthene														0.08		
Chrysene														0.17		
Dibenzo(a,h)anthracene														0.08		
Fluoranthene														0.3		
Fluorene														0.06		
Indeno(1,2,3-cd)pyrene														0.14		
Naphthalene														0.05		
N-Nitrosodi-n-propylamine													0.1 J			
Phenanthrene														0.21		
Pyrene														0.39		
Polynuclear Aromatic Hydrocarbons (mg/kg)																
1-Methylnaphthalene				0.47										0.1	0.09	0.09

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

	GP-316 GP-316-R4-12.5	GP-317 GP-317-R2-7	GP-318 GP-318-R2-6	GP-321 GP-321-R2-6	GP-7 GP-7-S3-9.0	IB-201 IB-201-S1-0.8	IB-210 IB-210-S4-11	IB-212 IB-212-S6-16	IB-226 IB-226-12	IB-227 IB-227-10	TB-100 TB-100:3:1	TB-100 TB-100:3:2	TB-100 TB-100:7.5	TB-101 TB-101:1.1	TB-101 TB-101:2	TB-102 TB-102:3.5
2-Methylnaphthalene				1.4												
Acenaphthene				0.076												
Acenaphthylene				0.059										0.11		
Anthracene				0.23										0.1		
Benz[a]anthracene				0.7										0.25		
Benzo(a)pyrene		0.015	0.0093	0.68										0.25		
Benzo(b)fluoranthene		0.023	0.011	1.4										0.23		
Benzo(ghi)perylene		0.047		0.56										0.22	0.05	0.06
Benzo(k)fluoranthene				0.26										0.091		
Chrysene		0.011	0.01	1.7		0.06								0.19		
Dibenzo(a,h)anthracene				0.21										0.091		
Fluoranthene			0.018	1.6			0.06							0.34		0.09
Fluorene				0.32										0.068		
Indeno(1,2,3-cd)pyrene		0.01		0.43										0.16		0.05
Naphthalene				0.6										0.057		
Phenanthrene			0.01	1.8										0.24		0.05
Pyrene			0.02	1.7			0.06							0.44		0.1

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

	TB-203 TB-203:5.5	TB-205 TB-205:2.7	TB-211 TB-211:5.3	UB-1 UB-1-S4-8.5	UB-100 UB-100-S19-70.0	UB-100 UB-100-S8-20.0	UB-101 UB-101-S3-7.5	UB-2 UB-2-S6-18.5	UB-203 UB-203-S12-40.0	UB-204 UB-204-S12-40.0	UB-204 UB-204-S4-10.0	UB-205 UB-205-S12-40.0	UB-205 UB-205-S3-7.5
Analyte													
Petroleum (mg/kg)													
Total Petroleum Hydrocarbons-Heavy Fraction/Oil													
Diesel Range Organics													
Lube Oil		79											
Gasoline	10												
Volatile Organic Compound (mg/kg)													
1,2,4-Trichlorobenzene													
1,3,5-Trimethylbenzene													
2-Butanone				0.083 J					0.0082	0.0091			
Benzene			1.5										
Carbon Disulfide				0.0071 J	0.0022	0.004			0.0059	0.0053		0.015	
Ethylbenzene			0.14		0.003	0.0083 J							
Isopropylbenzene (Cumene)													
m, p-Xylene					0.0095	0.02 J							
Naphthalene													
n-Butylbenzene													
n-Propylbenzene													
o-Xylene					0.0025	0.0048 J							
p-Isopropyltoluene							0.00095						
Sec-Butylbenzene													
Toluene			0.18										
Total Xylenes			0.21										
Trichloroethene				0.023 J				0.0018					
Semivolatile Organic Compounds (mg/kg)													
1,4-Dichlorobenzene													
1-Methylnaphthalene													
4-Nitrophenol													
Acenaphthylene													
Anthracene													
Benz[a]anthracene													
Benzo(a)pyrene													
Benzo(b)fluoranthene													
Benzo(ghi)perylene													
Benzo(k)fluoranthene													
Chrysene													
Dibenzo(a,h)anthracene													
Fluoranthene													
Fluorene													
Indeno(1,2,3-cd)pyrene													
Naphthalene													
N-Nitrosodi-n-propylamine													
Phenanthrene													
Pyrene													
Polynuclear Aromatic Hydrocarbons (mg/kg)													
1-Methylnaphthalene													

Exhibit F-3A. Detected Organic Analytes in Soil in the South Portal Area

	TB-203 TB-203:5.5	TB-205 TB-205:2.7	TB-211 TB-211:5.3	UB-1 UB-1-S4-8.5	UB-100 UB-100-S19-70.0	UB-100 UB-100-S8-20.0	UB-101 UB-101-S3-7.5	UB-2 UB-2-S6-18.5	UB-203 UB-203-S12-40.0	UB-204 UB-204-S12-40.0	UB-204 UB-204-S4-10.0	UB-205 UB-205-S12-40.0	UB-205 UB-205-S3-7.5
2-Methylnaphthalene										0.015	0.016		
Acenaphthene													
Acenaphthylene													0.011
Anthracene													
Benz[a]anthracene						0.02							0.029
Benzo(a)pyrene						0.027							0.055
Benzo(b)fluoranthene						0.032							0.083
Benzo(ghi)perylene						0.022							0.059
Benzo(k)fluoranthene													0.026
Chrysene						0.027							0.045
Dibenzo(a,h)anthracene													0.016
Fluoranthene						0.039							0.028
Fluorene													
Indeno(1,2,3-cd)pyrene						0.019							0.05
Naphthalene										0.015	0.017		
Phenanthrene						0.021							0.016
Pyrene		0.09				0.044							0.037

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

		Point	CB-106	CB-106	CB-106	CB-107	CB-107	CB-108	CB-112	CB-112	CB-112	CB-112	CB-16A	CB-19A	CB-19A	CB-22A	CB-22A
		Client ID	CB-106-S1-3.5	CB-106-S2-13.0	CB-106-S3-19.0	CB-107-S1-3.0	CB-107-S2-11.0	CB-108-S1-3.0	CB-112-S1-3.0	CB-112-S3-11.0	CB-112-S4-22.5	CB-112-S4-27.5	CB-16A-S5-17.5	CB-19A-S4-14	CB-19A-S9-35	CB-22A-S2-10	CB-22A-S5-17.5
Analyte	**Method**																
Petroleum (mg/kg)																	
Gasoline	NWTPH-HCID																
Diesel Range Organics	NWTPH-Dx		51 Y	53 Y		51 Y Z J	45 Y Z J				40 Y						
Lube Oil	NWTPH-Dx		180 Y	190 Y		650 Y Z	550 Y Z	2300 Y	88 Y		150 Y	480 Y					
Gasoline	NWTPH-GX																
Volatile Organic Compound (mg/kg)																	
1,2,4-Trichlorobenzene	SW8260B																
1,3,5-Trimethylbenzene	SW8260B																
2-Butanone	SW8260B															0.0056	0.011
Benzene	SW8260B																
Carbon Disulfide	SW8260B				0.0051					0.0081			0.0039	0.0011	0.0043		
Ethylbenzene	SW8260B																
Isopropylbenzene (Cumene)	SW8260B																
m, p-Xylene	SW8260B																
Naphthalene	SW8260B									0.21							
n-Butylbenzene	SW8260B																
n-Propylbenzene	SW8260B																
o-Xylene	SW8260B																
p-Isopropyltoluene	SW8260B									0.019				0.015	0.035		
Sec-Butylbenzene	SW8260B																
Tert-Butylbenzene	SW8260B																
Tetrachloroethene	SW8260B																
Toluene	SW8260B																
Trichloroethene	SW8260B																
Semivolatile Organic Compounds (mg/kg)																	
1-Methylnaphthalene	SW8270C																
Acenaphthylene	SW8270C																
Anthracene	SW8270C																
Benz[a]anthracene	SW8270C																
Benzo(a)pyrene	SW8270C																
Benzo(ghi)perylene	SW8270C																
Benzo(k)fluoranthene	SW8270C																
Bis(2-Ethylhexyl) Phthalate	SW8270C																
Carbazole	SW8270C																
Chrysene	SW8270C																
Dibenzofuran	SW8270C																
Fluoranthene	SW8270C																
Fluorene	SW8270C																
Indeno(1,2,3-cd)pyrene	SW8270C																
Phenanthrene	SW8270C																
Pyrene	SW8270C																
Polynuclear Aromatic Hydrocarbons (mg/kg)																	
1-Methylnaphthalene	SW8270CSIM																
2-Methylnaphthalene	SW8270CSIM																
Acenaphthene	SW8270CSIM																
Acenaphthylene	SW8270CSIM																
Anthracene	SW8270CSIM																
Benz[a]anthracene	SW8270CSIM																

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

		Point	CB-106	CB-106	CB-106	CB-107	CB-107	CB-108	CB-112	CB-112	CB-112	CB-112	CB-16A	CB-19A	CB-19A	CB-22A	CB-22A
		Client ID	CB-106-S1-3.5	CB-106-S2-13.0	CB-106-S3-19.0	CB-107-S1-3.0	CB-107-S2-11.0	CB-108-S1-3.0	CB-112-S1-3.0	CB-112-S3-11.0	CB-112-S4-22.5	CB-112-S4-27.5	CB-16A-S5-17.5	CB-19A-S4-14	CB-19A-S9-35	CB-22A-S2-10	CB-22A-S5-17.5
Benzo(a)pyrene	SW8270CSIM																
Benzo(b)fluoranthene	SW8270CSIM																
Benzo(ghi)perylene	SW8270CSIM																
Benzo(k)fluoranthene	SW8270CSIM																
Chrysene	SW8270CSIM																
Dibenzo(a,h)anthracene	SW8270CSIM																
Fluoranthene	SW8270CSIM																
Fluorene	SW8270CSIM																
Indeno(1,2,3-cd)pyrene	SW8270CSIM																
Naphthalene	SW8270CSIM																
Phenanthrene	SW8270CSIM																
Pyrene	SW8270CSIM																

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

	CB-26A CB-26A-S3-12.5	EB-10A EB-10A-S1-6	EB-10A EB-10A-S3-9	EB-10A EB-10A-S8-26	EB-18A EB-18A-S7-20	GP-10 GP-10-S3-6.5	GP-10 GP-10-S5-9.5	GP-100 GP-100-S1-3.0	GP-100 GP-100-S6-15.0	GP-11 GP-11-S5-9.0	GP-12 GP-12-S3-5.5	GP-13 GP-13-S3-6.0	GP-13 GP-13-S5-10.0	GP-201 GP-201-S2-5.5	GP-202 GP-202-S2-5.5	GP-203 GP-203-S2-6.1
Analyte																
Petroleum (mg/kg)																
Gasoline	Y D															
Diesel Range Organics											61 Y J					
Lube Oil						150 Y	200 Y	Y D			180 Y J	2500 Y	130 Y			
Gasoline	12															
Volatile Organic Compound (mg/kg)																
1,2,4-Trichlorobenzene																
1,3,5-Trimethylbenzene																
2-Butanone										0.012 J			0.0043 J			
Benzene																
Carbon Disulfide									0.054							0.0022
Ethylbenzene																
Isopropylbenzene (Cumene)																
m, p-Xylene																
Naphthalene																
n-Butylbenzene																
n-Propylbenzene																
o-Xylene	0.079															
p-Isopropyltoluene				0.014					0.33							
Sec-Butylbenzene																
Tert-Butylbenzene																
Tetrachloroethene								0.00082	0.006							
Toluene																
Trichloroethene								0.0021								
Semivolatile Organic Compounds (mg/kg)																
1-Methylnaphthalene					0.2											
Acenaphthylene					0.33											
Anthracene					0.75											
Benz[a]anthracene					1.5											
Benzo(a)pyrene		0.11			1.3											
Benzo(ghi)perylene					0.85											
Benzo(k)fluoranthene					0.49											
Bis(2-Ethylhexyl) Phthalate		0.11	0.26													
Carbazole					0.22											
Chrysene		0.11			1.5											
Dibenzofuran					0.21											
Fluoranthene		0.18			3.4											
Fluorene					0.35											
Indeno(1,2,3-cd)pyrene					0.7											
Phenanthrene		0.15			3.1											
Pyrene		0.19			3.8											
Polynuclear Aromatic Hydrocarbons (mg/kg)																
1-Methylnaphthalene																
2-Methylnaphthalene																
Acenaphthene																
Acenaphthylene														0.018		
Anthracene														0.0097		
Benz[a]anthracene														0.065	0.0088	0.011

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

	CB-26A CB-26A-S3-12.5	EB-10A EB-10A-S1-6	EB-10A EB-10A-S3-9	EB-10A EB-10A-S8-26	EB-18A EB-18A-S7-20	GP-10 GP-10-S3-6.5	GP-10 GP-10-S5-9.5	GP-100 GP-100-S1-3.0	GP-100 GP-100-S6-15.0	GP-11 GP-11-S5-9.0	GP-12 GP-12-S3-5.5	GP-13 GP-13-S3-6.0	GP-13 GP-13-S5-10.0	GP-201 GP-201-S2-5.5	GP-202 GP-202-S2-5.5	GP-203 GP-203-S2-6.1
Benzo(a)pyrene														0.16	0.0093	0.013
Benzo(b)fluoranthene														0.25	0.013	0.016
Benzo(ghi)perylene														0.11	0.0098	0.009
Benzo(k)fluoranthene														0.08		
Chrysene														0.098	0.011	0.015
Dibenzo(a,h)anthracene														0.042		
Fluoranthene														0.053	0.018	0.019
Fluorene																
Indeno(1,2,3-cd)pyrene														0.11		
Naphthalene																
Phenanthrene														0.024	0.013	0.013
Pyrene														0.068	0.018	0.02

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

	GP-204 GP-204-S2-5.7	GP-205 GP-205-S2-6	GP-206 GP-206-S2-6.5	GP-207 GP-207-S2-6	GP-208 GP-208-S2-9.1	GP-8 GP-8-S5-11.0	GP-9 GP-9-S7-13.0	TB-315 TB-315:15.5	TB-316 TB-316:10	TB-322 TB-322:7.5	TB-324 TB-324:22.5	TB-324 TB-324:8.0	TB-325 TB-325:2.7	TB-325 TB-325:9.5	TB-326 TB-326:22.3	UB-102 UB-102-S3-10.0
Analyte																
Petroleum (mg/kg)																
Gasoline						Detect		Detect								
Diesel Range Organics															160 J	
Lube Oil	180 Y	370 Y	100 Y	160 Y			120 Y J									
Gasoline																
Volatile Organic Compound (mg/kg)																
1,2,4-Trichlorobenzene																0.0037 J
1,3,5-Trimethylbenzene																
2-Butanone						0.015	0.014 J									
Benzene									0.021							
Carbon Disulfide							0.0028 J									
Ethylbenzene																
Isopropylbenzene (Cumene)																
m, p-Xylene																
Naphthalene																
n-Butylbenzene								0.055								
n-Propylbenzene								0.077								
o-Xylene																
p-Isopropyltoluene								0.99								0.0022 J
Sec-Butylbenzene																
Tert-Butylbenzene								0.036								
Tetrachloroethene																
Toluene																
Trichloroethene																
Semivolatile Organic Compounds (mg/kg)																
1-Methylnaphthalene																
Acenaphthylene																
Anthracene																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Bis(2-Ethylhexyl) Phthalate																
Carbazole																
Chrysene																
Dibenzofuran																
Fluoranthene																
Fluorene																
Indeno(1,2,3-cd)pyrene																
Phenanthrene																
Pyrene																
Polynuclear Aromatic Hydrocarbons (mg/kg)																
1-Methylnaphthalene		0.027									0.06 J		0.03 JH	0.05	0.4 J	0.13
2-Methylnaphthalene		0.033														0.11
Acenaphthene		0.084											0.07		0.06 J	
Acenaphthylene		0.091	0.0093										0.23		0.09 J	
Anthracene		0.18	0.022											0.08	0.09 J	0.011
Benz[a]anthracene		0.21	0.053	0.015										0.06	0.06 J	0.013

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

	GP-204 GP-204-S2-5.7	GP-205 GP-205-S2-6	GP-206 GP-206-S2-6.5	GP-207 GP-207-S2-6	GP-208 GP-208-S2-9.1	GP-8 GP-8-S5-11.0	GP-9 GP-9-S7-13.0	TB-315 TB-315:15.5	TB-316 TB-316:10	TB-322 TB-322:7.5	TB-324 TB-324:22.5	TB-324 TB-324:8.0	TB-325 TB-325:2.7	TB-325 TB-325:9.5	TB-326 TB-326:22.3	UB-102 UB-102-S3-10.0
Benzo(a)pyrene	0.0089	0.2	0.042	0.019	0.0091								1.5	0.12	0.31 J	0.013
Benzo(b)fluoranthene	0.011	0.25	0.055	0.027	0.012								0.16			0.013
Benzo(ghi)perylene	0.01	0.31	0.02	0.023	0.0092							0.06				0.0093
Benzo(k)fluoranthene		0.095	0.024	0.0084									0.14			
Chrysene	0.0082	0.24	0.05	0.021	0.0097					0.06	0.05 J	0.06	0.88	0.54	0.45 J	0.016
Dibenzo(a,h)anthracene		0.037														
Fluoranthene	0.011	0.55	0.13	0.032	0.019									0.22	0.28 J	0.036
Fluorene		0.078	0.0088										0.1			0.033
Indeno(1,2,3-cd)pyrene		0.21	0.021	0.017								0.13		0.05		
Naphthalene		0.038											0.14		0.08 J	0.054
Phenanthrene	0.0087	0.58	0.078	0.022	0.018						0.05 J			0.2	0.46 J	0.15
Pyrene	0.012	0.52	0.1	0.032	0.022								2.9	0.28	0.34 J	0.03

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

	UB-103 UB-103-R10-76	UB-103 UB-103-R1-9	UB-104 UB-104-S18-70	UB-107 UB-107-R2-11	UB-107 UB-107-R8-74	UB-108 UB-108-S15-52.5	UB-108 UB-108-S4-10.0	UB-3 UB-3-S5-18.5	UB-4 UB-4-S5-17.5	UB-5 UB-5-S4-13.5	UB-6 UB-6-S7-18.5	UB-7 UB-7-S7-28.5	UB-8 UB-8-S8-33.5	UB-9 UB-9-S6-23
Analyte														
Petroleum (mg/kg)														
Gasoline		Y D												
Diesel Range Organics		320 Y	110 Y					110 Y						
Lube Oil		260 Y	120 Y					330 Y	98 Y					
Gasoline		130 O												
Volatile Organic Compound (mg/kg)														
1,2,4-Trichlorobenzene		0.082 J												
1,3,5-Trimethylbenzene		0.035 J												
2-Butanone				0.015			0.027			0.0051				
Benzene		0.019												
Carbon Disulfide	0.0013			0.0018	0.0024			0.041	0.0024			0.0034		0.0053
Ethylbenzene		0.016 J												
Isopropylbenzene (Cumene)		0.0035 J												
m, p-Xylene		0.078 J												
Naphthalene		0.0072 J												
n-Butylbenzene		0.0041 J												
n-Propylbenzene		0.012 J												
o-Xylene		0.028 J												
p-Isopropyltoluene		0.014 J				0.0019		0.028	0.015		0.0014		0.0012	0.0014
Sec-Butylbenzene		0.0033 J												
Tert-Butylbenzene														
Tetrachloroethene										0.0012				
Toluene		0.02		0.0034	0.001									
Trichloroethene														
Semivolatile Organic Compounds (mg/kg)														
1-Methylnaphthalene														
Acenaphthylene														
Anthracene														
Benz[a]anthracene														
Benzo(a)pyrene														
Benzo(ghi)perylene														
Benzo(k)fluoranthene														
Bis(2-Ethylhexyl) Phthalate														
Carbazole														
Chrysene														
Dibenzofuran														
Fluoranthene														
Fluorene														
Indeno(1,2,3-cd)pyrene														
Phenanthrene														
Pyrene														
Polynuclear Aromatic Hydrocarbons (mg/kg)														
1-Methylnaphthalene		0.18						0.087						
2-Methylnaphthalene		0.21						0.082						
Acenaphthene								0.15						
Acenaphthylene								0.15						
Anthracene								0.64						
Benz[a]anthracene		0.011		0.013				1.6						

Exhibit F-3B. Detected Organic Analytes in Soil for the Tunnel Area

	UB-103 UB-103-R10-76	UB-103 UB-103-R1-9	UB-104 UB-104-S18-70	UB-107 UB-107-R2-11	UB-107 UB-107-R8-74	UB-108 UB-108-S15-52.5	UB-108 UB-108-S4-10.0	UB-3 UB-3-S5-18.5	UB-4 UB-4-S5-17.5	UB-5 UB-5-S4-13.5	UB-6 UB-6-S7-18.5	UB-7 UB-7-S7-28.5	UB-8 UB-8-S8-33.5	UB-9 UB-9-S6-23
Benzo(a)pyrene				0.022				1.6						
Benzo(b)fluoranthene				0.034				1.6						
Benzo(ghi)perylene				0.024				0.89						
Benzo(k)fluoranthene				0.011				0.59						
Chrysene		0.026		0.015				2.1						
Dibenzo(a,h)anthracene								0.29						
Fluoranthene		0.035		0.012				3.4						
Fluorene		0.028						0.24						
Indeno(1,2,3-cd)pyrene				0.022				0.82						
Naphthalene		0.16						0.16						
Phenanthrene		0.23						2.2						
Pyrene		0.014		0.012				3.1						

Exhibit F-3C. Detected Organic Analytes in Soil in the North Portal Area

		Point	AB-2	AB-2	AB-22	AB-22	AB-23	AB-24	AB-3	AB-3
		Client ID	AB-2-S6-20	AB-2-S7-25	AB-22-S2-5	AB-22-S4-10	AB-23-S4-10	AB-24-S1-1.5	AB-3-S2-10	AB-3-S2A-5
Analyte	**Method**									
Petroleum (mg/kg)										
Heavy Fraction/Oil	NWTPH-HCID									
Lube Oil	NWTPH-Dx					58 Y		650 Y		
2-Butanone	SW8260B		0.0074	0.0075	0.012		0.012			
Volatile Organic Compound										
Chloromethane	SW8260B									
cis-1,2-Dichloroethene	SW8260B									
Naphthalene	SW8260B									
Tetrachloroethene	SW8260B								0.00099	0.0013
Vinyl Chloride	SW8260B									

		Point	AB-3	AB-4	AB-4	AB-4	AB-4	TB-249	TB-249	TB-300
		Client ID	AB-3-S6-20	AB-4-S2-10	AB-4-S2A-5	AB-4-S6-20	AB-4-S8-30	TB-249:17.5	TB-249:40	TB-300:1.5
Analyte	**Method**									
Petroleum (mg/kg)	Method									
Heavy Fraction/Oil	NWTPH-HCID									
Lube Oil	NWTPH-Dx									1100
2-Butanone	SW8260B			0.0078	0.0072					
Volatile Organic Compound (mg/kg)										
Chloromethane	SW8260B							0.44		
cis-1,2-Dichloroethene	SW8260B						0.0061			
Naphthalene	SW8260B								0.03	
Tetrachloroethene	SW8260B		0.0014			0.0011				
Vinyl Chloride	SW8260B						0.047			

Exhibit F-3C. Detected Organic Analytes in Soil in the North Portal Area

NOTES:

1. Methods: Petroleum Hydrocarbons by Northwest Total Petroleum Hydrocarbons-
   Hydrocarbon Identification (NWTPH-HCID);
   diesel and oil by NWTPH-Dx/D Ext.; gasoline by NWTPH-Gx;
   metals by Environmental Protection Agency (EPA) method 6020;
   Volatile Organic Compounds (VOCs) by EPA Method 8260;
   polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270C-Selective Ion method (SIM);
2. Units: mg/kg = milligrams per kilogram, mg/l = milligrams per liter.
3. Qualifiers: U = not detected at the reporting limit; J = estimated value.; Y= silica gel cleanup step.

Exhibit F-3D. Detected Organic Analytes in Soil for North Portal and North Area

		Point	AB-14	AB-14	AB-14	AB-16	AB-16	AB-16	AB-16	AB-16	AB-16	AB-16	AB-17	AB-2	AB-2	AB-20
		Client ID	AB-14-S2-5	AB-14-S2-6.5	AB-14-S7-17.5	AB-16-S11-32.5	AB-16-S12-37.5	AB-16-S13-42.5	AB-16-S14-47.5	AB-16-S17-62.5	AB-16-S3-7.5	AB-16-S7-17.5	AB-17-S11-32.5	AB-2-S6-20	AB-2-S7-25	AB-20-S1-2.5
Analyte	**Method**															
Petroleum (mg/kg)																
Diesel Range Organics	NWTPH-Dx		35 Y J	740 Y J												
Lube Oil	NWTPH-Dx		Y D	Y,F JD												
Oil Range Organics	NWTPH-Dx		140 Y J	2300 Y J												
Volatile Organic Compound																
1,2,4-Trichlorobenzene	SW8260B															
2-Butanone	SW8260B													0.0074	0.0075	
Benzene	SW8260B			0.0064 J												
cis-1,2-Dichloroethene	SW8260B															
Ethylbenzene	SW8260B		0.0026 J	0.024 J												
Naphthalene	SW8260B		1.9 J	0.53 J												
Tetrachloroethene	SW8260B															0.0034
Toluene	SW8260B			0.0063 J	0.0025	0.0031	0.0032	0.0029	0.0017	0.002	0.0025	0.0036	0.0034			
Trichloroethene	SW8260B															
Vinyl Chloride	SW8260B															

		Point	AB-22	AB-22	AB-23	AB-24	AB-3	AB-3	AB-3	AB-4	AB-4	AB-4	AB-4	AB-5	AB-6	AB-6
		Client ID	AB-22-S2-5	AB-22-S4-10	AB-23-S4-10	AB-24-S1-1.5	AB-3-S2-10	AB-3-S2A-5	AB-3-S6-20	AB-4-S2-10	AB-4-S2A-5	AB-4-S6-20	AB-4-S8-30	AB-5-S3-10	AB-6-S12-50	AB-6-S3-12.5
Analyte	Method															
Petroleum (mg/kg)																
Diesel Range Organics	NWTPH-Dx															
Lube Oil	NWTPH-Dx			Y D		Y D										
Oil Range Organics	NWTPH-Dx															
Volatile Organic Compound (mg/kg)																
1,2,4-Trichlorobenzene	SW8260B															0.0018
2-Butanone	SW8260B		0.012		0.012					0.0078	0.0072					
Benzene	SW8260B															
cis-1,2-Dichloroethene	SW8260B												0.0061			
Ethylbenzene	SW8260B															
Naphthalene	SW8260B															0.0017
Tetrachloroethene	SW8260B						0.00099	0.0013	0.0014			0.0011				
Toluene	SW8260B														0.0025	
Trichloroethene	SW8260B													0.0021		
Vinyl Chloride	SW8260B												0.047			

Exhibit F-3. Detected Organic Analytes in Soil

NOTES:

1. Methods: Petroleum Hydrocarbons by Northwest Total Petroleum Hydrocarbons-Hydrocarbon Identification (NWTPH-HCID);
   diesel and oil by NWTPH-Dx/D Ext.; gasoline by NWTPH-Gx;
   metals by U.S. Environmental Protection Agency (EPA) method 6020;
   Volatile Organic Compounds (VOCs) by EPA Method 8260;
   polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270C-Selective Ion method (SIM);
2. Units: mg/kg = milligrams per kilogram, mg/L = milligrams per liter.
3. Qualifiers: U = not detected at the reporting limit; J = estimated value.; Y= silica gel cleanup step.

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

			South Portal Area								South Portal Area					
		Point	AH-28	AH-33	CB-27A	CB-30A	CB-34A	CB-35A	CB-40A	EB-16A	EB-16B	GP-312	GP-316	GP-5	IB-2A	PW-252
		Client ID	AH-28-GW-1	AH-33-GW-1	CB-27A-GW-1	CB-30A-GW-1	CB-34A-GW-1	CB-35A-GW-1	CB-40A-GW-1	EB-16A-GW-1	EB-16B-GW-1	GP-312-GW	GP-316-GW	GP-5-W	IB-2A-GW-1	PW-252:GW:1
Analyte		**Method**														
Petroleum (ug/l)																
Gasoline		NWTPH-HCID														
Diesel Range Organics		NWTPH-Dx								400000 J						
Lube Oil		NWTPH-Dx														
Gasoline		NWTPH-GX			2000											
Metals (ug/l)																
Antimony		EPA200.8														
Antimony	Dissolved	EPA200.8														
Arsenic		EPA200.8			7.9							17	18			
Arsenic	Dissolved	EPA200.8														
Barium		EPA200.8				57										
Beryllium		EPA200.8														2
Beryllium	Dissolved	EPA200.8														1
Cadmium		EPA200.8														
Cadmium	Dissolved	EPA200.8														
Chromium		EPA200.8			35							61	42	20	13	
Chromium	Dissolved	EPA200.8	22													
Copper		EPA200.8			37			8.3				74	41	20	5.1	
Copper	Dissolved	EPA200.8														
Lead		EPA200.8			51	1.7		10				21	10	3	3.1	2
Lead	Dissolved	EPA200.8														
Mercury		SW7471														
Mercury	Dissolved	SW7471														
Nickel		EPA200.8			40							60	35		15	
Nickel	Dissolved	EPA200.8														
Selenium		EPA200.8														
Selenium	Dissolved	EPA200.8														
Silver		EPA200.8					1.9									
Silver	Dissolved	EPA200.8														
Zinc		EPA200.8			77		30	50				160	91	32		
Zinc	Dissolved	EPA200.8														

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

		South Portal Area									South Portal Area				
	Point	AH-28	AH-33	CB-27A	CB-30A	CB-34A	CB-35A	CB-40A	EB-16A	EB-16B	GP-312	GP-316	GP-5	IB-2A	PW-252
	Client ID	AH-28-GW-1	AH-33-GW-1	CB-27A-GW-1	CB-30A-GW-1	CB-34A-GW-1	CB-35A-GW-1	CB-40A-GW-1	EB-16A-GW-1	EB-16B-GW-1	GP-312-GW	GP-316-GW	GP-5-W	IB-2A-GW-1	PW-252:GW:1
Volatile Organic Compounds (ug/l)															
1,2,4-Trimethylbenzene	SW8260B			0.85											
1,3,5-Trimethylbenzene	SW8260B			1.6											
Acetone	SW8260B														
Benzene	SW8260B			2.2											
Bromomethane	SW8260B														
Carbon Disulfide	SW8260B										0.27				
Chloroform	SW8260B														
Chloromethane	SW8260B														9.4
cis-1,2-Dichloroethene	SW8260B														
Ethylbenzene	SW8260B			3.8											
Isopropylbenzene (Cumene)	SW8260B			41											
m, p-Xylene	SW8260B			11											
Methyl isobutyl ketone	SW8260B														
n-Propylbenzene	SW8260B			30											
o-Xylene	SW8260B			0.97											
p-Isopropyltoluene	SW8260B		1.4	1.6											
Sec-Butylbenzene	SW8260B			7.5											
Tert-Butylbenzene	SW8260B			0.85											
Toluene	SW8260B			2.8											10
Total Xylenes	SW8260B														
Vinyl Chloride	SW8260B														
Semi-volatile Organic Comounds (ug/l)															
Benz[a]anthracene	SW8270C														
Benzo(a)pyrene	SW8270C														
Benzo(b)fluoranthene	SW8270C														
Benzo(ghi)perylene	SW8270C														
Benzo(k)fluoranthene	SW8270C														
Chrysene	SW8270C														
Dibenzo(a,h)anthracene	SW8270C														
Indeno(1,2,3-cd)pyrene	SW8270C														

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

		South Portal Area								South Portal Area					
	Point	AH-28	AH-33	CB-27A	CB-30A	CB-34A	CB-35A	CB-40A	EB-16A	EB-16B	GP-312	GP-316	GP-5	IB-2A	PW-252
	Client ID	AH-28-GW-1	AH-33-GW-1	CB-27A-GW-1	CB-30A-GW-1	CB-34A-GW-1	CB-35A-GW-1	CB-40A-GW-1	EB-16A-GW-1	EB-16B-GW-1	GP-312-GW	GP-316-GW	GP-5-W	IB-2A-GW-1	PW-252:GW:1
Polynuclear Aromatic Hydrocarbons (ug/l)															
m,p-Cresol	SW8270CSIM														
Benz[a]anthracene	SW8270CSIM														
Benzo(a)pyrene	SW8270CSIM														
Benzo(b)fluoranthene	SW8270CSIM														
Benzo(ghi)perylene	SW8270CSIM														
Benzo(k)fluoranthene	SW8270CSIM														
Chrysene	SW8270CSIM														
Dibenzo(a,h)anthracene	SW8270CSIM														
Fluoranthene	SW8270CSIM														
Indeno(1,2,3-cd)pyrene	SW8270CSIM														
Phenanthrene	SW8270CSIM														
Pyrene	SW8270CSIM														
Water Quality (mg/l)															
Ammonia	EPA350.3			2.5	1.9	2.8	2.5	0.72	28	8				0.86	
Biochemical Oxygen Demand	EPA405.1				41.8	35	27.9	8.38 J	21					20	
Chemical Oxygen Demand	EPA410.2			77.3	46.9	55.7	40	19.2						8.45	
Chloride	EPA325.3														
Conductivity	EPA120.1				882				230	88					
Hardness	SM2340B			430	330	330	230	300						110	92
Nitrite	EPA300.0														
Salinity	SM2520B														130
Sulfate	EPA300.0														0.32
Sulfide	EPA376.2														
Sulfur	EPA200.7								460	490					0.37
Total Dissolved Solids	EPA160.1			562	556	588	460	21200						174	
Total Suspended Solids	EPA160.2	7	56	440	47	44	82	58						110	230
Methane	RSK-175			31		5.8								5.7	1.1
Cyanide	SM4500CNC														

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

				South Portal Area									South Portal Area			
	PW-252	PW-252	TB-100	TB-101	TB-102	TB-200A	TB-201	TB-202A	TB-203	TB-203	TB-204	TB-205	TB-205	TB-206	TB-207	TB-208
	PW-252:GW:3	PW-252:GW:4	TB-100:GW:1	TB-101:GW:1	TB-102:GW:1	TB-200A:GW:1	TB-201:GW:1	TB-202A:GW:1	TB-203:GW:1	TB-203:GW:2	TB-204:GW:1	TB-205:GW:1	TB-205:GW:2	TB-206:GW:1	TB-207:GW:1	TB-208:GW:1
Analyte																
Petroleum (ug/l)																
Gasoline																
Diesel Range Organics																
Lube Oil																
Gasoline																
Metals (ug/l)																
Antimony															10	
Antimony Dissolved															8	
Arsenic			4.3	6.1			2		8	6				6		
Arsenic Dissolved				4.5					6	3				8		4
Barium																
Beryllium						12	3	2	3	2	25	3	5	21	17	11
Beryllium Dissolved						11	3	4	2	2	41	9.9	7	35	22	14
Cadmium						0.5	0.7	0.7	1.1	0.7						
Cadmium Dissolved						0.4	0.6		0.2	1						
Chromium						5	4	4	16	19	5	2 J	6 J	4	5	
Chromium Dissolved						6	4	5	2	2	29	8 J	5 J	21	13	6
Copper									12	16	13	5.7	7.2		10	40
Copper Dissolved												4.9 J			5.2	
Lead			8.4	7.2	6.7				3	3						
Lead Dissolved			5.4	5.3	5.4											
Mercury				0.023												
Mercury Dissolved				0.011 JT												
Nickel									21	25					20	10
Nickel Dissolved																10
Selenium			5.4	1.5	4.6											
Selenium Dissolved			2.9	2.4	3.5											
Silver			0.67	0.62	0.63											
Silver Dissolved			0.65	0.63	0.65											
Zinc			75		11	13	12		37 J	20 J	34	18	21	13	18	27
Zinc Dissolved																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

				South Portal Area										South Portal Area			
	PW-252 PW-252:GW:3	PW-252 PW-252:GW:4	TB-100 TB-100:GW:1	TB-101 TB-101:GW:1	TB-102 TB-102:GW:1	TB-200A TB-200A:GW:1	TB-201 TB-201:GW:1	TB-202A TB-202A:GW:1	TB-203 TB-203:GW:1	TB-203 TB-203:GW:2	TB-204 TB-204:GW:1	TB-205 TB-205:GW:1	TB-205 TB-205:GW:2	TB-206 TB-206:GW:1	TB-207 TB-207:GW:1	TB-208 TB-208:GW:1
Volatile Organic Compounds (ug/l)																
1,2,4-Trimethylbenzene																
1,3,5-Trimethylbenzene																
Acetone																
Benzene																
Bromomethane																
Carbon Disulfide																
Chloroform																
Chloromethane																
cis-1,2-Dichloroethene																
Ethylbenzene		1.1														
Isopropylbenzene (Cumene)																
m, p-Xylene																
Methyl isobutyl ketone																
n-Propylbenzene																
o-Xylene																
p-Isopropyltoluene																
Sec-Butylbenzene																
Tert-Butylbenzene																
Toluene		6.1														
Total Xylenes		9.1														
Vinyl Chloride																
Semi-volatile Organic Comounds (ug/l)																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Indeno(1,2,3-cd)pyrene																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

				South Portal Area										South Portal Area			
	PW-252 PW-252:GW:3	PW-252 PW-252:GW:4	TB-100 TB-100:GW:1	TB-101 TB-101:GW:1	TB-102 TB-102:GW:1	TB-200A TB-200A:GW:1	TB-201 TB-201:GW:1	TB-202A TB-202A:GW:1	TB-203 TB-203:GW:1	TB-203 TB-203:GW:2	TB-204 TB-204:GW:1	TB-205 TB-205:GW:1	TB-205 TB-205:GW:2	TB-206 TB-206:GW:1	TB-207 TB-207:GW:1	TB-208 TB-208:GW:1
Polynuclear Aromatic Hydrocarbons (ug/l)																
m,p-Cresol																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Fluoranthene																
Indeno(1,2,3-cd)pyrene																
Phenanthrene																
Pyrene																
Water Quality (mg/l)																
Ammonia																
Biochemical Oxygen Demand					13							23 J	31 J			
Chemical Oxygen Demand				8.6 JT	12											
Chloride				300	110							55	50			
Conductivity																
Hardness	78	79		16	170							340 J	330 J			
Nitrite																
Salinity	150	150	520	750	310	1500	340	450	570	580	3400	580	570	2400	2500	2200
Sulfate	4.7	5.3	9.7	9.3	28	2.2	0.9	0.5	16	16	2.6	7.2	6.7	13	37	95
Sulfide																
Sulfur	4.7	5.5	13	13	35	2.5	0.9	0.5	16	18	2.7	7.3	6.9	13	39	93
Total Dissolved Solids	210	180		860	430							550	550			
Total Suspended Solids	20000			5.5	5							27 J	36 J			
Methane	1.3	1.4	6.4	0.017	0.92	19	5.6	9.1	0.02	0.019	110 E	0.087 J	0.12 J	110 E	29 E	0.014
Cyanide																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

						South Portal Area				Tunnel					Tunnel	
	TB-209A	TB-209A	TB-210	TB-212	UB-101	UB-112	UB-203	UB-204	UB-205	B-102	B-102	CB-16A	CB-16A	CB-19A	CB-22A	CB-25A
	TB-209A:GW:1	TB-209A:GW:3	TB-210:GW:1	TB-212:GW:1	UB-101-GW-1	UB-112-GW-1	UB-203-GW-1	UB-204-GW-1	UB-205-GW-1	B-102-GW-1	B-102-GW-2	CB-16A-GW-1	CB-16A-GW-1-Dup	CB-19A-GW-1	CB-22A-GW-1	CB-25A-GW-1
Analyte																
Petroleum (ug/l)																
Gasoline																0.25 Y
Diesel Range Organics																
Lube Oil																
Gasoline																
Metals (ug/l)																
Antimony																
Antimony Dissolved																
Arsenic					40		3.6								10	
Arsenic Dissolved					35											
Barium																260
Beryllium				1												
Beryllium Dissolved	5		1	3												
Cadmium																
Cadmium Dissolved																
Chromium	3		12	7			26					24	25	13	24	41
Chromium Dissolved	5			4												
Copper	8.7		13	19	54		26					16	17	7.1	28	32
Copper Dissolved	5.3 J		4.2 JT	5.5												
Lead			2	3	5.3		5.4		2.2			8.6	8.5	5.6	63	74
Lead Dissolved																
Mercury																
Mercury Dissolved																
Nickel			10	20			17					30	36	16	51	89 J
Nickel Dissolved																
Selenium																
Selenium Dissolved																
Silver																
Silver Dissolved																
Zinc	40		18	15			35			16		32	36	30	75	66
Zinc Dissolved										9						

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

						South Portal Area				Tunnel					Tunnel	
	TB-209A TB-209A:GW:1	TB-209A TB-209A:GW:3	TB-210 TB-210:GW:1	TB-212 TB-212:GW:1	UB-101 UB-101-GW-1	UB-112 UB-112-GW-1	UB-203 UB-203-GW-1	UB-204 UB-204-GW-1	UB-205 UB-205-GW-1	B-102 B-102-GW-1	B-102 B-102-GW-2	CB-16A CB-16A-GW-1	CB-16A CB-16A-GW-1-Dup	CB-19A CB-19A-GW-1	CB-22A CB-22A-GW-1	CB-25A CB-25A-GW-1
Volatile Organic Compounds (ug/l)																
1,2,4-Trimethylbenzene																
1,3,5-Trimethylbenzene																
Acetone					1900					600 J	390					
Benzene																
Bromomethane																
Carbon Disulfide																
Chloroform																
Chloromethane																
cis-1,2-Dichloroethene																
Ethylbenzene																
Isopropylbenzene (Cumene)																
m, p-Xylene																
Methyl isobutyl ketone																2.7
n-Propylbenzene																
o-Xylene																
p-Isopropyltoluene														0.94		22
Sec-Butylbenzene																
Tert-Butylbenzene																
Toluene																0.28
Total Xylenes																
Vinyl Chloride																
Semi-volatile Organic Comounds (ug/l)																
Benz[a]anthracene					0.011	0.033										
Benzo(a)pyrene						0.029										
Benzo(b)fluoranthene					0.011	0.029										
Benzo(ghi)perylene					0.018	0.026										
Benzo(k)fluoranthene						0.026										
Chrysene					0.011	0.028										
Dibenzo(a,h)anthracene						0.024										
Indeno(1,2,3-cd)pyrene						0.026										

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	South Portal Area									Tunnel					Tunnel	
	TB-209A	TB-209A	TB-210	TB-212	UB-101	UB-112	UB-203	UB-204	UB-205	B-102	B-102	CB-16A	CB-16A	CB-19A	CB-22A	CB-25A
	TB-209A:GW:1	TB-209A:GW:3	TB-210:GW:1	TB-212:GW:1	UB-101-GW-1	UB-112-GW-1	UB-203-GW-1	UB-204-GW-1	UB-205-GW-1	B-102-GW-1	B-102-GW-2	CB-16A-GW-1	CB-16A-GW-1-Dup	CB-19A-GW-1	CB-22A-GW-1	CB-25A-GW-1
Polynuclear Aromatic Hydrocarbons (ug/l)																
m,p-Cresol																120
Benz[a]anthracene																0.089
Benzo(a)pyrene																0.087
Benzo(b)fluoranthene																0.096
Benzo(ghi)perylene																0.048
Benzo(k)fluoranthene																0.036
Chrysene																0.094
Dibenzo(a,h)anthracene																0.012
Fluoranthene																0.19
Indeno(1,2,3-cd)pyrene																0.041
Phenanthrene																0.15
Pyrene																0.17
Water Quality (mg/l)																
Ammonia	2.4	2.1								0.31		1.3	1.1	0.95	1.6	0.7
Biochemical Oxygen Demand			7.9							6		2		109		27.9 J
Chemical Oxygen Demand										6		718	718	50.7	622	170
Chloride	140		9.2													
Conductivity																594
Hardness	350		47							240		4200	3900	3300	3800	220
Nitrite		0.13														
Salinity	540		150	160												
Sulfate	63		0.6	10												
Sulfide												0.19	0.16	27		
Sulfur	65		0.8	10								420	400	1600		
Total Dissolved Solids	1100		130							190		424 J	20300 J	16300	20200	572
Total Suspended Solids	21		60		20		550	46	170	89		210	210	120	180	230
Methane	0.25		0.04	26 E								0.81		0.89		
Cyanide	0.3															

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	CB-26A CB-26A-GW-1	CB-28A CB-28A-GW-1	EB-10A EB-10A-GW-1	EB-10A EB-10A-GW-2	EB-10B EB-10B-GW-1	EB-10B EB-10B-GW-2	EB-18A EB-18A-GW-1	Tunnel EB-18B EB-18B-GW-1	EB-3 EB-3-GW-1	GP-201 GP-201-GW	GP-202 GP-202-GW	GP-203 GP-203-GW	GP-204 GP-204-GW	GP-205 GP-205-GW	GP-206 GP-206-GW	GP-207 GP-207-GW
Analyte																
Petroleum (ug/l)																
Gasoline																
Diesel Range Organics																
Lube Oil												460 Y			730 Y	
Gasoline																
Metals (ug/l)																
Antimony																18
Antimony Dissolved																
Arsenic				30												
Arsenic Dissolved																
Barium																
Beryllium																
Beryllium Dissolved																
Cadmium																
Cadmium Dissolved																
Chromium	36			10					30					12		25
Chromium Dissolved																
Copper	44			6						13	16	17	72	30	23	38
Copper Dissolved																
Lead	45	5.1	4	10			15		11		3.8	18	56	11	19	51
Lead Dissolved				7												
Mercury																
Mercury Dissolved																
Nickel	48	18	15	12	5		5		11	46				23	26	34
Nickel Dissolved			10	10						33						
Selenium			9													
Selenium Dissolved																
Silver																
Silver Dissolved																
Zinc	110	36			27				31	29		26	88	65	52	60
Zinc Dissolved												27	66			

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	CB-26A CB-26A-GW-1	CB-28A CB-28A-GW-1	EB-10A EB-10A-GW-1	EB-10A EB-10A-GW-2	EB-10B EB-10B-GW-1	EB-10B EB-10B-GW-2	EB-18A EB-18A-GW-1	Tunnel EB-18B EB-18B-GW-1	EB-3 EB-3-GW-1	GP-201 GP-201-GW	GP-202 GP-202-GW	GP-203 GP-203-GW	GP-204 GP-204-GW	GP-205 GP-205-GW	GP-206 GP-206-GW	GP-207 GP-207-GW
Volatile Organic Compounds (ug/l)																
1,2,4-Trimethylbenzene																
1,3,5-Trimethylbenzene																
Acetone																
Benzene																
Bromomethane												0.32				
Carbon Disulfide											0.45				0.33	
Chloroform																
Chloromethane												1.3				
cis-1,2-Dichloroethene																
Ethylbenzene										0.66	0.34				0.28	
Isopropylbenzene (Cumene)																
m, p-Xylene										1.1	0.49					
Methyl isobutyl ketone																
n-Propylbenzene																
o-Xylene										0.54	0.26					
p-Isopropyltoluene											4.4					
Sec-Butylbenzene																
Tert-Butylbenzene																
Toluene										1.4						
Total Xylenes																
Vinyl Chloride																
Semi-volatile Organic Comounds (ug/l)																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Indeno(1,2,3-cd)pyrene																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	CB-26A CB-26A-GW-1	CB-28A CB-28A-GW-1	EB-10A EB-10A-GW-1	EB-10A EB-10A-GW-2	EB-10B EB-10B-GW-1	EB-10B EB-10B-GW-2	EB-18A EB-18A-GW-1	Tunnel EB-18B EB-18B-GW-1	EB-3 EB-3-GW-1	GP-201 GP-201-GW	GP-202 GP-202-GW	GP-203 GP-203-GW	GP-204 GP-204-GW	GP-205 GP-205-GW	GP-206 GP-206-GW	GP-207 GP-207-GW
Polynuclear Aromatic Hydrocarbons (ug/l)																
m,p-Cresol																
Benz[a]anthracene		0.017														
Benzo(a)pyrene		0.021														
Benzo(b)fluoranthene		0.023														
Benzo(ghi)perylene		0.015														
Benzo(k)fluoranthene																
Chrysene		0.018														
Dibenzo(a,h)anthracene																
Fluoranthene																
Indeno(1,2,3-cd)pyrene		0.012														
Phenanthrene							0.02									
Pyrene																
Water Quality (mg/l)																
Ammonia	0.89	0.83	0.24	0.26	0.1		5.5	1.6	0.24							
Biochemical Oxygen Demand		10.9	3	2	6		5									
Chemical Oxygen Demand	723	34.1	140	120	12		21									
Chloride																
Conductivity																
Hardness	3900	420	130	4500	86		360	67	140							
Nitrite																
Salinity																
Sulfate																
Sulfide	0.126		0.026								0.17					
Sulfur	460	9.6														
Total Dissolved Solids	20100	1130	25000	25000	580		980	170	230							
Total Suspended Solids	360	46 J	38	15	26		64		480	150	81	45	140	160	98	110
Methane	3.3	53				0.04		7.5								
Cyanide																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

		Tunnel GP-208 GP-208-GW	TB-107 TB-107:GW:1	TB-108 TB-108:GW:1	TB-109 TB-109:GW:1	TB-111 TB-111:GW:1	TB-220 TB-220:GW:1	TB-221 TB-221:GW:1	TB-221 TB-221:GW:2	TB-222 TB-222:GW:1	Tunnel TB-224 TB-224:GW:1	TB-225 TB-225:GW:1	TB-226 TB-226:GW:1	TB-307 TB-307:GW:1	TB-308 TB-308:GW:1	TB-309 TB-309:GW:1	TB-312 TB-312:GW:1
Analyte																	
Petroleum (ug/l)																	
Gasoline																	
Diesel Range Organics																	
Lube Oil																	
Gasoline																	
Metals (ug/l)																	
Antimony				13	19												
Antimony	Dissolved																
Arsenic				41										3.9	3.9	2.6	2.8
Arsenic	Dissolved		4	1.2										5			2
Barium																	
Beryllium					7.3												
Beryllium	Dissolved										2			2		2	2
Cadmium																	
Cadmium	Dissolved																
Chromium					380		3.9	18	19		12	8	26		53		
Chromium	Dissolved						2.9						6	2			
Copper		130	9.7		43			25 U	39 U	9.5 U	14	8.8	24		29	3	
Copper	Dissolved	46						3.7 JT	3.3 JT	4 JT				5	6	8	11
Lead		3.3			84	6.5		4	3		3		5		10		
Lead	Dissolved	1.2		8.6	6.1	5.8								31			
Mercury			0.56	0.52							0.013				0.45 JT		
Mercury	Dissolved		0.0005														
Nickel					180			17	18		12	8 JT	30		62		
Nickel	Dissolved								14								8
Selenium																	
Selenium	Dissolved					3.8											
Silver					2.5	1.4											
Silver	Dissolved																
Zinc		42			4600			41	44		20		34		38	43	
Zinc	Dissolved	43												1200			94

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	Tunnel GP-208 GP-208-GW	TB-107 TB-107:GW:1	TB-108 TB-108:GW:1	TB-109 TB-109:GW:1	TB-111 TB-111:GW:1	TB-220 TB-220:GW:1	TB-221 TB-221:GW:1	TB-221 TB-221:GW:2	TB-222 TB-222:GW:1	Tunnel TB-224 TB-224:GW:1	TB-225 TB-225:GW:1	TB-226 TB-226:GW:1	TB-307 TB-307:GW:1	TB-308 TB-308:GW:1	TB-309 TB-309:GW:1	TB-312 TB-312:GW:1
Volatile Organic Compounds (ug/l)																
1,2,4-Trimethylbenzene																
1,3,5-Trimethylbenzene																
Acetone																
Benzene																
Bromomethane																
Carbon Disulfide																
Chloroform											6.1					
Chloromethane																
cis-1,2-Dichloroethene																
Ethylbenzene	0.31															
Isopropylbenzene (Cumene)																
m, p-Xylene	0.42															
Methyl isobutyl ketone																
n-Propylbenzene																
o-Xylene																
p-Isopropyltoluene																
Sec-Butylbenzene																
Tert-Butylbenzene																
Toluene						1.9										
Total Xylenes																
Vinyl Chloride																
Semi-volatile Organic Comounds (ug/l)																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Indeno(1,2,3-cd)pyrene																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	Tunnel GP-208 GP-208-GW	TB-107 TB-107:GW:1	TB-108 TB-108:GW:1	TB-109 TB-109:GW:1	TB-111 TB-111:GW:1	TB-220 TB-220:GW:1	TB-221 TB-221:GW:1	TB-221 TB-221:GW:2	TB-222 TB-222:GW:1	Tunnel TB-224 TB-224:GW:1	TB-225 TB-225:GW:1	TB-226 TB-226:GW:1	TB-307 TB-307:GW:1	TB-308 TB-308:GW:1	TB-309 TB-309:GW:1	TB-312 TB-312:GW:1
Polynuclear Aromatic Hydrocarbons (ug/l)																
m,p-Cresol																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Fluoranthene																
Indeno(1,2,3-cd)pyrene																
Phenanthrene																
Pyrene																
Water Quality (mg/l)																
Ammonia																
Biochemical Oxygen Demand																
Chemical Oxygen Demand																
Chloride																
Conductivity																
Hardness																
Nitrite																
Salinity		120	210	180	160	100	200	200	200	160	99	150	170	200	180	160
Sulfate		15	14	27	32	9.8	15	15	4	22	5.8	3.5	48	34	34	18
Sulfide							0.5	0.5	0.5							
Sulfur		19	19	39	40	10	16	16	4.2	22	5.9	3.5	48	34	34	18
Total Dissolved Solids																
Total Suspended Solids																
Methane		0.04	0.37	0.025	0.022	3.6	2.8	3.1	6.6	0.093	3.6	0.56		0.027	0.007	0.016
Cyanide																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

Analyte		TB-313 TB-313:GW:1	TB-315 TB-315:GW:1	Tunnel TB-316 TB-316:GW:1	TB-317 TB-317:GW:1	TB-318 TB-318:GW:1	TB-319 TB-319:GW:1	TB-319 TB-319:GW:2	TB-321 TB-321:GW:1	TB-323 TB-323:GW:1	TB-324 TB-324:GW:1	TB-324 TB-324:GW:2	Tunnel TB-325 TB-325:GW:1	TB-326 TB-326:GW:1	UB-102 UB-102-GW-1	UB-102 UB-102-GW-2	UB-103 UB-103-GW-1
Petroleum (ug/l)																	
Gasoline																	
Diesel Range Organics																	
Lube Oil										270							
Gasoline																	
Metals (ug/l)																	
Antimony																	
Antimony	Dissolved																
Arsenic		4.3		4		2			3	3					9.8	10	
Arsenic	Dissolved	2		4		2				2.3					9.5	9.5	
Barium																	
Beryllium									1								
Beryllium	Dissolved	2	4	3	3	2	2	2	4	3	3	3	4	3			
Cadmium																	
Cadmium	Dissolved																
Chromium		2.6					10	10	27	10							
Chromium	Dissolved		3	3	2				4	2.8	3	3	3	9			
Copper		6.3		7			8	7.4	22								
Copper	Dissolved	8												76			
Lead		9.9							3						1.1	1.1	
Lead	Dissolved										3			2			
Mercury									0.014								
Mercury	Dissolved																
Nickel				11			8	8	31								
Nickel	Dissolved																
Selenium																	
Selenium	Dissolved								5 J	7.1	5	5	8	7			
Silver																	
Silver	Dissolved																
Zinc		500		37	18		19	21	43	13	19						
Zinc	Dissolved				10									91			

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	TB-313 TB-313:GW:1	TB-315 TB-315:GW:1	Tunnel TB-316 TB-316:GW:1	TB-317 TB-317:GW:1	TB-318 TB-318:GW:1	TB-319 TB-319:GW:1	TB-319 TB-319:GW:2	TB-321 TB-321:GW:1	TB-323 TB-323:GW:1	TB-324 TB-324:GW:1	TB-324 TB-324:GW:2	Tunnel TB-325 TB-325:GW:1	TB-326 TB-326:GW:1	UB-102 UB-102-GW-1	UB-102 UB-102-GW-2	UB-103 UB-103-GW-1
Volatile Organic Compounds (ug/l)																
1,2,4-Trimethylbenzene																
1,3,5-Trimethylbenzene																
Acetone														56	63	
Benzene																2.3
Bromomethane																
Carbon Disulfide																0.75
Chloroform																
Chloromethane														0.4		0.24
cis-1,2-Dichloroethene																
Ethylbenzene																
Isopropylbenzene (Cumene)																
m, p-Xylene																
Methyl isobutyl ketone																
n-Propylbenzene																
o-Xylene																
p-Isopropyltoluene																
Sec-Butylbenzene																
Tert-Butylbenzene																
Toluene																1.7
Total Xylenes																
Vinyl Chloride																
Semi-volatile Organic Comounds (ug/l)																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Indeno(1,2,3-cd)pyrene																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	TB-313 TB-313:GW:1	TB-315 TB-315:GW:1	Tunnel TB-316 TB-316:GW:1	TB-317 TB-317:GW:1	TB-318 TB-318:GW:1	TB-319 TB-319:GW:1	TB-319 TB-319:GW:2	TB-321 TB-321:GW:1	TB-323 TB-323:GW:1	TB-324 TB-324:GW:1	TB-324 TB-324:GW:2	Tunnel TB-325 TB-325:GW:1	TB-326 TB-326:GW:1	UB-102 UB-102-GW-1	UB-102 UB-102-GW-2	UB-103 UB-103-GW-1
Polynuclear Aromatic Hydrocarbons (ug/l)																
m,p-Cresol																
Benz[a]anthracene																
Benzo(a)pyrene																
Benzo(b)fluoranthene																
Benzo(ghi)perylene																
Benzo(k)fluoranthene																
Chrysene																
Dibenzo(a,h)anthracene																
Fluoranthene																
Indeno(1,2,3-cd)pyrene																
Phenanthrene																
Pyrene									0.6		0.5					
Water Quality (mg/l)																
Ammonia																
Biochemical Oxygen Demand																
Chemical Oxygen Demand																
Chloride																
Conductivity																
Hardness																
Nitrite																
Salinity	220	190	180	140	150	140	140	170	220	110	110	130	110			
Sulfate	28	0.75	2.6	3	17	7.2	7.3	0.92	44	1	0.96	0.17	0.39			
Sulfide																
Sulfur	28	0.86	2.6	3.1	17	7.2	7.3	1	44	0.98	0.99	0.13	0.35			
Total Dissolved Solids																
Total Suspended Solids														96	89	26
Methane		29	35	29	19	23	24	5.5	1.9	2.5	2.5	3.1	2			
Cyanide																

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

		UB-104 UB-104-GW -1	UB-104 UB-104-GW-1	UB-106 UB-106-GW-1
Analyte				
Petroleum (ug/l)				
Gasoline				
Diesel Range Organics				
Lube Oil				
Gasoline				
Metals (ug/l)				
Antimony				
Antimony	Dissolved			
Arsenic			11	7.3
Arsenic	Dissolved		6	7.2
Barium				
Beryllium				
Beryllium	Dissolved			
Cadmium				
Cadmium	Dissolved			
Chromium			29	
Chromium	Dissolved			
Copper			32	
Copper	Dissolved			
Lead			18	
Lead	Dissolved			
Mercury				
Mercury	Dissolved			
Nickel			33	
Nickel	Dissolved			
Selenium				
Selenium	Dissolved			
Silver				
Silver	Dissolved			
Zinc			64	
Zinc	Dissolved			

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	UB-104 UB-104-GW -1	UB-104 UB-104-GW-1	UB-106 UB-106-GW-1
Volatile Organic Compounds (ug/l)			
1,2,4-Trimethylbenzene			
1,3,5-Trimethylbenzene			
Acetone			330
Benzene			
Bromomethane			
Carbon Disulfide			
Chloroform			
Chloromethane		0.42	0.22
cis-1,2-Dichloroethene			
Ethylbenzene			
Isopropylbenzene (Cumene)			
m, p-Xylene			
Methyl isobutyl ketone			
n-Propylbenzene			
o-Xylene			
p-Isopropyltoluene			
Sec-Butylbenzene			
Tert-Butylbenzene			
Toluene			
Total Xylenes			
Vinyl Chloride			
Semi-volatile Organic Comounds (ug/l)			
Benz[a]anthracene		0.023	
Benzo(a)pyrene		0.02	
Benzo(b)fluoranthene		0.023	
Benzo(ghi)perylene		0.014	
Benzo(k)fluoranthene			
Chrysene		0.02	
Dibenzo(a,h)anthracene			
Indeno(1,2,3-cd)pyrene		0.012	

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	UB-104 UB-104-GW -1	UB-104 UB-104-GW-1	UB-106 UB-106-GW-1
Polynuclear Aromatic Hydrocarbons (ug/l)			
m,p-Cresol			
Benz[a]anthracene			
Benzo(a)pyrene			
Benzo(b)fluoranthene			
Benzo(ghi)perylene			
Benzo(k)fluoranthene			
Chrysene			
Dibenzo(a,h)anthracene			
Fluoranthene			
Indeno(1,2,3-cd)pyrene			
Phenanthrene			
Pyrene			
Water Quality (mg/l)			
Ammonia			
Biochemical Oxygen Demand			
Chemical Oxygen Demand			
Chloride			
Conductivity			
Hardness			
Nitrite			
Salinity			
Sulfate			
Sulfide			0.06
Sulfur			
Total Dissolved Solids			
Total Suspended Solids	450		
Methane			
Cyanide			

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	North Portal Area								
	AB-4	TB-245	TB-247A	TB-249	TB-300	TB-301	TB-302	TB-303	TB-304
	AB-4-GW-1	TB-245:GW:1	TB-247A:GW:1	TB-249:GW:1	TB-300:GW:1	TB-301:GW:1	TB-302:GW:1	TB-303:GW:1	TB-304:GW:1
Analyte									
Petroleum (ug/l)									
Gasoline									
Diesel Range Organics									
Lube Oil									
Gasoline									
Metals (ug/l)									
Antimony						2.1			
Antimony Dissolved									
Arsenic						13		16	1.9 JT
Arsenic Dissolved								16	
Barium									
Beryllium			2		2	2.6			
Beryllium Dissolved			1		21	2	2	2	3
Cadmium		4				0.4			
Cadmium Dissolved									
Chromium			70	74		110		5.2	
Chromium Dissolved			4	3	19		2	2	2
Copper			34	50		98		9.1	
Copper Dissolved			9				6	9	10
Lead			16	12		35		3	
Lead Dissolved		3	3	2					
Mercury						0.75			
Mercury Dissolved									
Nickel		13	52	84		130			
Nickel Dissolved			18	15	9				
Selenium									
Selenium Dissolved									
Silver							0.15 JT		
Silver Dissolved									
Zinc	190	14	720	84		180			
Zinc Dissolved	150		18						

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	North Portal Area AB-4 AB-4-GW-1	TB-245 TB-245:GW:1	TB-247A TB-247A:GW:1	TB-249 TB-249:GW:1	TB-300 TB-300:GW:1	TB-301 TB-301:GW:1	TB-302 TB-302:GW:1	TB-303 TB-303:GW:1	TB-304 TB-304:GW:1
Volatile Organic Compounds (ug/l)									
1,2,4-Trimethylbenzene									
1,3,5-Trimethylbenzene									
Acetone									
Benzene									
Bromomethane									
Carbon Disulfide	0.22								
Chloroform									
Chloromethane									
cis-1,2-Dichloroethene	0.27								
Ethylbenzene									
Isopropylbenzene (Cumene)									
m, p-Xylene									
Methyl isobutyl ketone									
n-Propylbenzene									
o-Xylene									
p-Isopropyltoluene									
Sec-Butylbenzene									
Tert-Butylbenzene									
Toluene									
Total Xylenes									
Vinyl Chloride	0.25								
Semi-volatile Organic Comounds (ug/l)									
Benz[a]anthracene									
Benzo(a)pyrene									
Benzo(b)fluoranthene									
Benzo(ghi)perylene									
Benzo(k)fluoranthene									
Chrysene									
Dibenzo(a,h)anthracene									
Indeno(1,2,3-cd)pyrene									

Exhibit F-4. Detected Analytes in Groundwater for the Bored Tunnel Alternative

	North Portal Area AB-4 AB-4-GW-1	TB-245 TB-245:GW:1	TB-247A TB-247A:GW:1	TB-249 TB-249:GW:1	TB-300 TB-300:GW:1	TB-301 TB-301:GW:1	TB-302 TB-302:GW:1	TB-303 TB-303:GW:1	TB-304 TB-304:GW:1
Polynuclear Aromatic Hydrocarbons (ug/l)									
m,p-Cresol									
Benz[a]anthracene									
Benzo(a)pyrene									
Benzo(b)fluoranthene									
Benzo(ghi)perylene									
Benzo(k)fluoranthene									
Chrysene									
Dibenzo(a,h)anthracene									
Fluoranthene									
Indeno(1,2,3-cd)pyrene									
Phenanthrene									
Pyrene									
Water Quality (mg/l)									
Ammonia	4.6								
Biochemical Oxygen Demand									
Chemical Oxygen Demand	19.1								
Chloride									
Conductivity									
Hardness	110								
Nitrite									
Salinity		230	200	470	1600	320	110	240	150
Sulfate		70	25	77	180		22	68	35
Sulfide									
Sulfur	4.7	70	25	76	160		22	67	36
Total Dissolved Solids	330								
Total Suspended Solids	23								
Methane		0.031	2.1	0.06	0.44				
Cyanide									

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ATTACHMENT G

Summary Table of Validated Sites

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Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
South Portal							
370.1-1	Former gas station 1041/1121 First Avenue S. King County Parcel #7666206955	S. Royal Brougham Way	Beneath and adjacent east and west of the project area. Probably upgradient of the project area. Groundwater is estimated to be 6-10 ft bgs. The site would be acquired.	Polk directories, current assessor records, windshield survey	A gas station was present from at least 1938 to 1943. A warehouse constructed in 1939 is present at the site. There is a potential for gasoline. Diesel and/or oil to be present in soil and groundwater from the former gas station operations. Due to the age of the warehouse being acquired, there is potential for asbestos and lead-based paint.	**No (already acquired)**	**Low- Straightforward** Site is beneath and adjacent to the project area. Explorations to date have not shown significant contamination. The site was acquired by WSDOT in November 2009. Shallow groundwater is present. The site has historical use as a gas station. Construction may include shallow excavations for surface street and utility construction.
370.1-2	Union Pacific Railroad 801 First Avenue S. (EDR Map No. 244) King County Parcel #7666206950	S. Dearborn Street	Beneath the project area. Probably upgradient of the Project area. Groundwater is estimated to be 6-10 ft bgs. The site would be acquired.	Ecology LUST and ICR site (ID#95533284), windshield survey	Phase II explorations were previously conducted for the Alaskan Way Viaduct Project. Isolated instances of solvents and lead have been detected in soil, but concentrations have not exceeded MTCA method A cleanup levels. Isolated areas of TPH contamination exist in soil resulting from removed or abandoned USTs. Groundwater has not been affected based on limited sampling. It does not appear that contaminants pose a potential to migrate off the site. No additional Ecology information was available in 2009. No buildings currently exist on the site. Based on the former railroad use and presence of fill, there is potential for petroleum, PAHs, metals, and solvents in soil and groundwater.	**No (already acquired)**	**Low - Straightforward** Site is adjacent to and beneath the project area. Explorations to date have not shown significant contamination. The site was acquired by WSDOT in November 2009. Construction may include shallow excavations for surface street and utility construction across the site, and deeper excavations adjacent to (west of) the site ranging from about 8 to 55 feet bgs, from south to north.
360.1-4	Dock with tank 525 Alaskan Way, Terminal 46 King County Parcel #7666207695			Assessor archive	Archive records indicate that the dock was built in 1964-65, and has a 2,000 gallon tank. Potential contaminants in soil and groundwater from historical land use includes petroleum. Other contaminants may be present because the area has been filled.	**No**	**Low- Straightforward** Site is adjacent to the project area. The site has no documented contamination, but the potential exists based on petroleum product storage. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 75 feet bgs.
360.1-5	Former machine shop / gasoline and oil / repair shop 549 Alaskan Way S. King County Parcel #7666207695			Assessor archive, Sanborn maps	Former businesses present from at least 1916 through 1969. Potential contaminants in soil and groundwater include solvents, metals and gasoline. Diesel and/or oil may be associated with the historical land use. If burned material, coal or heavy oil is encountered PAHs may also be detected.	**No**	**Low- Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 75 feet bgs.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
360.1-6	Former machine and blacksmith shops 579 Alaskan Way S. King County Parcel #7666207695			Assessor archive, Sanborn maps	Machine shop and blacksmith shop associated with the railroad were present from at least 1916 through 1950. Potential contaminants in soil and groundwater from historical land use include solvents and metals. Petroleum may also be encountered in fill soils. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low- Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 70 feet bgs.
360.1-7	Former repair shop 813 Alaskan Way S. King County Parcel #7666207695			Sanborn maps	Business was present in 1969. Potential contaminants in soil and groundwater from historical land use include metals and petroleum. If burned material, coal or heavy oil is encountered PAHs may also be detected.	**No**	**Low- Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials.
360.1-8	Former gasoline and service station 831 Alaskan Way S. King County Parcel #7666207695			Assessor archive, Polk directories, Sanborn maps	Business was present from at least 1938 to 1960. Potential contaminants in soil and groundwater from historical land use include gasoline. Diesel and oil as well as metals may be associated with the former service station or may be present in the fill soil. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low- Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 50 feet bgs.
360.1-9	Former construction and dry dock company with machine shops, blacksmith, auto repairs, forge shops, copper shop, and foundry 849-1051 Alaskan Way S. King County Parcel #7667800005			Sanborn maps	Businesses were present in 1916. Potential contaminants in soil and groundwater include solvents, petroleum, and metals.	**No**	**Low- Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 40 feet bgs.

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Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
360.1-10	Former machine shop 901 Alaskan Way S. King County Parcel #7666207695			Assessor archive, Sanborn maps	Business was present from at least 1950 through 1969. Potential contaminants in soil and groundwater include solvents, petroleum, and metals. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low- Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 40 feet bgs.
360.1-11	Former boat shop Terminal 46 King County Parcel #7666207695			Assessor archive	Potential contaminants in soil and groundwater include petroleum and metals. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low- Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 35 feet bgs.
360.1-12	Former locomotive repair shop 945 Alaskan Way S. King County Parcel #7666207695			Sanborn maps	Business was present from at least 1950 through 1969. Potential contaminants in soil and groundwater include petroleum and metals. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low- Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 10 feet bgs.
360.2-1	Former paint manufacturers 501 1st Avenue South, 83 King Street King County Parcel #7666206895	S. King Street	Adjacent west of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 45 ft bgs. No planned acquisition.	Ecology UST site (ID#24388967), Assessor archive, Polk directories, current assessor records	Former business present at least in 1951. Assessor records indicate that office buildings were built in 1904 and 2009. Potential contaminants in soil and groundwater include solvents and gasoline. One UST has been removed and one UST is a closure in process.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. The bored tunnel crown is approximately 30 feet bgs in the site vicinity.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
360.2-2	Former fuel company 525 1st Avenue South King County Parcel #7666206895	S. Dearborn Street	Adjacent west of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 8-12 ft bgs. No planned acquisition.	Assessor archive, Polk directories, current assessor records, windshield survey	Former business present at least from 1938 to 1940. Assessor records indicate that office buildings were built in 1904, 1923, and 2009. Potential contaminants in soil and groundwater from historical land use includes petroleum. Other contaminants may be present in fill soil. New multi-story office building constructed in 2009.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 75 feet bgs.
360.2-3	Former auto service company 535 1st Avenue South King County Parcel #7666206895	S. Dearborn Street	Adjacent west of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 8-12 ft bgs. No planned acquisition.	Assessor archive, Polk directories, Sanborn maps, current assessor records, windshield survey	Former business present at least from 1938 to 1950. Assessor records indicate that office buildings were built in 1904 and 2009. Potential contaminants in soil and groundwater include gasoline and petroleum. New multistory office building constructed in 2009.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 75 feet bgs.
360.2-4	Former painters and sign company 539 1st Avenue South King County Parcel #7666206895	S. Dearborn Street	Adjacent west of the project area. Probably downgradient of the Project area. Perched groundwater is estimated to be 8-12 ft bgs. No planned acquisition.	Assessor archive, Polk directories, current assessor records, windshield survey	Former business present at least in 1951. Assessor records indicate that office buildings were built in 1904 and 2009. Potential contaminants in soil and groundwater from former land use includes solvents. Other contaminants may be present in fill soil. New multistory office building constructed in 2009.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Excavation for the adjacent cut-and-cover tunnel extends from ground surface to approximately 75 feet bgs.
Bored Tunnel							
350.1-1	Former repair workshop 324, 327 Alaskan Way S. & 17 S. Jackson King County Parcel #7666207696			Assessor archive, Sanborn maps	Former business was present in at least 1916 and likely later. Potential contaminants in soil and groundwater include gasoline and petroleum. If burned material, coal or heavy oil is encountered PAHs may also be detected.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. The bored tunnel crown is approximately 45 feet bgs in the site vicinity.

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350.1-2	Seattle Port Terminal 46 and former gas station 401-403 Alaskan Way S. (EDR Map No. 226) King County Parcel #7666207695			Ecology CSCSL, LUST and ICR site (ID #99728255), Assessor archive, Polk directories, Sanborn maps	The former gas station was present from at least 1938 to 1950. The database information indicates that 7 USTs have either been removed (3) or closed in place (4). Ecology received a final cleanup report regarding petroleum in the soil from a tank in 1992. The CSCSL indicates that phenolic compounds and metals are suspected in sediment. See Site 350.1-4 for other UST at Terminal 46.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. The bored tunnel crown is approximately 45 feet bgs in the site vicinity.
350.1-3	Former welding shop 413 Alaskan Way S. King County Parcel #7666207695			Sanborn maps	Business was present in at least 1950. Potential contaminants in soil and groundwater include metals. Other contaminants may be encountered in fill soil.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. The bored tunnel crown is approximately 40 feet bgs in the site vicinity.
350.1-4	Former gas station 421 Alaskan Way S. King County Parcel #7666207695			Sanborn maps	Business was present in at least 1916. Potential contaminants in soil and groundwater include gasoline. The Port of Seattle removed a 10,000-gallon gasoline tank and oil-water separator located 500 feet north of the Terminal 46 entrance and 100 feet west of S. Alaskan Way in 2003. With minimal overexcavation BTEX and petroleum levels were not detected in soil. There is no record of spills or releases. Groundwater was not affected.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. The bored tunnel crown is approximately 35 feet bgs in the site vicinity.
350.1-5	Former plating company and machine shop 417-427 Alaskan Way S. King County Parcel #7666207695			Sanborn maps	One or both businesses were present from at least 1916 through 1950. Potential contaminants in soil and groundwater from former land use include solvents and metals. Petroleum may also be associated with the machine shop. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. The bored tunnel crown is approximately 30 feet bgs in the site vicinity.
350.2-1	Former gasoline station 420 Alaskan Way S. King County Parcel #5247800201			Assessor archive, Polk directories, Sanborn maps	The business was present from at least 1938 to 1950. Potential contaminants in soil and groundwater include gasoline and petroleum. If burned material, coal, or heavy oil is encountered, PAHs may also be detected.	**No**	**Low - Straightforward** Site is adjacent to and upgradient of the project area where the tunnel crown is approximately 30 feet bgs. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials.

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330.2-1	Former laundry 88 Main Street King County Parcel #5247800100			Sanborn maps	Business was present in at least 1949. Potential contaminants in soil and groundwater include solvents, if the laundry also provided dry cleaning services. Other contaminants may be encountered in fill soil.	**No**	**Low - Straightforward** Site is adjacent to and upgradient of the project area (bored tunnel). The tunnel crown is approximately 60 feet bgs in site vicinity. The site has no documented contamination, but the potential exists based on the use history. Soil excavated from tunnel zone could be contaminated.
330.2-2	Former laundry/cleaners 85 Washington Street King County Parcel #5247800065			Polk directories	A laundry was present from at least 1943 to 1951. A cleaners was present from 1951 to at least 1956. Potential contaminants in soil and groundwater from former land use include solvents. Other contaminants may be present in the fill soil.	**No**	**Low - Straightforward** Site is adjacent to and upgradient of the project area (bored tunnel). The tunnel crown is approximately 65 feet bgs in site vicinity. The site has no documented contamination, but the potential exists based on the use history. Soil excavated from tunnel zone could be contaminated.
330.1-1	Former gas station 221 Alaskan Way S. King County Parcel #7666202630			Polk directories	Business was present from at least 1938 to 1940. Potential contaminants in soil and groundwater include gasoline. Petroleum may also be present. Other contaminants may be encountered in fill soil.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. The bored tunnel crown is approximately 60 feet bgs in the site vicinity.
320.1-2	Former lithographer 75 Yesler Way King County Parcel #5247800005			Polk directories	Business was present from at least 1943 through 1960. Potential contaminants in soil and groundwater include solvents.	**No**	**Low - Potentially Complex** Site is adjacent to and upgradient of the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 80 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated.
290.2-1	Former printer 627 Western Avenue King County Parcel #7666202565			Assessor archive, current assessor records, Polk directories, Sanborn maps	Business was present from at least 1960 through 1969 in a building that was constructed in 1910. Potential solvent contamination of soil and groundwater from former land use. Other contaminants may be present in fill soil.	**No**	**Low - Potentially Complex** Site is below the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 90 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated.

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290.2-2	Former ink manufacturer 63 Columbia Street King County Parcel #7666202565			Sanborn maps	Business was present in at least 1969. Potential solvent contamination of soil and groundwater. Other contaminants may be encountered in fill soil.	**No**	**Low - Potentially Complex** Site is below the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 90 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated.
290.2-4	Former gas station and auto repair 72 Yesler Way King County Parcel #7666202575			Assessor archive, Polk directories and Sanborn maps	Business was present from at least 1938 though 1965. Potential contaminants in soil and groundwater include gasoline.	**No**	**Low - Straightforward** Site is below or adjacent to the project area (bored tunnel). The site has no documented contamination, but the potential exists based on the use history. The tunnel crown is approximately 80 feet bgs in the site vicinity. Soil excavated from tunnel zone could be contaminated.
130.9-1	600 Wall Street (former gas station) 600 Wall Street (EDR Map No. 67) King County Parcel #0697000370	Wall Street	Adjacent west of the project area. Probably upgradient of the project area. No groundwater was detected in nearest soil boring. No planned acquisition.	Ecology CSCSL and VCP site (ID#4456856), Assessor archive, Polk directories, Sanborn maps, current assessor records, windshield survey	A gas station was present from at least 1938 to 1978. Assessor records indicate that the building was constructed in 1934, remodeled in 1959, and demolished in 1978. Demolition permit included 5 USTs; no record of how USTs were decommissioned, and no record of 1,000- and 550-gallon USTs also on site; 2007 site characterization found gasoline and BTEX in soil greater than MTCA-A, and gasoline and benzene in groundwater greater than MTCA-A. Proposed cleanup action plan (CAP) includes removing potential USTs and excavating PCS. Ecology determined CAP likely sufficient, but does not represent NFA determination. No information in the file to indicate if the CAP was implemented. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations, as well as BTEX and VOCs. A paved parking lot currently occupies the site.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Site has documented soil and groundwater contamination whose status is unknown. The potential for contamination still exists. The bored tunnel crown is approximately 90 feet bgs in the site vicinity. Remediation would not be the responsibility of the project.

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80.5-3	Former gas station and auto repair 604 Denny Way King County Parcel #1991200695	Denny Way	Approximately 100 feet west of the project area. Probably upgradient of the project area. No groundwater was detected in nearest soil boring. No planned acquisition.	Assessor archive, Polk directories, current assessor records, windshield survey	Former gas station was present from at least 1931 to 1942. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations. A multistory apartment building was observed to be under construction (2009).	**No**	**Low - Straightforward** Site is adjacent to the project area (bored tunnel) where the tunnel crown is approximately 85 feet bgs. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. It is unlikely that soil excavated from tunnel zone would be contaminated with petroleum products. In addition, if petroleum was present it would likely have been removed during construction of the multistory building under construction in 2009.
North Portal							
60.1-1	Former gas station 521 Broad Street King County Parcel #1991200405	Thomas Street	Approximately 625 feet west of the project area. Probably upgradient of the project area. Regional groundwater is estimated to be 70 ft bgs. No planned acquisition.	Assessor archive, Polk directories, Sanborn maps, current assessor records	Service station built in 1958 was present until at least 1969. Potential gasoline contamination in soil and groundwater.	**No**	**Low - Straightforward** Site is adjacent to the project area (Broad Street). No excavation is anticipated. Groundwater is not expected to be encountered. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Remediation would not be the responsibility of the project.
60.1-2	Former gas station and auto repair shop 500 Broad Street King County Parcel #1991200375	Thomas Street	Approximately 750 feet west of the project area. Probably upgradient of the project area. Regional groundwater is estimated to be 70 ft bgs. No planned acquisition.	Assessor archive, Sanborn maps, current assessor records	Former gas station was present at least in 1946. Assessor records indicate that station was built in 1946 and was replaced by a commercial building constructed in 1963. There is a potential for gasoline, diesel, and/or oil to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area (Broad Street). Groundwater is not expected to be encountered. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Remediation would not be the responsibility of the project.

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Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
60.1-3	Former oil company 516 Broad Street King County Parcel #1991200375	Thomas Street	Approximately 775 feet west of the project area. Probably upgradient of the project area. Regional groundwater is estimated to be 70 ft bgs. No planned acquisition.	Assessor archive, Sanborn maps, current assessor records	Former company was replaced with commercial buildings constructed in 1963-1964. Potential contaminants in soil and groundwater include petroleum.	**No**	**Low - Straightforward** Site is adjacent to the project area (Broad Street). Groundwater is not expected to be encountered. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Remediation would not be the responsibility of the project.
60.1-4	Former dry cleaners 505 Harrison Street & 332 5th Avenue N. King County Parcel #1991200400	Harrison Street	Approximately 750 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 20 ft bgs. No planned acquisition.	Assessor archives, Polk directories, Sanborn maps, Phase I ESA (GeoEngineers), current assessor records	Former company was present at least from 1929 to 1970. Assessor records indicate that store and warehouse buildings were constructed in 1929. Potential contaminants in soil and groundwater from former land use include solvents.	**No**	**Low - Potentially Complex** Site is adjacent to the project area (surface street improvements). Shallow (perched) groundwater may be present. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Remediation would not be the responsibility of the project.
50.2-2	Former film processing company 401 Dexter Avenue N. King County Parcel #1988201310	Harrison Street	Approximately 100 feet east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 20 ft bgs. No planned acquisition.	Assessor archives, Polk directories, current assessor records, windshield survey	Former company was present at least from 1980 to 1990. Site is currently listed as a print shop. Assessor records indicate that commercial building was constructed in 1948. Potential contaminants in soil and groundwater include solvents.	**No**	**Low - Potentially Complex** Site is adjacent to the project area (surface street improvements). Construction may include shallow excavations for surface street and utility construction. Shallow groundwater may be present. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Remediation would not be the responsibility of the project.
50.2-3	Former sign painting/maintenance shop and oil company 700 Harrison Street King County Parcel #1988201320	Harrison Street	Adjacent east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 20 ft bgs. No planned acquisition.	Assessor archives, Sanborn maps, current assessor records, windshield survey	Former company was present at least from 1950 to 1969. Assessor records indicate that a warehouse was constructed in 1924. Currently a paved parking lot. Potential contaminants in soil and groundwater include solvents and petroleum.	**No**	**Low - Potentially Complex** Site is adjacent to the project area (surface street improvements). Construction may include shallow excavations for surface street and utility construction. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the use history and the presence of fill materials. Remediation would not be the responsibility of the project.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
50.2-4	Interstate Brands Corp. Hostess 434 Aurora Avenue N. (EDR Map No. 32) King County Parcel #1988201285	Republican Street	Adjacent east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10-20 ft bgs. No planned acquisition.	Ecology CSCSL-NFA and VCP site (ID#84512858), Assessor archive, current assessor records, windshield survey	Assessor records indicate that a manufacturing building was constructed in 1900. Two diesel USTs removed August 1997; PCS over excavated and removed; two other USTs closed in place (diesel and Bunker oil); soil sampling indicated no petroleum at greater than regulatory criteria; NFA granted March 2003 with no restrictions. Potential contaminants in soil and groundwater include petroleum.	**Permanent Tieback Easement**	**Low - Straightforward** Site is adjacent to the project area (surface street improvements) (surface street improvements) and a permanent tieback easement will be acquired. Shallow groundwater is present. Site has documented contamination. Spoils could be contaminated and would require special handling if contaminated, but site remediation would not be the responsibility of the project.
50.1-4	Former battery manufacturer 600 Broad Street King County Parcel #1988201090	Republican Street	Approximately 100 feet west of project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Polk directories, current assessor records, windshield survey	ForFormer company was present at least from 1938 to 1956. Assessor records indicate that commercial building was constructed in 1922. Most of the site is now part of Broad Street. Potential contaminants in soil and groundwater include metals.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. Parcel part of Broad Street; contaminants likely excavated during construction of the street. Broad Street will be filled; no excavation is anticipated.
50.05-1	Former paint shop and auto rebuild company 580 Broad Street King County Parcel #1988201155	Republican Street	Approximately 250 feet west of project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archives, Sanborn maps, current assessor records	Former company was present at least in 1950. Assessor records indicate that shop building was constructed in 1947 and torn down in 1962. Potential contaminants in soil and groundwater include solvents and petroleum.	**No**	**Low - Potentially Complex** Site is adjacent to the project area (Broad Street). No excavation is anticipated. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Remediation would not be the responsibility of the project.
50.05-2	Former gas station and auto repair shop 567 Broad Street King County Parcel #2570400000	Harrison Street	Approximately 250 feet west of project area. Probably upgradient of the project area. Perched groundwater is estimated to be 20 ft bgs. No planned acquisition.	Assessor archive, Polk directory, Sanborn maps, Current assessor records	Former gas station was present at least from 1938 to 1951. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area (surface street improvements). Shallow groundwater is present. Most of the parcel is part of Broad Street; contaminants likely excavated during construction of the street. Construction may include shallow excavations for surface street and utility construction.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
40.2-2	Former printing company and auto service shop 509 Dexter Avenue N. King County Parcel #1988201240	Republican Street	Approximately 100 feet east of project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Polk directory, Sanborn maps, current assessor records, windshield survey	Former businesses were present at least from 1938 to 1989. Assessor records indicate that garage was constructed in 1930. Possible fill port and vent pipe for potential UST located on west side of building. Potential contaminants in soil and groundwater include solvents and petroleum.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. No excavation is anticipated. Remediation would not be the responsibility of the project.
40.2-3	Former gasoline station 514 Aurora Avenue N. King County Parcel #1988201260	Republican Street	Adjacent east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. The site would be acquired.	Assessor archive, Polk directory, Sanborn maps, current assessor records, windshield survey	Former gas station was present at least from 1938 to 1951. Assessor records indicate that store and warehouse buildings were constructed in 1934. No buildings currently exist on the site (paved parking lot with large patch). There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area (Broad Street). Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the commercial use history and the presence of fill materials. No excavation is anticipated.
40.2-4	Former laundry and gas station 532 Aurora Avenue N. King County Parcel #(NA)	Mercer Street	Adjacent east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Polk directory, Sanborn maps, current assessor records, windshield survey	Former laundry was present in at least 1917; former gas station was present at least from 1938 to 1956. Assessor records indicate that store and warehouse buildings were constructed in 1930. Parcel has become part of roadway and no longer exists. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. Parcel is part of Broad Street; contaminants likely excavated during construction of the street. No excavation is anticipated.
40.05-1	Mercer Operating Base (former bus barn) 506 Republican Street & 520 5th Avenue North (EDR Map No. 26) King County Parcel #1988201155	Mercer Street	Approximately 275 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Ecology LUST site (ID#2593), Assessor archive, Polk directory, Sanborn maps, current assessor records	Maintenance, fueling, and storage facility for streetcars, trolleys, and buses since early 1900s. Site is now cojoined with blocks 40.05, 50.05 and site 40.1-5. Remediation of petroleum began in 1989 (LUST ID#2593) and continued as an ICR under the name Seattle City Seattle Center in 1996 (see site 40.1-5). Nine USTs were removed in 1990 and three additional USTs were removed in 1996. Approximately 3,000 to 4,000 cy of petroleum-contaminated soil were treated on-site using landfarming. Over 10,000 cy of heavy TPH-contaminated soil remains on site (above MTCA A). Potential contaminants in soil and groundwater include solvents, metals and petroleum.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. Site has documented contamination whose status is unknown; the potential for contamination still exists. Construction may include shallow excavations for surface street and utility construction. Remediation would not be the responsibility of the project.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
30.3-2	Former gas station and auto repair shop 613 8th Avenue N., 777 Broad King County Parcel #2249000055	Mercer Street	Approximately 475 feet east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, current assessor records	Former gas station was present at least from 1938 to 1940. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. No excavation is anticipated. Remediation would not be the responsibility of the project.
30.3-3	Former gas station 610 Dexter Avenue N. King County Parcel #2249000055	Mercer Street	Approximately 325 feet east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Polk directory, current assessor records	Former gas station was present at least from 1930 to 1956. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. No excavation is anticipated. Remediation would not be the responsibility of the project.
30.2-1	Former gas station and auto repair shop 650 Dexter Avenue N. King County Parcel #2249000080	Roy Street	Approximately 300 feet east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Polk directory, Sanborn maps, current assessor records	Former gas station and auto repair shop was present at least from 1951 to 1960. Assessor records indicate that gas station/repair garage was constructed in 1929. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. No excavation is anticipated. Remediation would not be the responsibility of the project.
30.1-1	Former gas station 607 Dexter Avenue N. King County Parcel #2249000100	Mercer Street	Approximately 100 feet east of the project area. Probably downgradient of the Project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, current assessor records	Former gas station was present at least from 1930 to 1941. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Construction may include shallow excavations for surface street and utility construction. Remediation would not be the responsibility of the project.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
30.1-2	Former laundry, varnish manufacturer, and coated wall board manufacturer 700 Mercer Street King County Parcel #2249000120	Mercer Street	Adjacent east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Sanborn map, Polk directory, Current assessor records	Former businesses were present at least from 1940 to 1950. 1950 Sanborn map notes the presence of in-ground solvent tanks with 2,000 gallon capacity. Potential contaminants in soil and groundwater include solvents.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Construction may include shallow excavations for surface street and utility construction. Remediation would not be the responsibility of the project.
30.1-4	Former paint products company and floor factory 616 Aurora Avenue N. King County Parcel #2249000120	Roy Street	Adjacent east of the project area. Probably downgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Polk directory, current assessor records	Former company was present at least in 1938. Potential contaminants in soil and groundwater include solvents.	**No**	**Low - Potentially Complex** Site is adjacent to the project area (surface street). Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Construction may include shallow excavations for surface street and utility construction. Remediation would not be the responsibility of the project.
30.05-1	Former oil burner service company 601-611 Aurora Avenue N. King County Parcel #2249000150	Mercer Street	Approximately 25 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Sanborn map, current assessor records	Former company was present at least in 1950. Assessor records indicate that the original store/office was built in 1941 and remodeled in 1953. Potential contaminants in soil and groundwater include petroleum.	**No**	**Low - Straightforward** Site is adjacent to the project area. Mercer Street will be widened in the existing right-of-way and will require a cut of 20 feet bgs. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Remediation would not be the responsibility of the project.

Exhibit G-1. Summary Table of Validated Sites - Low Potential Impact

Site No.	Site Name[1], Address, and County Parcel Number	Nearest Cross Street	Proximity to Project Area, Groundwater Flow, and Acquisition Plans	Site Information Sources (Ecology ID)	Relevant Site Uses(s), Site Conditions of Concern, Affected Media and Remediation History, and Hazardous Materials of Concern	Site to Be Acquired? (Yes, No, Option)	Risk Analysis: Impact - Potential Complexity and Rationale
30.05-2	Former contractor's warehouse 600-622 6th Avenue N. King County Parcel #2249000170	Mercer Street	Approximately 125 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Sanborn map, current assessor records	Former company was present at least in 1950. Potential contaminants in soil and groundwater includes gasoline.	**No**	**Low - Straightforward** Site is adjacent to the project area. Mercer Street will be widened in the existing right-of-way and will require a cut of 20 feet bgs. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Remediation would not be the responsibility of the project.
30.01-1	PCY Corp (former sheet metal works and gasoline engine rebuild company) 570 Mercer Street (EDR Map No. 20) King County Parcel #5458300405	Mercer Street	Approximately 325 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Ecology LUST site (ID#36533718), Assessor archive, Polk directory, Sanborn maps, current assessor records	Former company was present at least from 1950 to 1989. Decommissioned tank encountered in 1998. Gasoline soil contamination was found at 5,000 ppm. Contamination and/or tank may still be present on site. No additional information was available in 2009. Assessor records indicate that the warehouse was built in 1946. Potential contaminants in soil and groundwater include petroleum and gasoline.	**No**	**Low - Straightforward** Site is adjacent to the project area. Mercer Street will be widened in the existing right-of-way and will require a cut of 20 feet bgs. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Remediation would not be the responsibility of the project.
30.01-3	Former gas station 600 Taylor Street King County Parcel #5458300425	Mercer Street	Approximately 500 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Assessor archive, Polk directory, Sanborn maps, current assessor records	Former gas station was present at least from 1938 to 1951. There is a potential for gasoline to be present in soil and groundwater from the former gas station operations.	**No**	**Low - Straightforward** Site is adjacent to the project area. Mercer Street will be widened; requiring a cut. Shallow groundwater is present. The site has no documented contamination, but the potential exists based on the industrial use history and the presence of fill materials. Remediation would not be the responsibility of the project.
30.0-1 **30.0-2** **30.0-3**	Tower Records (former sheet iron billboard company, paint storage facility, laundry and gas station) 500 Mercer Street / 623 Taylor Avenue N. (EDR Map No. 21) King County Parcel #4458720000	Mercer Street	Approximately 600 feet west of the project area. Probably upgradient of the project area. Perched groundwater is estimated to be 10 ft bgs. No planned acquisition.	Ecology CSCSL-NFA and VCP site (ID#1513190), Assessor archive, Sanborn maps, current assessor records	Former businesses were present at least from 1938 to 1950. Gas station occupied parcels 30.0-2 and 30.0-3. USTs from gas station operations were removed in 1992; 35,000 tons of fill soils with fuel hydrocarbons and cPAHs (plus 2 unregistered USTs) were excavated and disposed off site; NFA granted February 2006. Potential contaminants in soil and groundwater include petroleum, PAHs, solvents, and metals.	**No**	**Low - Potentially Complex** Site is adjacent to the project area. Mercer Street will be widened in the existing right-of-way; shallow soils may be excavated. Shallow groundwater is present. Site has documented contamination. PAHS may be present above MTCA Method A cleanup levels in fill that likely exists in the adjacent right-of-way. Remediation would not be the responsibility of the project.

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Notes:

The name shown in this table is the current Department of Ecology site name. All other sites have been

bgs = below ground surface

CERCLIS-NFRAP = Comprehensive Environmental Response, Compensation and Liability Information System - No Further Remedial Action Planned

CSCSL = Confirmed and Suspected Contaminated Sites List

cy = cubic yards

Ecology = Washington State Department of Ecology

EDR = Environmental Data Resources, Inc.

ESA = Environmental Site Assessment

ICR = Washington Site Register of Independent Cleanup Reports

NFA = No Further Action

LUST = leaking underground storage tank

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

PAH = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

PCE = tetrachloroethylene

PCS = petroleum-contaminated soil

UST = underground storage tank

VCP = Voluntary Cleanup Program

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ATTACHMENT H

Applicable Federal and State Laws and Regulations

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ATTACHMENT H

Federal Regulations

The following federal laws and regulations relating to hazardous materials and wastes apply to the Alaskan Way Viaduct Replacement Project (the project).

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 101 (35)(B)(ii) and (iii) of CERCLA and the Superfund Amendments and Reauthorization Act (SARA) define liability for hazardous waste contamination and require liable parties to take responsibility for cleanup. The Standards and Practices for All Appropriate Inquiries (40 CFR Part 312) establishes specific regulatory requirements and standards for conducting all appropriate inquiries necessary to qualify for certain landowner liability protections under CERCLA. The purpose of hazardous material discipline reports is, in part, to address liability issues relating to identification of, and acquisitions of, previously contaminated property.

Resource Conservation and Recovery Act (RCRA) provides requirements for the handling, transportation, treatment, storage, and disposal of hazardous materials and wastes. It includes provisions for identifying and classifying hazardous materials and wastes, and creates treatment standards for specific wastes through the Hazardous and Solid Waste Amendments (HSWA). The HSWA also establish requirements for ownership, operation, maintenance, and closure of underground storage tanks (USTs). Regulation of RCRA-regulated USTs is administered through the state under Washington Administrative Code (WAC) 173-360. Any removal, treatment, or transportation of contaminated soils as part of the project would need to be conducted in compliance with RCRA.

Toxic Substances Control Act (TSCA) allows EPA to regulate existing chemicals when they pose an unreasonable risk to health or to the environment, and to regulate their distribution and use. Under TSCA Section 6, EPA can limit or ban manufacturing and distribution, require labeling, or place other restrictions. Chemicals regulated include asbestos, lead (such as lead-based paint), and PCBs. If these chemicals were encountered, they would have to be handled and disposed of in compliance with relevant sections of TSCA.

Occupational Safety and Health Act establishes requirements for site safety procedures, worker training, and worker safety and health standards for employees engaged in work related to hazardous materials. All work involving the handling of and potential exposure to hazardous substances by workers while conducting activities associated with the project must comply with the relevant sections of this act.

Clean Air Act (CAA) provides for comprehensive federal regulation of all sources of air pollution. Any activities associated with the project that have the potential to introduce hazardous substances to air must comply with the CAA. Regulations regarding discharges to air (including fugitive dust, asbestos, and hazardous chemicals) will be enforced at the state and local municipality level through Puget Sound Clean Air Agency (PSCAA).

Clean Water Act (CWA) provides for comprehensive federal regulation of all sources of water pollution. Pollution of state waters in controlled by two administrative regulation that implement Chapter 90.48 RCW, Water Pollution Control Act: Chapter 173-201A, WAC Water Quality Standards for Surface Waters of the State of Washington and Chapter 173-200, WAC Water Quality Standards for Groundwater of the State of Washington.

Chapter 173-201 WAC indicates that toxic substance above natural background levels will not be introduced into water of the state if the substance will (1) singularly or cumulatively adversely affect characteristic water uses, (2) cause acute or chronic toxicity to the most sensitive biota dependent on the water, or (3) adversely affect public health. Ecology would employ or require chemical toxicity testing and biological assessments as appropriate to determine compliance with the above-mentioned requirements. WAC 173-201A-160 lists the primary means for controlling municipal, commercial, and industrial waste discharges through the issuance of waste disposal permits.

Several permit programs have been established to address the potential of construction projects that may introduce hazardous substances to surface water, including wetlands. The State Water Discharge Permit (WAC 173-216) program includes a variety of exemptions, most of which relate to discharges that are permitted under a National Pollution Discharge Elimination System (NPDES) permit or are otherwise authorized by a publicly owned treatment works (POTW) with an authorized pretreatment program. This regulation may apply to stormwater detention basins planned for the project if the water were to contain unacceptable concentrations of pollution materials. The NPDES General Stormwater Permit for Construction Activities requires the development and implementation for a Stormwater Pollution Prevention Plan.

National Environmental Policy Act (NEPA) requires that all actions sponsored, funded, permitted, or approved by federal agencies undergo planning to ensure that environmental considerations are given due weight in project decision-making. Because the project is likely partially funded by the Federal Highway Administration (FHWA), NEPA compliance is required. One of the major elements addressed in a NEPA assessment is environmental health. Assessment of effects associated with hazardous materials and waste is a component of the environmental health evaluation.

The Endangered Species Act (ESA) regulates a wide range of activities affecting plants and animals designated as "endangered" or "threatened." The ESA states that it is unlawful to "take" an animal listed as an endangered species. ESA lists "endangered" animals or plants that are in danger of being extinct. ESA broadly defines a "take" to include, "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect," or an attempt to engage in such conduct. Chinook salmon, bull trout, and steelhead are listed as threatened under the federal Endangered Species Act and live within the Green/Duwamish Watershed and Central Puget Sound Watershed. These watersheds extend from the Cascade Mountains to Puget Sound. While there are some references to the recently listed Pacific eulachon occurring in Puget Sound, there are no known spawning populations and only rare instances of individual fish occurrences.

National Emission Standards fro Hazardous Air Pollutants (NESHAP) (Code of Federal Regulations, Title 40, Volume 5, Parts 61 to 71) – The U.S. Environmental Protection Agency (EPA) rules concerning the removal and disposal of asbestos-containing materials (ACM) were issued under NESHAP. NESHAP requires a thorough inspection for friable and nonfriable ACM within a structure prior to demolition activities. An accredited inspector as required by the Asbestos Hazard Emergency Response Act (AHERA) must conduct all inspections. The NESHAP regulation also includes specific notification, work practice, packaging, labeling, and disposal requirements.

The **Asbestos Hazard Emergency Response Act (AHERA**), 40 CFR 763, is the primary governing regulation for performing asbestos surveys. AHERA defines suspect ACM and specifies the minimum number of samples to be collected and analyzed from a suspect material. AHERA was originally enacted for school buildings, but since 1994 it has been applied to public and commercial buildings by the Asbestos School Hazard Abatement Reauthorization Act (ASHARA). The Occupational Safety and Health Administration (OSHA) and WISHA worker protection regulations, specifically 29 CFR 1926.1101(k) and WAC 296-62-077, have also incorporated AHERA for demolition and renovation projects.

The Puget Sound Clean Air Agency (PSCAA) requires that a notice of intent be submitted prior to beginning any work on an asbestos demolition. The only exception is asbestos projects involving less than 48 square feet and the removal of nonfriable asbestos-containing roofing material. An AHERA building inspector or competent person must make the determination if it is nonfriable material. There is a notification waiting period and fee that will need to be considered prior to planning and abatement work. Asbestos removed from buildings prior to demolition must be disposed in a landfill permitted to receive ACM.

State Regulations

Washington State implements many of the federal statutes pertaining to hazardous materials and wastes along with its own, often more stringent, laws and regulations. These requirements, listed below, take precedence over all other laws for governing business and operations within the state.

Model Toxics Control Act Cleanup Regulation (MTCA) – WAC 173-340 implements MTCA, Revised Code of Washington (RCW) 70.105D. Several administrative rules include strict requirements for site discovery and reporting, site assessments, and hazardous site listing. This regulation defines standard methods used to assess whether a site is contaminated or clean. An overview of the cleanup standard is detailed in WAC 173-340-700, and groundwater and soil cleanup standards are listed in WAC 173-340-720 and WAC 173-340-740, respectively. WAC 173-340-450 sets forth the requirements for addressing USTs.

MTCA applies to any site identified with environmental contamination that may pose a threat to human health or the environment. MTCA establishes the acceptable cleanup limits for contaminated media. Cleanup of contaminated sites is likely to be accomplished as independent actions, with technical review provided by Ecology on an as-needed basis.

Dangerous Waste Regulations – WAC 173-303 implements RCRA and the Hazardous Waste Management Act, RCW 70-105. This provides for waste identification procedures and disposal requirements for Washington State. It provides some unique standards for Washington State, such as specific land treatment standards for high levels of cadmium under WAC 173-303-655. Detailed requirements for forms and rules related to manifesting and transporting of hazardous waste are included. As stated above, any handling, treatment, or transport of hazardous waste associated with the project must comply with RCRA and also with Washington's dangerous waste regulations and Hazardous Waste Management Act. Contaminated materials generated during construction, including soil, water, and debris, would need to be properly designated before disposal. WAC 173-303-070 through 173-303-110 includes the specific regulations that identify dangerous waste characteristics and criteria. In addition, waste generated by the contractor during construction would need to be properly designated. The requirements for generator of dangerous waste are included in WAC 173-303-170 through WAC 173-303-230. A transporter of dangerous waste must comply with the procedures listed in WAC 173-303-250.

WAC 173-303-145 lists the reporting requirements for spills and discharges into the environment, except when otherwise permitted under state or federal law. This section of the WAC applies "when any dangerous waste or hazardous substance is intentionally or accidentally spilled or discharged into the environment such that human health or the environment is threatened, regardless of the quantity of dangerous waste or hazardous substance." This portion of the regulation also details the required procedures for notification and mitigation should a spill occur on site.

Solid (Non-Dangerous) Waste Regulations (RCW 70.95, WAC 173-304) – Under the State Solid Waste Management Act, RCW 70.95 states that primary responsibility for managing solid waste is assigned to local government. The state, however, is responsible for ensuring the establishment of effective local programs throughout the state.

The local jurisdiction's Health Department regulates the handling and disposal of solid waste. Identifying the appropriate waste disposal facility is the most likely portion of local solid waste regulation that could affect the project. The local Health Department determines whether a waste material is acceptable at one or more of the public and private solid waste facilities in the county. In some cases, testing may be required prior to disposal. Even waste that is being shipped to a disposal facility out of the county, and soil treatment facilities, falls under the jurisdiction of the local Health Department.

WAC 173-304 lists the Minimum Functional Standards for Solid Waste Handling. WAC 173-304-200 designates the on-site containerized storage, collection, and transportation standards for solid waste. The regulations apply to all persons storing containerized solid waste that is generated on site. Revisions are anticipated for WAC 173-304, and the final revised rules should be reviewed prior to the commencement of construction. The updated solid waste rule is likely to include new provisions for demolitions and inert waste streams.

Solid waste facilities, including landfills, transfer stations, wood waste sites, and concrete recycling facilities, are permitted and monitored to ensure proper handling of wastes to prevent environmental contamination. Solid waste generated by this project could include soil

contaminated at concentrations below dangerous waste criteria, wood, and construction debris in addition to typical municipal waste. These waste types can be disposed of as solid waste at an appropriately permitted facility.

Washington State Environmental Policy Act (SEPA) – WAC 197-11 and WAC 468-12 implement SEPA, which provides a way to identify environmental effects that may result from proposed actions. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a proposal would affect the environment. Assessment of effects associated with hazardous materials and waste and demonstration that the proposed action has avoided or minimized those potential effects are components of the SEPA review process.

Water Pollution Control Act – RCW 90.48 implements two administrative regulations that control pollution in state waters. Water Quality Standards for Surface Waters of the State of Washington, WAC 173-201A, establishes standards for toxic substances, conventional parameters (e.g., pH, dissolved oxygen, temperature), and aesthetic values for marine and fresh surface waters. The Water Quality Standards for Ground Water of the State of Washington contain similar regulations for groundwater, with special emphasis on radionuclides and carcinogens, due to potability issues. Any construction or operational activities associated with the project must comply with Washington's water quality standards. Wastewater Discharges to Surface Waters, WAC 173-220, regulates discharges to surface water from construction projects. Under this program, it is unlawful to discharge polluting matter to surface waters without an NPDES permit. A general NPDES permit for construction would be required for the project. Wastewater Discharges to the Ground, WAC 173-216, regulates discharge of stormwater to detention basins if this water contains unacceptable concentrations of polluting matter. The proposed project would likely e exempt from the requirements of this regulation if an NPDES Stormwater Permit for construction is acquired. This should be verified during the permitting process conducted for this project.

Water Quality Standard for Surface Water (Chapter 173-201A WAC) – WAC 173-201A-040 is the section of the Water Quality Standards that specifically deals with toxic substances within surface waters of the state. The WAC indicates that toxic substances, above natural background levels, shall not be introduced into waters of the state if the substance will (1) singularly or cumulatively adversely affect characteristic water uses, (2) cause acute or chronic toxicity to the most sensitive biota dependent on the water, or 3) adversely affect public health. Ecology shall employ or require chemical toxicity testing and biological assessment as appropriate to determine compliance with the above-mentioned requirements. WAC 13-201A-160 lists the primary means for controlling municipal, commercial, and industrial waste discharges through the issuance of waste disposal permits.

Wastewater Discharges to Ground (WAC 173-216) – The State Water Discharge Permit program includes a variety of exemptions, most of which relate to discharges that are permitted under an National Pollution Discharge Elimination System (NPDES) permit or are otherwise authorized by a publicly owned treatment works (POTW) with and authorized pretreatment program. This regulation may apply to stormwater detention basins planned on the project if the water contains unacceptable concentrations of polluting materials.

Underground Storage Tank Statute and Regulations (RCW 90-76, WAC 173-360) – The purpose of RCW 90-76 and WAC 173-360 regulations are to address the serous threat posed to human health and the environment by leaking underground storage tank systems (LUSTS) containing petroleum and other regulated substances. The regulations describe the enforcement, notification, and reporting requirements for LUSTS. The regulations also detail the performance standards and operating and closure requirements.

Washington Industrial Safety and Health Act (WISHA) – RCW 49-17 implements the Occupational Health Standards (WAC 296-62). RCW 49-17 also implements Safety Standards for Construction Work (WAC 296-155), which contains the Safety Standards for Asbestos and Encapsulation (WAC 296-65). These regulations apply to all construction activities, and the regulations are enforced by the Washington State Department of Labor and industries (L&I).

These standards include rules covering operations at known hazardous waste sites and initial investigations of sites identified by the government, which are conducted before the presence or absence of hazardous substances has been ascertained. Also included are rules on site assessment and control, training, protective equipment, and emergency response. All construction activities associated with the project must comply with WISHA. WISHA includes specific procedures for work with lead-based paint and ACM. WAC 296-155 requires employers to inform their workers of the potentially hazardous conditions of the workplace. When WSDOT informs the Contractor of these conditions, the Contractor is required to train the workers to recognize hazardous conditions in the workplace and train them how to respond to and report such conditions. It is important that WSDOT inform the Contractor through the Contract and/or Special Provisions so that the Contractor is aware and responsible to prepare his employees to appropriately and safely handle encounters of hazardous materials with minimal delays.

The safety requirements also provide specific procedures for work with asbestos-containing materials (ACM) and lead-based paint (LBP). L&I regulates asbestos and LBP removal and encapsulation (WAC 296-62 Part I-1 and 296-155). All contractors must be certified in asbestos and LBP removal, and their supervisors and laborers must be trained. For asbestos, L&I and the Puget Sound Clean Air Agency (PSCAA) must be notified of any asbestos removal. ACM and LBP must be disposed of in a specially permitted landfill. This includes disposable clothing, respirator filters, and equipment, as well as the ACM and LBP itself. The use of landfills results in an irretrievable commitment of landfill space. Liability for asbestos and LBP disposal remains with WSDOT indefinitely.

Hazardous Waste Operations and Treatment, Storage, and Disposal Facilities (WAC 296-62 Part P, RCW 49-17) – WAC 296-62 Part P includes all of the required procedures for work involving hazardous materials. Due to the possible impacts indicated above for specific sites, there are sections of the WAC 296-62 that are of key importance for this project.

WAC 296-62 Part P also details the requirements for handling drums and containers. Unlabeled drums and containers must be considered to contain hazardous waste and handled accordingly until the contents are positively identified and labeled. Drums and containers that cannot be moved without rupture, leakage, or spillage must be emptied into a sound container. Personal

protective equipment selection protocol is outlined within multiple sections of Part P, depending upon the designation of the contamination on site.

Safety Standards for Construction Work – Lead (WAC 296-155) – WAC 296-155 indicates that workers may not be exposed to lead at concentrations greater than fifty micrograms per cubic meter of air (50μg/m^3) averaged over an 8-hour period. WAC 296-155 also outlines the personal protective equipment that shall be given to employees, as well as medical surveillance procedures that are to be implemented for exposed personnel.

General Occupational Health Standards – Asbestos (WAC 296-62 Part I-1) – WAC 296-62 requires that prior to commencement of work an owner must conduct a good faith inspection to determine whether materials to be worked on or removed contain asbestos. An accredited inspection must conduct the good faith inspection. WAC 296-62 Part I-1 requires that an employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an 8-hour time-weighted average. Besides the permissible exposure limit, the regulation also requires appropriate respiratory protection as well as exposure assessment and monitoring.

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ATTACHMENT I

Standard Impacts and Mitigation Measures

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Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
Environmental Impacts	Environmental Impacts are impacts that the project causes to the environment or sensitive receptors.	
Direct Impacts to the Environment	Direct Environmental Impacts[1] are impacts that a project causes that occur at the same time and place. Direct Impacts from construction activities are typically short-term and temporary in nature.	
In Situ Soil and Groundwater Contamination	Environmental impacts may result if contaminated soils and groundwater are not properly managed and are allowed to spread to clean soil, surface water, and/or groundwater. Contaminated water may also result from clean water coming into contact with contaminated stockpiled soil. The risk of encountering contaminated soil and groundwater is higher in areas that have a long and varied history of industrial and commercial land use, and especially near properties with underground storage tanks (USTs). Contamination not managed properly in accordance with existing regulations could potentially affect human health and ecological receptors.	Hazardous materials investigations that identify known or suspected contaminated sites can allow WSDOT staff to make informed decisions regarding planning, acquisition, design, and/or construction options. Hazardous materials investigations are conducted early in the environmental planning, design, and acquisition phase. The reports often indicate the type and severity of contaminants in the area. These environmental reports are maintained in the Regional Environmental Office's project file. Alternative construction design or techniques are used to avoid contaminated areas or minimize quantity of material generated. For example, different footing designs can lessen the area and depth of excavation to minimize the quantity of wasted soil generated. Another example is using driven piles where concrete is tremied into place to limit the volume of dewatering. WSDOT *Standard Specifications,* Section 1-07.5, requires the Contractor to comply with environmental regulations and current federal and state laws and regulations. General Special Provisions and Special Provisions (GSPs and SPs) can be added to the construction contract when site-specific circumstances warrant special measures that can be contractually enforced. GSPs are used when the contamination is predicted but not known. SPs are project-specific and used for known contamination. GSPs and SPs can inform the Contractor of known or potential contaminants and the investigative reports that are available for the Contractor's review. Once informed, the Contractor is responsible for safely and responsibly managing contamination in accordance with all federal, state, and local laws. WSDOT Manuals provide policy and procedures for hazardous materials encountered during construction. The *Environmental Procedures Manual* (31-11), Section 620.08, provides policy and procedures for identifying, handling, and disposing of hazardous materials encountered during construction. The *Construction Manual* (M 41-01), Section 1-2.2K, provides WSDOT staff guidance and procedures to ensure environmental compliance during construction. These publications are available at http://www.wsdot.wa.gov/fasc/EngineeringPublications/library.htm. Proper planning and training should be conducted for projects likely to encounter contamination. Planning should address the project-specific needs (e.g., limited space constraints preventing ability to stockpile contaminated soil or store several Baker tanks) to identify specific techniques and training requirements needed to effectively manage the hazardous materials generated during construction. Training should include key construction staff and project inspectors to recognize hazardous materials and understand appropriate protocols for safely isolating, containing, characterizing, and properly disposing of hazardous materials, and for securing disposal documentation. WSDOT Hazardous Materials and Solid Waste Program staff is available to provide construction support by giving guidance and recommendations for general hazardous materials management procedures. WSDOT on-call environmental consultants are available to provide hazardous materials management support. For projects that expect to encounter contaminants, it is recommended that a contract with an environmental consultant be established prior to the start of construction

[1] *See* 40 CFR 1508.8(a) (NEPA implementing regulations).

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
Indirect Impacts to the Environment	**Indirect Impacts[2] (also known as secondary impacts), are impacts caused by a project that occur later in time or further removed in distance, but are still reasonably foreseeable. Indirect Impacts caused by a project usually include changes in land use, water quality, social issues, and population density.**	
Construction Impacts	**Construction Impacts are direct impacts to the project including construction delays and increased costs.**	
General	Construction delays and increased costs often result from unexpected encounters of contamination. Delays are typically caused by segregating and containing contaminants, coordinating sample collection, waiting for laboratory results, identifying a permitted disposal facility, completing the disposal facility's waste profile sheet, and coordinating the hauling and disposal. Increased costs result from payments to the Contractor during delay, payments to a qualified professional to obtain and analyze samples, laboratory charges, and expensive disposal fees. The subcategories below discuss the following specific types of construction impacts along with associated regulations: * Contaminated Soil and Water * Underground Storage Tanks (USTs) * Spills * Demolition * Worker Safety & Public Health	These mitigation measures apply to all the general impacts during construction. Additional mitigation measures apply to each subset of impacts. <u>Hazardous materials investigations</u> that identify known or suspected contaminated sites can allow WSDOT staff to determine how to avoid or minimize potential construction impacts. Hazardous materials investigations are conducted early in the environmental planning, design, and acquisition phase. Investigation reports allow WSDOT staff to make informed decisions regarding planning, acquisition, design, and/or construction options. The reports often indicate the type and severity of contaminants in the area. Even if contamination is not identified prior to construction, hazardous materials investigations are still an important resource during construction when contamination is unexpectedly encountered, because WSDOT staff know the historical land use of the site. These environmental reports are maintained in the Regional Environmental Office's project file. Hazardous materials investigations and environmental reports include, but are not limited to: * Hazardous Material Discipline Reports (historical & record investigation for project corridors) * Site Reconnaissance/Windshield Surveys * Phase I Environmental Site Assessment (historical & record investigation for a site) * Phase II Environmental Site Assessment (sampling) * Phase III Environmental Site Assessment (a.k.a. Remedial Investigation/Feasibility Study; evaluates cleanup options and costs) * UST and/or aboveground storage tank (AST) Closure Reports * ACM/LBP Surveys <u>Alternative construction design or techniques</u> are used to avoid contaminated areas or minimize quantity of material generated. For example, different footing designs can lessen the area and depth of excavation to minimize the quantity of wasted soil generated. Another example is using driven piles where concrete is tremied into place to limit the volume of dewatering.

[2] *See* 40 CFR 1508.8(b) (NEPA implementing regulations).

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
		WSDOT *Standard Specifications,* Section 1-07.5, requires the Contractor to comply with Environmental Regulations and current rules of resource agencies. The Contractor is required to prevent spreading or contributing to existing contamination and appropriately dispose of waste material in a manner consistent with federal, state, and local regulations. Section 1-07.04(2) of the *Standard Specifications* requires the Contractor to take precautions and perform any necessary work to provide and maintain a safe and healthful worksite in accordance with applicable laws. Sections 1-07.15 and 8.01 require the Contractor to prepare and implement a project-specific Temporary Erosion and Sediment Control Plan, which addresses prevention of wind dispersion of soil and water pollution during construction. Section 1-07.15(1) requires the Contractor to prepare and implement a Spill Prevention, Control, and Countermeasures (SPCC) Plan, which addresses both spills from hazardous materials use (including petroleum) and specific measures to prevent release or further spreading of materials in areas with identified preexisting contamination. GSPs and SPs can be added to the construction contract when site-specific circumstances warrant special measures that can be contractually enforced. GSPs are used when the contamination is predicted but not known. SPs are project-specific and used for known contamination. GSPs and SPs can inform the Contractor of known or potential contaminants and the investigative reports that are available for the Contractor's review. Once informed, the Contractor is responsible for safely and responsibly managing contamination in accordance with all federal, state, and local laws. GSPs and SPs can include specific requirements related to containment, removal, and disposal of hazardous materials, USTs, and contaminated soil and water. GSPs and SPs can also establish certification requirements of personnel, notification procedures, and documentation requirements. WSDOT manuals provide policy and procedures for hazardous materials encountered during construction. The *Environmental Procedures Manual* (M 31-1 1), Section 620.08, provides policy and procedures for identifying, handling and disposing of hazardous materials encountered during construction. The *Construction Manual* (M41-01), Section 1-2.2K, provides guidance and procedures to ensure environmental compliance during construction. These publications are contained at http://www.wsdot.wa.gov/fasc/EngineeringPublications/library.htm. Proper planning and training should be conducted for projects likely to encounter contamination. Planning should address the project-specific needs (e.g., limited space constraints preventing ability to stockpile contaminated soil) to identify specific techniques and training requirements needed to effectively manage the hazardous materials generated during construction. Training should include key construction staff and project inspectors to recognize hazardous materials and understand appropriate protocols for safely isolating, containing, characterizing, and properly disposing of hazardous materials, and for securing disposal documentation. WSDOT Hazardous Materials and Solid Waste Program staff is available to provide construction support by giving guidance and recommendations for general hazardous materials management procedures. When resources are not available, the WSDOT project office can direct and manage environmental consultants in coordination with regional offices. This enables efficient work with the least amount of impact to construction schedule and budget as possible. WSDOT on-call environmental consultants are available to provide hazardous materials management support. Services include, but are not limited to, contaminant screening to identify and segregate potentially contaminated media; sampling; laboratory results QA/QC and interpretation; recommendations for proper management, reuse, or disposal options; preparation of waste profile forms; and assisting with waste manifesting and tracking. A contract with an environmental consultant should be established prior to the start of construction for projects that are expected to encounter contaminants.

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
In Situ Soil and Groundwater Contamination	Construction delays and increased costs often result from unexpected encounters of contamination in soil and water. Delays related to stockpiling contaminated soil, dewatering contaminated water into storage containers, coordinating sample collection, waiting for laboratory results, identifying a permitted disposal facility, completing the disposal facility's waste profile sheet, and coordinating the hauling and disposal. Increased costs result from payments to the Contractor during the delay, payments for containment supplies, payments to a qualified professional to obtain and analyze samples, laboratory charges, and expensive disposal fees. Construction (staging) activities may be impacted depending upon the need to alter their proximity due to contaminated media, USTs, etc.	Prior to Construction: Hazardous materials investigations conducted early in the project development phase can identify known and potentially contaminated sites within a project corridor. The reports often indicate the type and severity of contaminants in the area. These investigations identify known or suspected contaminated sites and allow WSDOT staff to make informed decisions regarding planning, acquisition, and design and/or construction options. These environmental reports are maintained in the Regional Environmental Office's project file. Mitigation measures for contaminated soil and groundwater include pre-construction planning to define the areas where contamination may be encountered, design changes to minimize contaminated media that must be managed, and implementing practical cleanup alternatives for contaminated soil and groundwater. Mitigation includes incorporating GSPs and project-specific SPs, which makes the Contractor responsible for being prepared to appropriately handle contaminated material with minimal delays. Proper planning and training should be conducted for projects likely to encounter contamination. Planning should address the project-specific needs (e.g., limited space constraints preventing ability to stockpile contaminated soil or store several Baker tanks) to identify specific techniques and training requirements needed to effectively manage the hazardous materials generated during construction. Training should include key construction staff and project inspectors to recognize hazardous materials and understand appropriate protocols for safely isolating, containing, characterizing, and properly disposing of hazardous materials, and for securing disposal documentation. Contaminated Media Management Plans (CMMPs) are developed when significant amounts of known contaminated soil, groundwater, and sediment requires excavation or dewatering. CMMPs establish specific handling and disposal procedures and chains of responsibility to effectively manage contaminated soil and groundwater as it is encountered in order to minimize schedule delays and excessive costs. A comprehensive CMMP would address field screening methods, notification requirements, soil stockpile management, and sampling and disposal requirements. During Construction: For encounters of known or unknown contaminated soil or groundwater, project offices are directed to contact their WSDOT Hazardous Materials Specialist. A WSDOT Hazardous Materials Specialist or other contracted qualified environmental professional will provide the project office direction and technical support. Internal notification to WSDOT Hazardous Materials Specialists also ensures that the appropriate follow-up work (should contamination be left in place) is conducted in accordance with Model Toxics Control Act (MTCA) regulations. WSDOT's policy and procedures for identifying, handling, disposing of, and documenting contamination encountered during construction is contained in *Environmental Procedures Manual*, Section 620.08. Timely, proper management of contaminated media can prevent spreading contaminants to clean soil, surface waters, and the air and can reduce construction delays and cost increases. Alternative construction techniques may need to be employed to minimize earthwork occurring near any of the above-mentioned liability issues. WSDOT and/or its contractors would be responsible for proper management of any regulated hazardous wastes.
USTs	USTs may be encountered during excavation activities. USTs may be filled with product and have the potential of creating a spill if the tank is ruptured. USTs in residential areas are likely to contain heating oil, whereas tanks used in commercial/industrial fueling will typically contain automobile fuel and other petroleum products. USTs in the automobile or machine repair business will typically contain petroleum, waste oil, and hydraulic and transmission fluids where commonly associated contaminants include petroleum, heavy oil, metals, and polychlorinated biphenyls (PCBs). Construction delays and increased costs often result from unexpected encounters of USTs. Contaminated soil and/or groundwater associated from USTs can affect project schedules and increase costs.	Hazardous materials investigations can identify documented leaking underground storage tanks (LUSTs), active regulated USTs, or potential historical UST sites. USTs can also be identified through Ecology's Facility Site Atlas (Internet mapping system), ground-penetrating radar, and old WSDOT right-of-way maps. Early identification of known or potential UST sites allows WSDOT staff to remove tanks, associated piping, and contaminated soil prior to project construction or incorporate GSPs in the construction contract requiring the Contractor to remove USTs during construction in accordance with the regulations. WSDOT would assume cleanup liability for decommissioning and removal of suspected USTs if a UST is encountered during excavation activities. WSDOT may also acquire cleanup liability for any contaminated media resulting from a leaking UST in the right-of-way. WSDOT will follow procedures and regulations for decommissioning USTs as outlined in *Environmental Procedures Manual*, Section 620.08. For unexpected encounters of USTs, project offices will contact their WSDOT Hazardous Materials Specialist and follow internal notification procedures prescribed in the *Construction Manual* (M 41-01.05), Section 1-2.2K(1), for the Environmental Compliance Assurance Procedure (ECAP). A WSDOT Hazardous Materials Specialist or other contracted qualified environmental professional provides the project office direction or oversight to ensure compliance with UST regulations and the appropriate follow-up work in accordance with MTCA regulations.

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
Spills	Construction delays and increased costs may result in the event of a spill and cleanup work of hazardous materials that are used or generated during construction. Construction vehicles and equipment typically use gasoline, diesel, motor oil, transmission fluid, radiator coolant, brake fluid, and hydraulic oil. New construction work typically uses cement, asphalt, tar, paving oils, tack, and paint.	WSDOT project office will follow the internal notification procedures prescribed in the *Construction Manual* (M 41-01.05), Section 1-2.2K(1), for the ECAP to report spills of hazardous materials. An SPCC Plan is also required for all WSDOT construction projects per *Standard Specifications*, Section 1-07.15. Prior to beginning construction, the Contractor is required to prepare a project/site-specific plan to be used throughout the duration of the project. The plan must be updated to reflect actual site conditions and practices. Preventing a spill is the primary goal; however, the Contractor is expected to be prepared to minimize the impacts of a spill through immediate and appropriate response actions. The required elements of the SPCC Plan includes: 1. Responsible Personnel 2. Spill Reporting 3. Project and Site Information 4. Potential Spill Sources 5. Preexisting Contamination 6. Spill Prevention and Response Training 7. Spill Prevention 8. Spill Response 9. Project Site Map 10. Spill Response Forms

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
Demolition	Increases costs and delays may result when demolition requires special handling and disposal of certain equipment, materials, or structures. Special demolition considerations can include: (a) **ACMs** are likely to exist in buildings constructed prior to 1985. ACM poses risks to public and worker safety when disturbed for maintenance, renovation, and demolition of structures. If a survey is not completed prior to construction, the project may be delayed. (b) **LBP** is likely to exist in structures built before 1978 and is typically found on steel bridge structures. LBP poses risks to environmental health and worker safety when disturbed for maintenance, renovation, and demolition of structures including bridges and buildings. If a survey is not completed prior to construction, the project may be delayed. (c) **USTs** and associated piping (see subcategory above for specific UST impacts). (d) **ASTs** and other containers (such as drums, cans, and bottles) that store hazardous materials. (e) **Universal Waste,** defined in Chapter 173-303 WAC, batteries, lamps, thermostats, and mercury-containing equipment. (f) **Creosote** or **Arsenic [a.k.a. Chromated Copper Arsenate (CCA)] treated wood,** such as railroad ties, telephone poles, and marine pilings. (g) **PCB-containing equipment** in aboveground utilities. (h) **Well decommissioning,** including groundwater monitoring, extraction, treatment, and supply wells.	Prior to demolition work, hazardous materials surveys with follow-up sampling (where required) should be conducted to identify equipment, materials, and structures that require special handling or disposal. A comprehensive building survey and sampling program helps limit the amount of material required for special removal and disposal. In addition, surveys help avoid the potential for environmental contamination and construction delays and promote worker health and safety. It is recommended that any demolition items (see list "Impact") that may be potential contaminant sources be clearly identified (locations and estimated quantities) and then appropriately handled, segregated, and removed for disposal as required by applicable regulations. **ACM** is often found in commercial and residential buildings constructed prior to 1985. A pre-demolition building survey, conducted by an Asbestos Hazard Emergency Response Act (AHERA)-certified building inspector would verify the presence of ACM and provide locations and estimated quantities requiring special handling and disposal in a report. If ACM is identified, mitigation would consist of removing these materials in compliance with regulations prior to building demolition and disposal in a legally permitted facility (i.e., lined landfill). Regulations include specific notification, work practice, packaging, labeling, and disposal requirements. Section 620.08 of the *Environmental Procedures Manual* provides additional details regarding mitigation measures. **LBP** poses risks to environmental health and worker safety when disturbed for maintenance, renovation, and demolition of structures including bridges and buildings. Testing and documentation should be completed as early in the project design phase as possible to determine if special procedures and disposal that will result in increased costs will be required for existing LBP. LBP testing, abatement, or related activities in Washington are required to be licensed by the Lead-Based Paint Program located within the Department of Community, Trade, and Economic Development (CTED). Performing such activities without LBP certification from CTED is a violation of Chapter 365-230 WAC. Section 620.08 of the *Environmental Procedures Manual* provides additional mitigation measure details. Standard removal, testing, and disposal protocols of LBP on bridge structures are described WSDOT *Standard Specifications*, Section 6.07.3, and *Environmental Procedures Manual*, Section 6.08. Lead pipe or lead-painted metal can be recycled as scrap metal in accordance with WAC 173-303-071(3)(ff). If the material is not recycled, it must be evaluated to determine whether it requires management and disposal as a dangerous waste (per Chapter 173-303 WAC). Contractors are required to abide by WAC 296-62-0752 1 for general lead exposure health and safety. **UST** mitigation information is provided above in the "USTs" row of this table. AST mitigation shall generally conform to UST mitigation. **Universal Waste** poses a risk to the worker health, public safety, and the environment if improperly handled and disposed of. A pre-demolition building survey should be conducted prior to demolition to identify these regulated materials and ensure that they are properly handled and disposed of in accordance with WAC 173-303-573. Additional information is available in the following Ecology Publications, which can be accessed by using the publication number at http://www.ecy.wa.gov/pubs.shtm: * The Universal Waste Rule, Publication 98-407 * The Universal Waste Rule for Batteries, Publication 98-407a * The Universal Waste Rule for Mercury-containing Equipment and Thermostats, Publication 98-407b * The Universal Waste Rule for Lamps, Publication 98-407c **Creosote or arsenic treated wood** may be reused even if the treated wood is designated as a hazardous/dangerous waste per a Toxicity Characteristic Leaching Procedure (TCLP) test (see Chapter 173-303 WAC). However, its reuse must be utilized for its "intended end use" per 40 CFR 261.4(b)(9). This means that treated wood cannot be chipped or shredded for mulch and used in landscaping applications. Ecology encourages reuse of treated wood as a preferred management alternative. If reuse is not feasible, disposal facilities will most likely require sampling (TCLP test for arsenic) of treated wood to determine if it is designated as a Dangerous Waste (per Chapter 173-303 WAC). If not a Dangerous Waste, then the treated wood can be managed as a solid waste (per Chapter 173-304 WAC) and accepted into a Subtitle D landfill or a Waste-to- Energy incinerator (hog fuel). If the wood is designated as a Hazardous/Dangerous Waste, then disposal at a higher cost is required at a Subtitle C facility. Section 620.08 of the *Environmental Procedures Manual* provides additional mitigation measure details. **PCB-containing equipment,** particularly aboveground utilities, poses a risk to worker health, public safety, and the environment if improperly handled and disposed of. A pre-construction survey should be completed to identify equipment of concern. PCB-containing equipment should be disposed of per federal and state regulations. **Well decommissioning** is required when wells are unusable or abandoned, or will be impacted by the project. The wells should be identified the during the design phase to determine if project design may affect a well. A licensed well driller is required to install and decommission wells. Licensed drillers complete the required Notice of Intent Forms (application), which allows Ecology to inspect a well as necessary to make sure it is completed or decommissioned according to state regulations. Additional regulatory requirements are available *Environmental Procedures Manual*, Section 540.25.

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
Worker Safety & Public Health	Exposure of hazardous materials to construction workers and the public may result during excavation and management of contaminated media (e.g., soil, groundwater, abandoned drums or containers) or from the misuse of hazardous substances used or generated on-site during construction activities. Typical exposures in these situations include ingestion, dermal contact, and/or inhalation. Contaminants including vapors that produce physical symptoms such as dizziness, irritated or burned skin and eyes, long-term serious injury, suffocation, and death may be present in excavations or drums. Minor spills of materials used in construction, such as fuels, lubricants, and hydraulic fluids, typically occur during construction operations. Exposure to such accidental release could damage skin, eyes, lungs, and other organs. Contaminants and vapors that are typical for WSDOT construction sites are primarily petroleum based, where concentrations are expected to be similar to exposures during fueling at public gas stations. Worker and public health and safety impacts are also a concern due to the explosion and fire hazards posed by USTs and ASTs, and abandoned drums or containers. USTs/ASTs are an explosion hazard when vapors trapped within the tank reach explosive limits and detonate when ignited by a spark or some other incendiary device like a cigarette. Fire may produce irritating, corrosive, and/or toxic gases. Demolition work may release ACM, LBP, and/or bird guano. Inhalation and ingestion of LBP, ACM, and/or bird guano could have a damaging effect on workers' health. Common short-term symptoms of **lead** poisoning include abdominal pain, headaches, constipation, and aches in the joints. Exposure to high levels of lead poisoning can result in retardation, convulsions, coma, and death. The risks associated with low levels of contact with **asbestos** are not well established, so the EPA concludes there is no level of exposure below which the risks of contracting an asbestos-related disease are zero. Exposures to asbestos can result in long-term progressive illnesses including lung cancer, asbestosis, and mesothelioma. Histoplasmosis is an infectious disease caused by inhaling spores of a fungus called *Histoplasma capsulatum* found in **bird guano.** Construction delays and increased costs may result when the Contractor is unaware of site-specific circumstances that would warrant special employee safety training, certification, and/or preparation of a site-specific Worker Health and Safety Plan.	Mandates for protecting the health safety of workers and the public from hazardous materials are identified in *Environmental Procedures* Manual, Section 620.08. WSDOT contractors must comply with Chapters 296-62 and 296-155 WAC, which are enforced by the Washington State Department of Labor and Industries (L&I). Additional contractor health and safety requirements are presented in Section 1-2-.2(l) of the *Construction Manual* (M 41-01). Identification and planning for hazardous material encounters reduces the potential exposure of workers and the public. **LBP, ACM, and/or bird guano surveys** are conducted so that these chemical can be identified and removed before demolition. This reduces the potential for air-born contaminants, which is one of the greatest immediate threats to the public and workers during demolition. Abatement activities conducted in accordance with federal, state, and local regulation require that work be conducted by trained workers, wearing the appropriate level of personal protective equipment (PPE), and using the prescribed procedures for handling and disposal of the contaminated (see Demolition above). Other investigations including **Phase I, Phase II, and Phase III ESA** are conducted to identify other hazardous materials that may be present in the soil, groundwater, or structures. If the chemicals are identified in advance of construction, then engineering and work practice controls can be developed to reduce exposure. Proper planning also reduces potential schedule delays associated with the hazardous materials.

Exhibit I-1. WSDOT Standard Hazardous Material Impacts and Mitigation Measures

Impact Type	Impact	Mitigation Measure
Acquisition – Cleanup Liability	WSDOT can inherit cleanup liability when (1) it acquires a contaminated site, (2) construction activities spread or cause contamination to become worse, or (3) final project construction prevents or obstructs a potentially liable party from conducting remedial activities. RCW 70-105D.040 identifies persons liable for a facility/property as: (1) the current or past facility owner/operator; (2) anyone who arranged for disposal/treatment of hazardous substances at the site; (3) anyone who transported hazardous substances for disposal/treatment at the site, unless it could legally receive the materials at the time of transport; or (4) anyone who sells a hazardous substance with written instructions for its use, where abiding by the instructions resulted in contamination. In situations where there is more than one liable party, each party is jointly and severally liable for costs associated with cleanup of a site and cost to repair damages to natural resources. Cleanup liability can become an expensive immediate or long-term cost. As a property owner, WSDOT would be liable for the cleanup of on-site contaminated soil and groundwater. Liability issues for sites with contamination can also extend beyond the property boundaries if contamination migrated off-site through soils or groundwater. In addition, WSDOT would be responsible for the removal of any stored or abandoned hazardous materials remaining on-site at the time of acquisition. WSDOT would incur the costs for characterization, cleanup, disposal, and potential long-term monitoring. WSDOT generally would not incur liability for groundwater contamination that has migrated into the project footprint as long as the agency does not acquire the source of the contamination. Any contaminated groundwater that has entered into the project footprint may create an impact to construction activities as described in further sections of this discipline study.	Hazardous materials investigations identify known or potentially contaminated sites early, which allow WSDOT project staff to avoid acquiring or excavating in contaminated sites. The preference is to avoid purchasing a contaminated site and avoid cleanup liability. However, there are options *prior to acquisition* to reduce liability risks when no feasible alternative or design option is available and WSDOT is forced to acquire and/or excavate contaminated property in order to complete a construction project. To manage potential cleanup liability risks, when necessary, WSDOT performs "all appropriate inquiry" prior to acquisition of and construction on potentially contaminated property. For WSDOT projects, "all appropriate inquiry" includes a site reconnaissance, and/or varied levels of Phase I and II Environmental Site Assessments generally following ASTM International (ASTM) standards 1527, 1528, and 1903. The type and level of environmental investigation is considered on a case-by-case basis in coordination with the WSDOT Hazardous Materials and Solid Waste Program. When USTs or contamination are identified prior to property acquisition, WSDOT should assign fair market property values that consider remediation costs and potential long-term (i.e., on-going monitoring and site management) cleanup costs. To limit potential liability risks prior to acquisition, WSDOT can use performance bonds, indemnifications, and other tools to minimize agency costs and cleanup liability. *For sites that may be substantially contaminated,* WSDOT must clearly demonstrate that "all appropriate inquiry" (per 40 CFR Part 312) had been undertaken to discover, investigate, and characterize the hazardous substance and, once discovered, that due care was exercised to prevent the release or spread of contamination. Demonstrating "all appropriate inquiry" per EPA's final rule establishes that WSDOT met specific regulatory requirements for conducting all appropriate inquiries into the previous ownership, uses, and environmental conditions of a property. This level of investigation should be considered only when WSDOT decides to acquire property that may be substantially contaminated and the responsible party is not performing cleanup or under an Agreed Order. Decisions regarding site cleanup should be made in coordination with the Hazardous Materials Program in order to ensure that the cleanup remedy will be "substantially equivalent of an Ecology conducted cleanup" to secure WSDOT's ability to recover cleanup costs from solvent companies who are potentially liable. Additional guidance regarding appraisal and acquisition guidance is presented in WSDOT's *Right-of-Way Manual* (M 26-01), May 2006, Sections 4-4.4 D & E and 6-5.14. These publications are available at http://www.wsdot.wa.gov/fasc/EngineeringPublications/library.htm.
Spills	Hazardous materials spills that impact surface water, groundwater, sediment, or soils located within the project footprint may result in WSDOT and/or the Contractor incurring liability for an appropriate cleanup of the affected area and for environmental damages to state and federal agencies.	WSDOT project office will follow the internal notification procedures prescribed in the *Construction Manual* (M 41-01.05), Section 1-2.2K(1), for the ECAP to report spills of hazardous materials. An SPCC Plan is also required for all WSDOT construction projects per *Standard Specifications*, Section 1-07.15. The SPCC Plan describes the process for prevention and response for spills of hazardous materials during construction.
Disposal	As an owner and/or generator, WSDOT could be subsequently liable for the cleanup of contaminated media disposed of at a non-permitted facility.	WSDOT maintains disposal documentation (i.e., lab data, sampling procedures, waste profile sheets, and disposal tickets) proving contaminated waste was properly characterized and disposed of at a legally permitted facility. GSPs or project-specific SPs added to the construction contract require the Contractor to provide a copy of the shipping manifest or bill of lading indicating the amount of material hauled to the disposal site, and bearing the disposal site operator's confirmation for receipt of the material. *Standard Specifications*, Section 2-03.3(7), requires the Contractor to provide the WSDOT Project Engineer the location of disposal sites and copies of required permits and approvals before any waste is hauled off the project site. Additional policy and procedures for identifying, handling, disposing of, and documenting contamination encountered during construction is contained in *Environmental Procedures Manual*, Section 620.08.

ATTACHMENT J

Cumulative Effects Analysis

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CUMULATIVE EFFECTS ANALYSIS

This cumulative effects analysis follows *Guidance on Preparing Cumulative Impact Analyses*, published by Washington State Department of Transportation (WSDOT) in February 2008. The guidance document was developed jointly by WSDOT, Federal Highway Administration (FHWA) – Washington Division, and U.S. Environmental Protection Agency – Region 10. The guidance can be used for FHWA's National Environmental Policy Act (NEPA) compliance (Code of Federal Regulations, Title 23, Part 771) and fulfillment of Washington State Environmental Policy Act (SEPA) requirements for evaluation of cumulative effects (Washington Administrative Code, Section 197-11-792).

The approach provided in the WSDOT guidance calls for early consideration of cumulative impacts while direct and indirect effects are being identified, preferably as part of the scoping process. For analysis, the guidance recommends the use of environmental documents such as discipline reports, as well as other relevant information such as local comprehensive plans, zoning, recent building permits, and interviews with local government. The guidance also advocates a partnership approach among agencies that includes early collaboration and integrated planning activities.

The guidance established eight steps to serve as guidelines for identifying and assessing cumulative impacts. These eight steps have been used in the following cumulative effects evaluation for the Bored Tunnel Alternative of the Alaskan Way Viaduct Replacement Project (the project). A matrix that identifies projects with the potential for cumulative effects with this project and an assessment of likely contributions to cumulative effects is also included.

Step 1. Identify the resource that may have cumulative impacts to consider in the analysis

Hazardous materials – note that hazardous materials are not a resource but instead may affect resources such as air, water, and soil.

Step 2. Define the study area and timeframe for the affected resource

Operational benefits and effects are assessed as they relate to the environmental quality, specifically soil, groundwater, and stormwater quality, of the city of Seattle and the surface water quality of Elliott Bay.

- During construction, the area of immediate effect is two city blocks around all sides of the portal construction areas (south and north), all access ramps, and all surface street modifications, as well as the area under and immediately adjacent to the existing viaduct. In the bored tunnel section, it is limited to the immediate tunnel alignment and the envelope above the tunnel to the ground surface and the staging areas that would receive the material removed from the tunnel. In addition, all disposal facilities in the northwest region that could accept material removed from the project are part of the cumulative affect study area.

- Before construction, the timeframe for the affected environment discussion is from the 1870s, when the city was first developed, to the present. The timeframe for construction-related (temporary) impacts is the approximately 5.5-year construction duration for the Bored Tunnel Alternative (2011 through 2017). After construction, the timeframe for operational impacts is from the year of opening (2015) to the design year of the project (2030).

Step 3. Describe the current health and historical context for each affected resource

The project area passes through highly developed industrial and commercial areas of Seattle. These areas of the city were first developed in the 1870s through the early 1900s and have a long and varied land use history. As a result of the industrial and commercial use of this area, hazardous materials may have been released into the surrounding soil and groundwater from a wide range of potential sources. Also, the placement of contaminated fill and road and pier construction may have adversely affected the subsurface conditions in the study area. Although localized areas of contamination have been identified during property redevelopment or roadway improvements, many subsurface sources of contamination remain.

Hazardous materials may have been introduced to Elliott Bay from the stormwater drainage system. Stormwater can become contaminated from contact with pollutant-generating impervious surfaces (PGIS), such as roads. The stormwater drainage system in Seattle is very complex, with some stormwater going directly to the combined sewer system, some discharging directly to Elliott Bay via storm drains, and some of it flowing to a partially separated stormwater system that diverts the first flush to the combined sewer with high flows discharging to Elliott Bay. The City of Seattle (the City) has developed stormwater flow and water quality treatment requirements for stormwater, and new roadway projects must comply with these regulations.

Step 4. Identify the direct and indirect impacts that may contribute to a cumulative impact

- The volume of potentially contaminated soil and groundwater that would be generated was assessed to evaluate the potential benefit to in situ soil and groundwater quality due to the removal of contaminated media.
- The volume of potentially contaminated soil that would be generated was assessed to evaluate the potential effect on landfills and their ability to handle the volume of material requiring disposal. If the landfills have handling and disposal limitations, the unit cost for disposal of material could increase.
- The construction footprint was evaluated for the area of PGIS that would be modified to comply with stormwater flow control and water quality treatment requirements of Seattle's drainage code. Improvement in stormwater management and treatment would improve stormwater quality. The water quality of Elliott Bay would improve because this body of water is the end-receiver of the majority of stormwater runoff in the downtown Seattle area.

- The construction footprint was evaluated for the area of impermeable surfaces that would prevent precipitation infiltration. Contaminants in the soil and groundwater can be carried along with precipitation as it infiltrates the ground. Capping contaminated soil would reduce contaminant migration by eliminating infiltrating precipitation. Because much of the surface soil in Seattle is contaminated, covering or capping these surfaces would improve soil and groundwater quality.

Other direct impacts:

- Spills that could occur during construction and operation were qualitatively evaluated.
- Hazardous materials generated during routine maintenance and operation were qualitatively assessed.
- Contaminated material from soil improvement activities (jet grouting) and the construction of subsurface structures such as drilled shafts was qualitatively assessed.

Step 5. Identify other historic, current, or reasonably foreseeable actions that may affect resources

The project team considered 39 projects (shown in the project-specific cumulative effects matrix at the end of this attachment) for potential activities that could have a cumulative effect related to hazardous materials on the soil, groundwater, and stormwater quality in Seattle and the surface water quality of Elliott Bay. The following 21 projects were identified as having cumulative effects:

- **A1.** Alaskan Way Surface Street Improvements – S. King Street to Pike Street
- **A2.** Elliott/Western Connector – Pike Street to Battery Street
- **B1.** Elliott Bay Seawall Project
- **B2.** Alaskan Way Promenade/Public Space
- **B4.** First Avenue Streetcar Evaluation
- **C1.** S. Holgate Street to S. King Street Viaduct Replacement Project
- **D1.** SR 99 Yesler Way Vicinity Foundation Stabilization (Column Safety Repairs)
- **D2.** S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project (Electrical Line Relocation Along the Viaduct's South End)
- **E1.** Gull Industries on First Avenue S.
- **E2.** North Parking Lot Development at Qwest Field
- **E3.** Seattle Center Master Plan (EIS) (Century 21 Master Plan)
- **E4.** Bill and Melinda Gates Foundation Campus Master Plan
- **E5.** South Lake Union Redevelopment

- **E8.** Seattle Combined Sewer System Upgrades
- **F3.** SR 99/East Marginal Way Grade Separation
- **F4.** Mercer East Project from Dexter Avenue N. to I-5
- **G1.** I-5 Improvements
- **H2.** Sound Transit University Link Light Rail Project
- **H4.** Sound Transit North Link Light Rail
- **H5.** Sound Transit East Link Light Rail
- **I2.** Sound Transit Phases 1 and 2

Step 6. Assess potential cumulative impacts to the resource; determine the magnitude and significance

Construction of the projects would include the following temporary effects:

- Generation of contaminated material that would require disposal at a facility permitted to accept the material. If there are high demands placed on the disposal facilities in the northwest region, the unit cost for material handling and disposal could increase.
- Hazardous materials spills could occur during construction, and materials associated with the cleanup would have to be disposed of. If there are high demands placed on the disposal facilities, the unit cost for material disposal could increase.

Long-term effects would include the following:

- Removal of contaminated soil and groundwater would eliminate sources of contamination and improve soil and water quality.
- Soil and groundwater quality would improve because contaminated soil would be covered with an impermeable surface that would restrict precipitation from infiltrating and mobilizing contaminants.
- Improved stormwater management and treatment would improve the quality of stormwater that discharges to Elliott Bay. Surface water quality in Elliott Bay should improve.

Step 7. Report the results

The effects would be localized around the immediate project area, with the exception of Elliott Bay, a downgradient receiving water for stormwater, and disposal facilities in the northwest region. Removal of contaminated soil and groundwater would improve the soil, groundwater, and air quality and would be a long-term benefit to the city. Improved stormwater quality would improve the water quality of Elliott Bay.

Step 8. Assess and discuss potential mitigation issues for all adverse impacts

The potential for spills and hazardous materials or contaminated material generated during construction and operation is addressed by standard mitigation measures that include the

development of plans to manage hazardous materials. Depending on the project, the following plans would be developed and implemented: temporary erosion and sediment control plan; spill prevention, control, and countermeasures plan; contaminated media management plan that addresses handling and disposal of known and unanticipated contamination; fugitive dust control plan for demolition activities; and water quality monitoring plan. In addition, the project would need to adhere to required regulatory permits, including the National Pollutant Discharge Elimination System (NPDES) stormwater permit.

The following matrix identifies projects with the potential for contributing to the cumulative effects of the proposed project and an assessment of their likely contributions.

PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX

PROJECT	POTENTIAL CUMULATIVE EFFECTS
A. Roadway Elements	
A1. Alaskan Way Surface Street Improvements – S. King Street to Pike Street	Moderate beneficial effect. Shallow contaminated soil would be removed, eliminating a potential contaminant source for soil and groundwater that might otherwise have remained in the environment. Pavement would cover potentially contaminated soil and prevent the spread of contaminants in infiltrating stormwater. Stormwater quality would improve as a result of improved stormwater flow control and water quality treatment.
A2. Elliott/Western Connector – Pike Street to Battery Street	Minimal adverse effect. Deep foundations, likely consisting of drilled shafts, would be used to support the elevated structure. This project would generate material that would require disposal at a facility permitted to accept the material.
A3. Mercer West Project – Mercer Street becomes two-way from Fifth Avenue N. to Elliott Avenue, and Roy Street becomes two-way from Aurora Avenue to Queen Anne Avenue N.	No cumulative effects are expected to result from this project because little excavation would occur, and the area of PGIS would be relatively unchanged.

PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
B. Non-Roadway Elements	
B1. Elliott Bay Seawall Project	Moderate adverse effect and moderate beneficial effect. The existing Elliott Bay Seawall from S. King Street to Pike Street would be replaced using a combination of jet grouting and drilled shafts. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities. Some in-water work would likely be necessary and could possibly disturb sediment in Elliott Bay. Contaminated sediments have been documented along the waterfront. Shallow sediment that may be removed would have to be disposed of at an off-site upland location. Sediment could also be resuspended, adversely affecting water quality. A substantial beneficial effect would result from the ground improvements along the seawall. Jet grouting and drilled shafts would tend to immobilize contaminants associated with creosote-treated timbers and other contaminants present west of the seawall.
B2. Alaskan Way Promenade/Public Space	Minimal beneficial effect. Substantial soil disturbance is not expected, and the PGIS would not be altered much. To the extent that soil is excavated and the area of PGIS is increased, soil and stormwater quality would improve.
B3. Transit Enhancements – 1) Delridge RapidRide 2) Additional service hours on West Seattle and Ballard RapidRide lines 3) Peak hour express routes added to South Lake Union and Uptown 4) Local bus changes to several West Seattle and northwest Seattle routes 5)Transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue 6) Simplification of the electric trolley system	No cumulative effects are expected because there would be no subsurface disturbance, and the area of PGIS would remain unchanged.
B4. First Avenue Streetcar Evaluation	Minimal adverse effect and minimal beneficial effect. Depending on the type of streetcar, localized contamination would result from operation of the streetcar. However, a streetcar would reduce the number of cars traveling on First Avenue, thereby reducing the quantity of contaminants released to the road surface that could degrade the stormwater quality.
C. Projects Under Construction	
C1. S. Holgate Street to S. King Street Viaduct Replacement Project	Moderate beneficial effect. Contaminated soil would be removed, eliminating a potential contaminant source for soil and groundwater that might otherwise have remained in the environment. Pavement would cover potentially contaminated soil and prevent the spread of contaminants in infiltrating stormwater. Stormwater quality would improve as a result of improved stormwater flow control and water quality treatment.

PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
C2. Transportation Improvements to Minimize Traffic Effects During Construction	No cumulative effects are expected because there will be no subsurface disturbance, and the area of PGIS will remain relatively unchanged.
D. Completed Projects	
D1. SR 99 Yesler Way Vicinity Foundation Stabilization (Column Safety Repairs)	Minimal adverse effect. A small amount of soil contaminated with concrete waste was likely generated during installation of the steel rods surrounded by concrete. This material required disposal at an approved facility.
D2. S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project (Electrical Line Relocation Along the Viaduct's South End)	Minimal adverse and beneficial effects. If contaminated soil was encountered during utility relocation, the material would have been disposed of at a landfill permitted to accept the material. This project also resulted in an improvement in soil quality because excavated contaminated soil would have been replaced with acceptable material.
E. Seattle Planned Urban Development	
E1. Gull Industries on First Avenue S.	Moderate beneficial effect. Assuming some of the required parking would be in a subsurface parking structure, shallow contaminated soil would be removed. Removal or remediation of the contamination during construction would improve soil quality. Moderate adverse effect. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.
E2. North Parking Lot Development at Qwest Field	Moderate adverse effect. Assuming some of the required parking would be in a subsurface parking structure, shallow contaminated soil would be removed. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities. Moderate beneficial effect. The property is identified as a Voluntary Cleanup Program site with the Washington State Department of Ecology. Contaminated soil is known to exist at this site. Removal or remediation of the contamination during construction would improve soil quality.
E3. Seattle Center Master Plan (EIS) (Century 21 Master Plan)	Moderate adverse effect. The new underground multimodal transportation center and parking garage would require excavation. Contaminated soil may be encountered. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.

PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
E4. Bill and Melinda Gates Foundation Campus Master Plan	Moderate adverse effect. Assuming some of the parking would be in a subsurface parking structure, contaminated soil could be encountered. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities. Moderate beneficial effect. Contaminated groundwater is known to exist at this site. Remediation is occurring as part of the redevelopment plan. This would lead to an improvement in groundwater quality. PGIS would be retrofitted for stormwater flow control and water quality treatment, thus improving stormwater quality.
E5. South Lake Union Redevelopment	Moderate adverse effect. Assuming some of the parking would be in a subsurface parking structure, contaminated soil could be encountered. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities. Minimal beneficial effect. Only a small portion of the project lies within the resource study area. Contaminated soil could be encountered during construction, and new PGIS would require stormwater flow control and treatment to improve stormwater quality.
E6. U.S. Coast Guard Integrated Support Command	No cumulative effect. Not located within the resource study area. Little excavation identified.
E7. Seattle Aquarium and Waterfront Park	No cumulative effect. Not located within the resource study area. Little excavation identified.
E8. Seattle Combined Sewer System Upgrades	Moderate adverse effect. Contaminated soil would likely be encountered along the waterfront. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.
F. Local Roadway Improvements	
F1. Bridging the Gap Projects	No cumulative effect. Only a small portion of the project lies within the resource study area. Soil excavation is not expected, and the area of PGIS would remain relatively unchanged.
F2. S. Spokane Street Viaduct Widening	No cumulative effect. Not located within the resource study area. Little excavation identified.
F3. SR 99/East Marginal Way Grade Separation	Moderate adverse effect. Contaminated soil would likely be encountered along the waterfront. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.

PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
F4. Mercer East Project from Dexter Avenue N. to I-5	Minimal beneficial effect. Only shallow soil would be excavated to prepare a road base; to the extent these soils are contaminated, potential sources of contamination would be removed. The area of PGIS would remain relatively unchanged. The volume of soil is unlikely to affect disposal costs or the capacity of disposal facilities.
G. Regional Roadway Improvements	
G1. I-5 Improvements	Moderate adverse effect. Concrete panels could require disposal at a landfill if the concrete is not reused. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.
G2. SR 520 Bridge Replacement and HOV Program	No cumulative effect. Not located within the resource study area. Little excavation identified.
G3. I-405 Corridor Program	No cumulative effect. Not located within the resource study area. Little excavation identified.
G4. I-90 Two-Way Transit and HOV Operations Stages 1 and 2	No cumulative effect. Not located within the resource study area. Little excavation identified.
H. Transit Improvements	
H1. First Hill Streetcar	No cumulative effect. Not located within the resource study area. Little excavation identified.
H2. Sound Transit University Link Light Rail Project	Moderate adverse effect. Contaminated soil would likely be encountered. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.
H3. RapidRide	No cumulative effect. Not located within the resource study area. Little excavation identified.
H4. Sound Transit North Link Light Rail	Moderate adverse effect. Contaminated soil would likely be encountered. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.
H5. Sound Transit East Link Light Rail	Moderate adverse effect. Effects would be similar to H4.
H6. Washington State Ferries Seattle Terminal Improvements	No cumulative effect. Not located within the resource study area. Little excavation identified.
I. Transportation Network Assumptions	
I1. HOV Definition Changes to 3+ Throughout the Puget Sound Region	No cumulative effect. Not located within the resource study area. Little excavation identified.

PROJECT-SPECIFIC CUMULATIVE EFFECTS MATRIX (CONTINUED)

PROJECT	POTENTIAL CUMULATIVE EFFECTS
I2. Sound Transit Phases 1 and 2	Moderate adverse effect. Contaminated soil would likely be encountered. Contaminated material would require disposal at a facility permitted to accept the material. Unit price for disposal of waste may be affected by the ability of the disposal companies to handle the material and the capacity of the facilities.
I3. Other Transit Improvements	No cumulative effect. Not located within the resource study area. Little excavation identified.
J. Completed but Relevant Projects	
J1. Sound Transit Central Link Light Rail (including the Sea-Tac Airport extension)	No cumulative effect. Not located within the resource study area. Disposal of excavated material would not affect future disposal.
J2. South Lake Union Streetcar	No cumulative effect. Not located within the resource study area. Little excavation identified.
J3. SR 519 Intermodal Access Project, Phase 2	No cumulative effect.