REVISED ENGINEERING EVALUATION/COST ANALYSIS

University of Portland River Campus Property aka Triangle Park Removal Action Area within the Portland Harbor Superfund Site

Portland, Oregon

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EXECUTIVE SUMMARY

AMEC Environment & Infrastructure, Inc. (AMEC), has prepared this Engineering Evaluation/Cost Analysis (EE/CA) on behalf of the University of Portland (UP) for the UP River Campus Property also known as the Triangle Park Removal Action Area within the Portland Harbor Superfund Site (the site). The Portland Harbor Superfund Site is listed on the National Priority List (NPL). This EE/CA summarizes historical analytical data for the site, presents an analysis of removal alternatives being considered for cleanup of the site, and describes a recommended removal action. This EE/CA and supporting investigations were undertaken by UP as a Bona Fide Prospective Purchaser, as defined by Section 101(40) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601(40), in cooperation with the U.S. Environmental Protection Agency (EPA), and pursuant to the Bona Fide Prospective Purchaser Agreement and Order on Consent for Removal Action, Docket No. CERCLA-10-2007-0027 (BFPPA).

In 2006, UP entered into an agreement with the former property owner to purchase the property then referred to as Triangle Park. UP during this same period entered into the BFPPA with the EPA, and entered into a separate Prospective Purchaser Agreement (PPA) with the Oregon Department of Environmental Quality (DEQ). UP finalized purchase of the property in December 2008. Under the terms of the BFPPA, the parties have agreed that removal action work at the site must be performed with EPA oversight and be consistent with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, and codified at 40 CFR Part 300 (the NCP) and EPA CERCLA removal action guidance.

The UP River Campus property is located in the University Park area of Portland, Oregon, along the north shore of the Willamette River, approximately 4.5 miles northwest of downtown Portland. The property is located on a terrace above the Willamette River and is generally flat except for at its steeply sloped river shoreline. The property is currently vacant and is not being used, but UP plans to redevelop the property for use as part of the larger UP campus. Under UP's vision for the property, the site will be redeveloped in phases, subject to review and approval of a final Master Plan for the property by the City of Portland. Planned redevelopment of the property ranges from landscaping and greenway restoration to construction of academic and maintenance facilities, parking facilities, a practice sports field, a rowing team dock, upland boat storage, and a new baseball stadium.

The site has a long history of industrial use since the early 1900s, including wood processing and product manufacturing, cooperage storage, marine operations and storage, chemical operations, scrap salvage storage, welding operations, hazardous waste storage (including waste oils, solvents, and other materials), and concrete manufacturing. Underground and aboveground storage tanks are known to have been formerly present at the site. For all practical purposes, the site has been vacant

since at least 1997, and all structures associated with former industrial activities at the site were demolished and removed by 2009.

In 1997, Triangle Park, LLC (Triangle), purchased the site from Edward Hostmann, Inc., under a State of Oregon PPA with the DEQ. The PPA conditionally limited Triangle's liability to the State of Oregon to $750,000 for investigation and cleanup of the property (DEQ, 2005). Under the DEQ PPA, Triangle LLC was not liable for groundwater impacts at the site under state law. Triangle was also relieved of any off-site sediment liability by DEQ upon performing limited baseline sediment sampling. In 2005, DEQ issued a Record of Decision (ROD) to Triangle to remediate soils at the site as part of the 1997 State of Oregon PPA between DEQ and Triangle (DEQ, 2005). Under the terms of the BFPPA entered into between UP and EPA, as well as a separate PPA with DEQ, that led to UP's purchase of the property in December 2008, the parties have agreed that, at a minimum, the removal action work at the site must meet the stipulations of the 2005 ROD. The 2005 ROD required that:

- A cap be installed over soil left in place that contains concentrations of contaminants of concern (COCs) that exceed DEQ-established screening levels;
- Specified "hot spot" areas with highly elevated concentrations of contaminants of concern be excavated and the removed soils be disposed of off-site; and
- Specific institutional controls be put in place, including proprietary controls (in the form of a DEQ-approved Easement and Equitable Servitude) and a DEQ-approved Soils Management Plan.

These remedies mandated by DEQ in the 2005 ROD were required to reduce or prevent possible exposures of human and ecological receptors to contaminated soil at the site.

In preparing this EE/CA, analytical data were reviewed from historical investigations conducted at the site, as well as from a data gaps investigation performed by AMEC in 2009 and 2010. These investigations indicate that much of the soil at the site is impacted with non-source-specific COCs, resulting in widespread impacts at relatively low concentrations. The COCs that have been detected on the site have low mobility in the environment and are not expected to migrate to the Willamette River via groundwater. Potential COCs include petroleum hydrocarbons, polychlorinated biphenyls (PCBs), tributyltin, metals, polycyclic aromatic hydrocarbons (PAHs) and carcinogenic PAHs (cPAHs), and dioxins. In addition, several specific source areas, referred to as *hot spots*, were identified that have more elevated concentrations of COCs or contaminants likely to be more mobile. Potential COCs in the hot spots are similar to the widespread COCs present at low-level concentrations at the site, but concentrations are higher in these specific source areas. Based on an empirical demonstration and calculated risks of soil-to-groundwater migration, soils that will remain at the site following cleanup are not anticipated to contain concentrations of contaminants sufficient to impact groundwater. Limited groundwater impacts have been identified. Groundwater is evaluated in this

EE/CA in order to provide a baseline for future proposed groundwater monitoring, but is not considered for cleanup based on the 2005 DEQ ROD and the expectation that cleanup of specific source areas will result in improvement in groundwater quality.

The data for this site reflects soil contaminants that are present throughout the site at fairly low concentrations and that have low mobility in the environment. For the purposes of this EE/CA, the characterization of the site was divided into 27 broad areas, including 21 areas considered “uplands” areas and 6 areas considered “river shoreline” (RS) areas (immediately adjacent to the Willamette River) (see Figure 3). Each of these 27 areas was further subdivided into specific depth intervals, and each depth interval in each area was evaluated using data from multi-incremental sampling investigations. Multi-incremental sampling (MIS) provides an average concentration of COCs over a wide area for each depth interval evaluated. In addition to these MIS results, potential hot spots were evaluated using discrete samples for each potential hot spot area, in order to determine the extent and depth of each of these specific source areas.

To determine which areas of the site require action, available site analytical data (both MIS and discrete) are compared in this EE/CA to site-specific action or screening levels developed using federal and state guidelines. Areas where action is necessary to address contamination are identified via a streamlined risk evaluation performed for the site based on protection of human and ecological receptors, as well as comparison to action or screening levels. The streamlined risk evaluation is based on a conceptual site model developed in this EE/CA and follows guidance provided to UP by the EPA, as well as Oregon law, which stipulates that achieving acceptable risk levels is an appropriate standard for hazardous substance response actions. Based on the shorter durations of exposure at a college campus, an occupational/ industrial risk exposure is appropriate and remains conservative. However, soils that exceed the residential risk exposure threshold will be required to be addressed (by a limited action/minimum of institutional controls) as part of the removal action to be protective of human health. Site specific action levels are used to divide the site into areas to determine where some response action (active response and/or institutional controls) is necessary to address contamination, as follows.

- **Limited action areas:** Upland area soils with COC concentrations below active response thresholds but above levels that allow for unlimited use/unrestricted exposure (risks between 1×10^{-5} and/or hazard index (HI) = 1 based on industrial use, and 1×10^{-6} and/or HI = 1 assuming residential use) appear to warrant only limited action. Most of the Upland area soils fall into this category.

- **Active response action areas:** Areas with soils that exceed certain thresholds described below appear to warrant active responses, such as treatment, excavation, and/or capping, and if the active response leaves waste in place above levels that allow for unlimited use/unrestricted exposure, institutional controls (ICs) would also be required. Active response action areas include:

    1. River Shoreline (RS) Areas: For the RS areas, response actions need to be protective of public health and the environment, comply with the DEQ ROD cleanup requirements, comply with applicable or relevant and appropriate requirements (ARARs) to the extent practicable (or comply completely for this to be a final action), and be consistent with and contribute to the efficient performance of anticipated long term remedial actions for the greater Portland Harbor Site which encompasses this Site. Because RS soils have the potential to slough or migrate into the river and affect sediments, EPA has determined that RS area actions should also comply with the draft Portland Harbor Site Preliminary Remediation Goals (March 27, 2009) (PRGs). All the RS areas exceed the most stringent of the above as shown in Table 2, typically the draft Portland Harbor Site Preliminary Remediation Goals, and appear to warrant active response action.

    2. Portions of the Upland Areas: Active response actions are evaluated for those upland areas where the DEQ ROD requires active response or subsequent sampling and risk assessment has identified soils posing potential carcinogenic risk greater than 1×10^{-4}, or non-cancer risks greater than an HI > 1. Note that upland area soils are not considered likely to migrate to river sediments, so Portland Harbor PRGs have not been used to guide response action decisions in Upland Areas.

- **Hot spot areas:** All areas that were designated as Hot Spots in the DEQ ROD will require active response. Two additional areas discovered during the removal assessment will also be excavated under the Hot Spot criteria.

Following these criteria, only one upland subarea (1B) was found to exceed the active response action threshold based on an occupational use scenario. Additionally, 11 uplands areas or subareas exceeded limited action levels based on an occupational risk less than 1×10^{-4} and a HI>1 and greater than a residential-use of 1×10^{-6} (unrestricted use level). All six RS areas exceed draft Portland Harbor PRGs and will require an active response action. The six hot spots identified in the ROD, as well as one additional hot spot, were found to fit the definition of a hot spot and were also identified for removal action. An eighth potential hot spot area did not meet the hot spot criteria but was determined to require a limited action.

To address potential risk to human health and ecological receptors posed by these areas, six potential removal action options for the site are identified in this EE/CA. These options include (1) no action, (2) institutional controls, (3) capping with institutional controls, (4) excavation of all soils above cleanup levels with off-site disposal of excavated soils, (4A) excavation of soils above cleanup levels based on occupational/industrial exposure combined with institutional controls, and (5) excavation

with on-site re-use of excavated soils where practicable (primarily for RS areas). The effectiveness, implementability, and cost of these technologies are evaluated and compared, following CERCLA, the NCP and EPA guidance. Based on the results of this evaluation, the following recommended actions are identified in this EE/CA (and displayed in Figure 13):

- Limited Response Areas (Upland Areas where soils exceed cleanup levels based on residential exposure but do not exceed cleanup levels of 1×10^{-4} risk or HI>1 based on occupational exposure): Institutional controls (Option 2) are the preferred option for these areas, consisting of an easement and equitable servitude that would prevent residential development. This option is recommended because it poses significantly fewer obstacles to implementability and is much less expensive than other options considered in this EE/CA. In addition, compared to other options, this option is considered equally effective in meeting ARARs and protecting human health and the environment over both the short and long term. UP is not proposing to use the site for residential use. Therefore leaving soils in these areas is consistent with the planned site use where risk is based on occupational use. Institutional controls provide equal protection of human health and the environment without the construction risks and costs of more aggressive actions.

- Active Response Action Areas:

  – **Upland Areas where soils exceed cleanup levels based on occupational exposure**: A combination of capping (Option 3) and re-use of excavated site soils from the shoreline areas (Option 5) is recommended for these areas, based on cost and implementability while still meeting ARARs and being protective of human health and the environment. It is recommended that the areas be capped with 2 feet of clean soil, re-using stockpiled soils excavated from the riverfront for any required backfill and for capping. Soils reused that exceed risk thresholds applied to the site may require institutional controls or capping. If the planned future use of an area includes covering the area with an equivalent capping material, such as a building or parking lot, this alternative cap is proposed in lieu of a soil cap as part of cleanup design. This recommended action will need to be combined with additional institutional controls in order to maintain long-term effectiveness. However, with institutional controls in place (such as an easement and equitable servitude, a soil management plan, a hazard communication plan, and monitoring and maintenance of the cap), this alternative is considered equally protective of human health and the environment over both the short and long term compared to other options. The more aggressive option of excavation and off-site disposal for these areas would have doubled the costs and resulted in a great deal more truck traffic through the campus and neighborhood. Managing the soil on site by capping is a preferred option, although it will require long term maintenance.

- **Areas along the waterfront where draft Portland Harbor PRGs apply (Areas RS-1, RS-2, and RS-3):** Excavation of soil and re-use of the soil on the uplands areas (Option 5), and potential capping (Option 3), are the recommended options for waterfront areas of the site where draft Portland Harbor PRGs are exceeded. Clean, imported soil will be used as backfill if required. It is assumed that most of the soil along the riverbank will be removed to eliminate potential migration of COCs from the shoreline into the river and river sediment. Soil from Areas RS-1, RS-2 and RS-3 should be compared to upland action threshold levels and evaluated for re-use in the uplands areas consistent with decisions made for the uplands. Soils re-used as backfill in upland areas of the site (Option 5). If soil exceeding the limited action thresholds is re-used as backfill or cap material in upland areas, institutional controls may need to be established to prevent unacceptable use and limit disturbance of capped areas. None of the RS Area soils exceed active response action thresholds based on risk greater than 1×10^{-4} or HI=1 occupational risk scenario. Capping within the RS areas may be used in combination with excavation if soils above draft Portland Harbor PRGs levels or other cleanup levels are left in place.

- **Hot Spots excavation areas:** Hot spots defined by DEQ regulation are source areas that have high COC concentrations (10 to 100 times screening levels) and therefore present a risk of mobility of COCs to groundwater. Hot spots identified in the DEQ 2005 ROD are required to be excavated and soils disposed of off-site. Only one additional hot spot not identified in the DEQ ROD presents similar concerns of contaminant mobility since it fits the DEQ definition of a hot spot. As such, soil in this area is recommended to be excavated and removed for off-site disposal.

Total estimated costs to implement the proposed removal actions described above are on the order of $2,700,000. The final recommended alternative for each area will be selected by EPA after an opportunity for input from other stakeholders and a public comment period of at least thirty days in accordance with the NCP.

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ACRONYMS AND ABBREVIATIONS

AMEC E&E	AMEC Earth & Environmental
AMEC Geomatrix	AMEC Geomatrix, Inc.
ARAR	applicable or relevant and appropriate requirements
AST	aboveground storage tank
BFPPA	Bona Fide Prospective Purchaser Agreement
bgs	below ground surface
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	contaminants of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CSM	conceptual site model
DEQ	Oregon Department of Environmental Quality
EE/CA	Engineering Evaluation/Cost Analysis
EES	Environmental Emergency Services
EG2	General Employment 2
EPA	US Environmental Protection Agency
ESA	environmental site assessment
Geomatrix	Geomatrix Consultants, Inc.
HI	hazard index
HSDB	Hazardous Substances Data Bank
IC	institutional controls
IH	Heavy Industrial
JSCS	Joint Source Control Strategy
MCL	maximum contaminant levels
MFA	Maul Foster & Alongi, Inc.
µg/kg	micrograms per kilograms
µg/L	micrograms per liter
mg/kg	milligrams per kilograms
MIS	multi-increment sampling
MRL	method reporting limit
msl	mean sea level
NCP	National Contingency Plan
NPL	National Priority List
O&M	operations and maintenance
ORSN	Oregon River & Steam Navigation Company
OSWER	Office of Solid Waste and Emergency Response
PAH	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
pg/g	picograms per gram

ACRONYMS & ABBREVIATIONS
(Continued)

PPA	Prospective Purchaser Agreement
PRG	preliminary remediation goal
QA	quality assurance
R2	Residential 2,000
R5	Residential 5,000
RAFLU	reasonably anticipated future land use
RAO	removal action objectives
RBC	risk-based concentrations
RCRA	Resource Conservation and Recovery Act
RES	Riedel Environmental Services
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RS	river shoreline
RSDs	relative standard deviations
RSL	Regional Screening Levels
Sakrete	Sakrete of Pacific Northwest, Inc.
SLV	Screening Level Values
SOW	statement of work
SRE	streamlined risk evaluation
SSL	soil screening levels
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons diesel range
TPH-O	total petroleum hydrocarbons heavy oil range
Triangle	Triangle Park, LLC
TSCA	Toxic Substances Control Act
UP	University of Portland
USFWS	US Fish and Wildlife Service
UST	underground storage tank
UU/UE	unrestricted use/unlimited exposure
VOCs	volatile organic compounds

REVISED ENGINEERING EVALUATION/COST ANALYSIS

University of Portland River Campus Property
aka Triangle Park Removal Action Area
Portland, Oregon

1.0 INTRODUCTION

AMEC Environment & Infrastructure, Inc. (AMEC), has prepared this Engineering Evaluation/Cost Analysis (EE/CA) on behalf of the University of Portland (UP) for the UP River Campus Property (the site) (Figure 1). This EE/CA presents an analysis of removal action options being considered for cleanup of the site and describes a recommended removal action. Data from historical investigations are also presented in support of the removal action options.

UP qualifies as a Bona Fide Prospective Purchaser as defined in Section 101(40) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601(40), This EE/CA and supporting investigations were undertaken by UP, in cooperation with the U.S. Environmental Protection Agency (EPA) and pursuant to a Bona Fide Prospective Purchaser Agreement and Order on Consent for Removal Action, Docket No. CERCLA-10-2007-0027 (BFPPA). In 2006, UP entered into an agreement with the former property owner to purchase the property then referred to as Triangle Park. UP during this same period entered into the BFPPA, as well as a separate Prospective Purchaser Agreement (PPA) with the Oregon Department of Environmental Quality (DEQ). UP closed on the purchase of the property in December 2008. Under the terms of the BFPPA, the parties have agreed that the removal action work at the site must be consistent with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, and codified at 40 CFR Part 300 (the NCP), EPA removal action guidance and be performed with EPA oversight.

This EE/CA was conducted in accordance with CERCLA, including the NCP (40 CFR § 300.415). Section 300.415(b)(4)(i) of the NCP requires that an EE/CA be completed for all non-time-critical removal actions. This EE/CA was prepared following EPA's Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (EPA, 1993). This EE/CA provides information about the nature and extent of contamination and the potential risks posed by the contaminants to human and ecological receptors. This EE/CA also identifies the proposed objectives of the removal action, analyzes the effectiveness, implementability, and cost of various options that may achieve these objectives, and identifies a recommended alternative.

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2.0 SITE CHARACTERIZATION

This section summarizes available data on the physical, demographic, and other characteristics of the site and surrounding areas to provide background engineering information for analyzing removal options. This section also sets forth the risk evaluation, action levels and identifies those areas of the site that require removal action. The overall layout of the site and historic structures are shown on Figure 2.

2.1 SITE DESCRIPTION

The 35 acre site has been investigated extensively for the past 15 years under DEQ and then EPA oversight. The following site description is based on the various reports prepared over that 15 year period. For purposes of characterizing the distribution of potential contaminants, the site has been subdivided into separate sampling areas, as shown on Figure 3 and described in detail in Sections 2.4 and 2.6.1.

2.1.1 Site Location and Legal Description

The site is located in the University Park area, along the north shore of the Willamette River, approximately 4.5 miles northwest of downtown Portland, Oregon (Figure 1). The site is an irregular-shaped tract of land occupying approximately 35 acres (1,524,600 square feet) in Section 18, Township 1 North, Range 1 East of the Willamette Meridian in Portland, Multnomah County, Oregon. The approximate center of the site is located at latitude 45º34’29.24’’N, longitude 122º44’08.09”W. The site comprises three tax parcels (R248492, R315795, and R315775). The property description is Portsmouth Addition, Block 36, lots 1 to 9, tax lots 100, 200, and 8900 (City of Portland, 2011).

The site is bounded by the Willamette River to the south and west, the former McCormick & Baxter Creosoting Company property to the northwest, the main UP campus to the east/southeast (including the area along the river to the southeast), and residential housing and Waud Bluff to the north, northeast, and east (Figure 2),

The site may be accessed from the north by North Van Houten Place, which traverses Waud Bluff and extends onto the northwest corner of the property. North Van Houten Court extends from North Van Houten Place onto the northeastern portion of the site. The site is also accessible from the south via North Bluff Street, which winds down the bluff from the southwestern extent of North Portsmouth Avenue.

2.1.2 Topography and Site Features

The site is located on a terrace above the Willamette River to the west and the 120-foot-high Waud Bluff to the east. The site is generally flat, at an elevation of 20 to 40 feet above mean sea level (msl). The 100-year floodplain is bounded at an elevation of approximately 28 feet msl, as shown on Figure 3, and occupies the western portion of the site. The Willamette River shoreline is steeply sloped, with three docks extending from the property into the river. A 200- to 300-foot embayment is located in the central shoreline, as shown in Figure 2 (MFA, 2002a).

A Union Pacific railway bisects the site from north to south (Figure 2); this railway is considered active but is rarely used. Buried utilities at the site are identified on Figure 2. An underground fuel pipeline and valve owned by Chevron are located near the southerly edge of the site. The pipeline traverses under the southern and southeastern portions of the site transporting jet fuel to Portland International Airport. Other utility lines at the site include a water line and a natural gas line. The water line runs north to south along the eastern side of North Van Houten Court. The natural gas line runs parallel to North Van Houton Court, angles to the southwest, and then proceeds west across the railway near the center of the site. The natural gas line continues west to the area of several former buildings on the west-central portion of the site. The water line proceeds south along the western side of the railway. No stormwater discharge lines currently discharge as all remaining catch basins were filled with concrete by UP upon acquisition of the property. A security floodlight line also runs east to west near the central portion of the site and northeast to southwest along the eastern side of the railway for the entire length of the site. A perimeter chain-link fence runs along the property boundaries, as well as along either side of the railway.

No aboveground structures currently exist on the site. Access roads and former parking areas on the eastern portion of the site and one former parking area on the western portion of the site are paved with asphalt. Areas of dense vegetation (including blackberry bushes and some mature trees) are present along the northwestern and northeastern site boundaries, and along the bank of the Willamette River. The remaining portions of the site are generally covered with gravel and/or grasses. The majority of concrete paving has been demolished at the site.

2.1.3 Geology

Environmental investigations at the site have identified the following geologic units (Geomatrix, 2008; AMEC E&E, 2006c; MFA, 2002a):

- **Imported fill:** The uppermost soil layer is imported fill material with a variable thickness of 10 to 16 feet. Fill (likely dredged river sand and gravel) was placed at the site in the early 1900s and along the northwestern boundary of the site in the early to mid-1970s. The upper 1 to 3 feet of fill material over most of the site generally consists of gravel. The gravel is typically underlain by fine- to medium-grained sand, generally with little to

no silt. However, within the sand fill, layers of gravel, silt, sandy silt, sandblast grit, and other materials have been observed. A different type of fill material is present in the northwestern portion of the site (the areas identified later in this report as Areas 6A, 6B, 6C, and 6D). This area consists of sandy silt.

- **Recent alluvium:** Recent alluvium underlies the imported fill. The alluvium consists of gravel, sand, silt, and clay. A deep boring (WGB-6) drilled at the site indicated the recent alluvium is approximately 90 feet thick.
- **Catastrophic flood deposits:** The deep boring WGB-6 revealed coarse-grained flood deposits from the bluff east of the site at a depth of approximately 105 feet below ground surface (bgs).
- **Bedrock:** The Troutdale Formation, Sandy River Mudstone, and Columbia River Basalt Group units are present at depth beneath the catastrophic flood deposits.

2.1.4 Hydrogeology

Uppermost groundwater is typically present in the imported fill and recent alluvium (MFA, 2002a). Groundwater is typically encountered at variable depths of 9 to 25 feet bgs, depending on the season and river stage (MFA, 2001, 2002a). Water levels recorded historically indicate that groundwater flows toward the Willamette River and is tidally influenced (AMEC E&E, 2006c).

2.1.5 Climate

The site is located in Portland, Oregon, in a west coast marine environment that receives moderate rainfall. Average rainfall in Portland is 37 inches, with the majority of rain occurring between October and May. December is generally the wettest month and July is generally the driest month. Prevailing winds are generally northwesterly in the spring and summer and southeasterly in fall and winter. January is generally the coldest month, with temperatures averaging in the low 30s to low 40s degrees Fahrenheit. August is generally the warmest month, with temperatures averaging in the mid-50s to upper 70s degrees Fahrenheit (MFA, 2002a).

2.1.6 Endangered/Threatened Species, Critical Habitat, and Wetlands

AMEC is preparing a biological assessment (BA) to evaluate whether EPA's selected removal action may affect the five salmon and steelhead species currently listed as threatened in this region as well as their critical habitat under the Endangered Species Act (ESA). The BA will be completed in the very near future to facilitate EPA's and UP's consultation obligations under the ESA.

In addition to the ongoing BA, AMEC is conducting a wetlands inventory at the site. The wetlands inventory is being undertaken to assure that the final EPA selected removal action will meet the substantive requirements of the Clean Water Act ARARs including Section 404 pertaining to wetlands.

2.2 SITE BACKGROUND AND HISTORY

Former and current uses of the site are described in this section.

2.2.1 Former Industrial Use

The site has a long history of industrial use. Figure 2 shows locations of documented historical structures at the site (GeoEngineers, 1992; MFA, 2002b). Research of historical records reveals that during the early to mid-1900s, several companies, including Standard Oil, as well as the Peninsula Lumber Co., acquired portions of the site and conducted various industrial operations. By 1909, Peninsula Lumber Co.'s wood products manufacturing facility occupied the north and northwest end of the property. At that time, the Oregon River & Steam Navigation Company (ORSN) Railroad, St. John's Branch, bisected the entire site from north to south, with the Peninsula Lumber Co. sawmill operation primarily to the west and lumber pile storage facilities to the east of the railway. The southern area of the site contained wharves and riverfront tanks associated with Standard Oil's business activities (AMEC E&E, 2006a).

As of the mid-1920s, the Peninsula Lumber Co. sawmill remained operational at the northwest end of the site. Between 1909 and 1924, several new facilities were constructed on the site:

- A large offshore dock was built parallel to the shoreline along the sawmill property.
- The Peninsula Ship Building Co. began operations on the southern boundary of the Peninsula Lumber Co. facility. The shipbuilding operation included four large piers that began directly southwest of the railway and extended into the Willamette River. Immediately east of the piers on the opposite side of the railway, the Peninsula Ship Building Co. maintained a boiler room, paint and iron storage areas, and a machine shop.
- Fenner Manufacturing Co. built a additional sawmill facility at the extreme north end of the site along the eastern side of the ORSN rail line in an area formerly occupied by lumber piles.
- Portland Railway Light and Power Co. built and maintained a power plant fired by oil, coal, and refuse along the eastern boundary of the site. This facility was located east of the railway at the base of the bluff.
- At that time in 1924, Standard Oil Co. retained a sparsely developed parcel with a vacant warehouse at the southernmost end of the site. The vacant warehouse was served by a 6-inch-diameter water line that ran across the site to the Portland Railway Light and Power Co. plant.

Throughout the 1930s and 1940s, wood processing, cooperage storage, and marine operations were the major industrial activities associated with the site. By 1950, the Western Cooperage Co. occupied a warehouse on the eastern side of the railway in the former Peninsula Ship Building Co. industrial area. At this time, Willamette Tug & Barge Co. owned the southernmost parcel of land formerly used

by Standard Oil Co. Willamette Tug & Barge Co. stored marine equipment and conducted marine operations from this property until at least 1975. As of 1950, Peninsula Lumber Co. was replaced by the Wilson River Lumber Co.

By 1950, only the operational buildings west of the railroad remained. Buildings associated with Fenner Manufacturing Co. on the east side of the railway no longer existed, and the Peninsula Shipbuilding Co. piers had been removed. At that time, the property between Wilson River Lumber Co. and Willamette Tug and Barge Co. was vacant except for a single office building. Occupant records also indicate the presence of Willamette Hi-Grade Concrete Co. on the site by at least 1950 (GeoEngineers, 1992).

During the 1950s and 1960s, site records show that Willamette Hi-Grade Concrete Co., Willamette Tug and Barge Co., and various wood product manufacturing and storage companies maintained property ownership at the site. Additionally, new industry established at the site included Evergreen Chemical and Soap Co., which ran its operations from 1952 through at least 1963 (GeoEngineers, 1992). By 1969, Oregon Woodworking Ltd. occupied northern areas of the site on both sides of the railway. A scrap salvage storage yard, general storage buildings, and a building used for welding operations were located on the former Peninsula Ship Building Co. property. By 1969, Willamette Hi-Grade Concrete Co. owned the land previously occupied by Portland Railway Light and Power Co. on the east side of the railway as well as property stretching southwestward to the Willamette River. The southern extent of the site remained in the possession of Willamette Tug & Barge Co. for maritime storage as well as other maritime operations. Willamette Tug and Barge Co. continued operations until at least 1975.

During the 1970s, land ownership records indicate Willamette Hi-Grade Concrete Co. and Sakrete of Pacific Northwest, Inc., produced concrete on the site. Western Pacific Dredging Co. and Willamette Western Corporation also owned property at the site from 1970 until at least 1975. In the 1980s, primary land owners at the site included Riedel Industries and Sakrete of Pacific Northwest, Inc. Riedel Industries' main business was dredging river bottoms, pole driving, and marine construction (DEQ, 2011). In 1972, Riedel became involved in cleanup of hazardous waste spills, especially near railroads. Riedel Industries created a division called Environmental Emergency Services (EES), which completed a Resource Conservation and Recovery Act (RCRA) part B permit in 1984 to build a large hazardous waste storage building. Neighbors protested the storage area so vehemently that the City of Portland refused to grant a conditional use permit, and EES decided to close the storage area and move it to another location (off-site). In 1984, soil contaminated with polychlorinated biphenyls (PCBs) was excavated from a location near North Bluff Street on the southeastern edge of the site.

By the early 1990s, the southern end of the site contained an office building for Riedel Environmental Services (RES). Other structures located within this portion of the site included an oil spill response warehouse, and the remnants of both a concrete batch plant and a truck weigh station. Various small storage buildings and a warehouse (former power plant) were present in the central portion of the site east of the railway. A concrete pad in front of the warehouse covered underground fuel storage bins formerly associated with the power plant's energy production. The converted power plant was positioned either directly upon or at least proximate to the historic Portland Railway Light and Power Co. property. Metal parts, dredging equipment, pumps, engine parts, paint, and other equipment were stored in these buildings. Immediately north of the former power plant were buildings that previously held stored waste oils and solvents. This area was also utilized as a storage area for approximately fifty, 55-gallon drums. In 1992, several of the drums were observed to be rusted through and leaking while other drums were bulging and full. South of the warehouse were two non-operational underground storage tanks (USTs) and two active aboveground storage tanks (ASTs) (GeoEngineers, 1992).

On the west side of the railway, a concrete slab and steam-cleaning facility provided an area for washing equipment used by RES for cleanup operations. Stored oily waste containers were also observed at this location by GeoEngineers in 1992. At the northern end of the site, excavated former USTs, as well as former ASTs, dredge piping and equipment, heavy equipment, and various types of metal debris were stored (GeoEngineers, 1992). Transformers and large steel tanks were also kept in this area of the site. An old brick drying kiln served as a storage building for scrap metal and small equipment.

By the early 1990s, the site was served by three docks along the Willamette River. General marine equipment, tugs, dinghies, boats, and barges were kept at these docks or moored offshore (GeoEngineers, 1992). From that time to the present, Chevron has maintained a pump station and fuel line at the southernmost end of the site that supplies jet fuel to the Portland International Airport, located several miles to the north.

Most of the structures at the site were demolished in the 1990s. The remaining structures were removed in 2009 by UP under EPA oversight in accordance with a demolition work plan (AMEC Geomatrix, 2009) approved by EPA.

2.2.2 Triangle Park Prospective Purchaser Agreement

In 1997, Triangle Park, LLC (Triangle), purchased the site from Edward Hostmann, Inc., under a State of Oregon PPA with the DEQ. The PPA conditionally limited Triangle's liability to the State of Oregon to $750,000 for investigation and cleanup of the property (DEQ, 2005). For all practical purposes, the site has been vacant since at least 1997. From 1998 to 2004, Triangle conducted a remedial

investigation/feasibility study (RI/FS) under DEQ oversight (MFA, 2004, 2004b). In 2005, DEQ issued a Record of Decision (ROD) to Triangle, pursuant to state law, to remediate soils at the site (Section 2.2.4). Under the DEQ PPA, Triangle was not liable under state law for groundwater impacts at the site. Triangle was also relieved of any off-site sediment liability by DEQ upon performing limited baseline sediment sampling.

2.2.3 University of Portland Bona Fide Prospective Purchaser Agreement

In December 2006, UP entered into a BFPPA with the EPA, as well as a separate PPA with DEQ, that led to UP's purchase of the property in December 2008. The BFPPA statement of work (SOW) requires completion of an EE/CA. Under the BFPPA, the removal action work at the site must be consistent with EPA removal action guidance under CERCLA and performed with EPA oversight. The SOW also requires that UP conduct a technical briefing to EPA, DEQ, concerned Tribes, and the Willamette River Trustees to outline the proposed removal options that will be presented in the EE/CA. This technical briefing will be scheduled after EPA completes its review of this EE/CA. Based on results from the technical briefing, the EE/CA will be updated as necessary and submitted for approval to EPA. Upon approval by EPA, the EE/CA will be issued for formal public comment. The SOW specifies the sections and topics that must be included in this EE/CA.

As part of the BFPPA, subject to certain conditions, the United States covenants not to sue or take administrative action against UP for existing contamination at the site. Likewise, UP (and its contractors and employees) covenants not to sue or assert any claims or causes of action against the United States with respect to existing contamination, work at the site, oversight costs, or the BFPPA.

2.2.4 Oregon Department of Environmental Quality Record of Decision

DEQ's 2005 ROD findings described low concentrations of contaminants of concern (COCs) present throughout the site, interspersed with specific source areas with higher concentrations of COCs. These isolated source areas were identified in the ROD as "hot spots." In general, relatively low concentrations of petroleum hydrocarbons, PCBs, metals, polycyclic aromatic hydrocarbons (PAHs), and dioxins are present throughout the site. The COC sources derived from long-term industrial activities at the site including periodic imported fill placed at the site. Grading activities may also have spread and diluted contamination from original source areas into soils across the site. The source areas or hot spots contain chiefly petroleum hydrocarbons and PAHs, although some also contain other COCs.

The 2005 ROD established cleanup levels (Table 3) and specified that the hot spot areas be excavated, and the excavated soils be disposed of off-site. The ROD also required that a cap be installed over the remaining soil containing concentrations of COCs that exceed DEQ-established screening levels. These remedies were required to reduce or prevent possible exposures of human

and ecological receptors to contaminated soil at the site. The 2005 ROD imposed specific institutional controls (ICs), including a deed restriction (in the form of a DEQ-approved Easement and Equitable Servitude) and a DEQ-approved Soils Management Plan that includes procedures to address four issues:

1. Notifying workers at the site about the presence of soil contamination;
2. Characterization, management, and disposal of waste soil (should it be generated in the future);
3. Maintaining residual concentrations of contaminants in newly exposed surface soil (0-3 feet bgs) at levels protective of human and ecological (terrestrial and aquatic) receptors; and
4. Health and safety requirements related to currently existing contaminated soil for any future site redevelopment activities.

DEQ's 2005 ROD notes that while shallow groundwater has been minimally impacted by releases from historic site operations - any residual soil contamination remaining on site after soil cleanup is completed is not expected to significantly impact groundwater in the future. The 2006 PPA also specifies that DEQ will retain liability for any impacts on groundwater.

The majority of the work outlined in the DEQ ROD, including excavation of approximately 800 cubic yards of soil hot spots, capping of approximately 5,000 square yards of residual contaminated soil, and implementation of institutional controls, has not yet been implemented pending the ongoing CERCLA removal action process overseen by EPA. Consistent with the BFPPA, the DEQ ROD mandated action is expected to be implemented as part of this CERCLA removal action.

2.3 CURRENT USE AND REASONABLY ANTICIPATED FUTURE LAND USE

This section describes current use of the property and summarizes reasonably anticipated future land use (RAFLU). This discussion of land use provides the basis for assumptions used in the risk assessment, informs definition of removal action objectives, and will inform selection of the final remedy. A complete Reuse Assessment has been completed pursuant to EPA requirements and is included as Appendix A. This section summarizes the most important elements of the Reuse Assessment.

2.3.1 Current Use

The site is currently vacant and is not being used. UP controls the site and has fenced it and implemented erosion controls to minimize access and exposure to the site soils pending completion of the EE/CA and removal actions. The site was historically zoned for Heavy Industrial (IH) use. In January 2009, the zoning was changed to General Employment 2 (EG2) to accommodate

UP's future anticipated use of the site. Adjacent properties to the north/northwest, east/northeast, and east/southeast of the site are zoned IH, Residential 5,000 (R5), and Residential 2,000 (R2), respectively. The site is bounded to the northwest by the former McCormick & Baxter Creosoting Company CERCLA site, to the east/northeast by Waud Bluff and residential properties, to the east/southeast by the main UP campus and residential properties, and to the south/southwest by the Willamette River.

Chevron currently holds an easement for an underground petroleum fuel line that runs across the southeastern portion of the site. No other institutional controls, including easements and covenants, are known to be currently in place on the site. Engineering controls currently in place at the site include a chain-link fence surrounding the site; security lights installed along the railroad on the eastern portion of the site; and stormwater/erosion control best-management practices (BMPs), including sediment fencing, straw wattles, and plastic sheeting over stockpiles of fill material. The site currently has no stormwater catchbasins or outfalls. All precipitation falling on the site is allowed to infiltrate. UP plans to retain stormwater on site. The site development is not planned as heavy development and stormwater for at least the initial phases of site development will be allowed to infiltrate.

2.3.2 Reasonably Anticipated Future Land Use

UP plans to redevelop the site for use as part of the larger UP campus. A schematic layout of the anticipated future redevelopment is presented in Figure 4, which is based largely on a land-use analysis prepared by UP (UP, 2008). It is our understanding that the entire site will be redeveloped to some extent, with activities ranging from landscaping and greenway restoration to construction of new buildings, parking areas, and ballfields. The final River Campus Plan needs to be approved by the City of Portland through a formal planning process. Therefore, ultimate development of the River Campus could change from the current concept described in this report. In addition, construction timing will depend on UP's financial capacity to expand the campus.

The current UP redevelopment plans include construction of the following facilities:

- A new environmental learning center building encompassing a large portion of Area 5A;
- Paved parking areas associated with the environmental learning center covering most of the remaining portions of Area 5A;
- Physical plant/shop/office building and physical plant vehicle parking shed in Area 1B;
- Print shop and storage facility building in Area 1A;
- Tennis facility building in Areas 6D1 and 6D3;

- Event ticket building in Area 6D2;
- A new crew house building in Area 4 and/or RS-3;
- New baseball stadium over portions of Areas 6D2, 6D3, 6A, 6B, and 5B, and a new baseball practice facility in Area 5B;
- Recreational softball fields; and
- A pedestrian trail running generally along the current shoreline.

UP intends to demolish the existing baseball stadium located on the upper campus to accommodate several major new developments on its upper Bluff campus (library expansion in 2012 and a new Recreation/Wellness Center groundbreaking in 2013). UP also plans to construct a new sports practice field with associated paved parking areas on the southern end of the River Campus beginning in spring 2012. In addition, UP has begun discussions with its Athletic Department administrators to finalize plans to begin construction in the summer of 2012 of a new NCAA Division-1 baseball field in the northwest quadrant of the River Campus. The field will be enhanced with lighting, outfield fences, batting facility, team dugouts, temporary bleacher seating, and adjacent paved parking lots. UP hopes to have the new baseball field and other amenities ready to host practices and games by the summer of 2013. Construction of a new baseball stadium with permanent seating will follow in 2 to 3 years depending on the availability of funds.

Development of the proposed City of Portland pedestrian trail will depend on final decisions regarding habitat restoration along the shoreline. Habitat restoration is separate from the removal action process or the BFPPA, but may be implemented at the same time as the removal action work. Any habitat restoration must be approved and coordinated with other agencies, including the Trustees for the Portland Harbor NPL-listed Superfund Site.

To reiterate, the zoning designation for the site has recently been changed from heavy industrial general employment to accommodate UP's future use of the site. The site will no longer be used for industrial purposes. UP does not intend to use the site for residential purposes or daycare facilities.

2.3.3 Recontamination Potential

Under Oregon law, it is necessary to evaluate the potential for recontamination of the site after the removal action is completed. Recontamination can occur through the inadvertent spreading of remaining contaminated soil or via migration of contaminated groundwater. As UP intends to develop the River Campus site for use as part of the planned larger campus, the risk for recontamination due to future activities at the site is low. This EE/CA will evaluate the risk of exposure to site contaminants. The identified environmental risks to human health and the environment will be

addressed through removal actions developed in this EE/CA. The removal actions must be designed to eliminate the potential for recontamination.

The DEQ ROD assumed that final cleanup actions on the site would include institutional controls, capping of contaminated soils, excavation and reuse of slightly contaminated soils, removal (excavation and off-site disposal) of contaminated soils, or a combination of these actions. These removal action technologies are assessed in this EE/CA along with other potentially applicable technologies. These removal actions should prevent recontamination and are considered appropriate options because:

- Surface material remaining at the property would not contain residual concentrations of contaminants at concentrations greater than cleanup levels (i.e., any residual contamination will be capped or will be present at sufficient depth that it will not be exposed to potential wind or surface water runoff, and/or institutional controls will be in place that limit site use).
- The most highly impacted soil would be excavated, and would therefore not pose the potential for recontamination of soil or groundwater.
- Institutional controls (e.g., restrictions on subgrade excavation and long-term operation, monitoring and maintenance plans) would be in place to ensure that site uses are consistent with the required actions. In addition information must be provided to future users regarding precautions that may need to be implemented to prevent recontamination and exposure to receptors. Actions such as caps must be adequately monitored and maintained.
- No upgradient contamination sources have been identified that pose a recontamination threat to the site.

Sections 4 through 6 develop and evaluate removal action options to address contamination on the site, including the potential for recontamination.

2.4 PREVIOUS INVESTIGATIONS

Environmental investigations have been conducted at the site since the 1980s to document areas affected by releases of hazardous substances from historical industrial activities. The locations of sampling points used during the various environmental investigations at the site are shown in Figure 3.

Riedel began investigations at the site in 1986 as part of facility closure under RCRA. This investigation identified PCB contamination in shallow soils and recommended removal of the upper 1 foot of soil over limited areas of the site. Site investigations continued in the 1990s, and included the following studies:

- A Phase I (GeoEngineers, 1992) and focused Phase II (EMCON, 1993) Environmental Site Assessment (ESA) identified the presence of PAHs, carcinogenic PAHs (cPAHs), and arsenic above screening levels in soil; PAHs/cPAHs and metals (antimony, beryllium, lead, and copper) in selected groundwater wells; and diesel in soils near locations where USTs had been removed.

- EMCON (1993 and 1995) documented the removal of USTs. Confirmation sampling indicated the presence of petroleum hydrocarbons in soil at concentrations greater than screening levels.

- A preliminary site assessment (DEQ, 1995) identified the following contaminants at concentrations of concern: arsenic, PCBs, petroleum hydrocarbons, cPAHs, and chlorinated hydrocarbons in soils, and metals (arsenic, antimony, beryllium, chromium, copper, lead, and nickel) and petroleum hydrocarbons in groundwater. The assessment also concluded that further investigation was necessary to better define the nature and extent of soil and groundwater contamination.

- A baseline sediment assessment (MFA, 1997) conducted on behalf of Triangle determined that shallow sediments adjacent to the site contained concentrations of copper, tributyltin, motor oil, and PAHs/cPAHs above screening levels. The sediment assessment noted that other potential sources of copper and PAHs/cPAHs had been identified during investigations of upstream and nearby sediments conducted for nearby facilities. This investigation satisfied Triangle's requirement under the 1997 PPA to perform limited baseline sediment sampling prior to being relieved of any Oregon State related off-site sediment liability.

- An RI was conducted from 1999 to 2002 (MFA, 2002a). DEQ approved the RI work plan in April 1999, and the initial field work for the RI was conducted in mid-1999. Phase II RI field work was conducted in spring 2000. During the RI field effort in June 1999, DEQ worked with MFA, Triangle's consultant, to collect approximately 20 grab groundwater samples. DEQ officially designated groundwater and sediments at site to be an Orphan project in March 2001, so Orphan funds could be used to pay for groundwater and sediment investigation and cleanup. MFA completed a *Beneficial Water Use Determination* (MFA, 2001a) and a *Land Use Assessment* (MFA, 2001b) for the site in December 2001. MFA submitted a human health risk assessment report in December 2002 (MFA, 2002b).

The findings of these investigations informed the FS conducted between 2002 and 2004 (MFA, 2002a, 2004a,b), which was overseen by the DEQ and concluded with a Record of Decision (DEQ, 2005). Based on the 1997 PPA between Triangle and the DEQ limiting Triangle's liability under Oregon law to soil, the RI/FS was conducted for soil only. The RI/FS concluded that much of the site is impacted with non-source-specific COCs in soil, resulting in widespread impacts at

relatively low concentrations. These COCs include PCBs, metals, volatile organic compounds (VOCs), PAHs/cPAHs, petroleum hydrocarbons, chlorinated phenolics, and dioxins/furans. In addition, several specific source areas were identified, referred to by the DEQ as hot spots. The RI/FS resulted in selection of remedial actions specified in the ROD and described more fully in Section 2.2.4. Most of the work outlined in the DEQ ROD has not yet been completed pending EPA's ongoing removal action process.

The EPA removal action process was initiated during preparation of the BFPPA for UP's purchase of the property. As part of developing the BFPPA, AMEC Earth & Environmental (AMEC E&E) performed a multi-increment sampling (MIS) investigation in 2006 on behalf of UP. The MIS investigation was conducted pursuant to a Settlement Agreement with EPA in order to thoroughly evaluate remaining site risks and evaluate what portions of the property may warrant additional removal actions (AMEC E&E, 2008). The MIS approach was selected in order to more fully characterize potential risk due to widespread impacts of the COCs found at low levels in the earlier studies.

The MIS approach evaluates contamination over a relatively wide area based on analysis of composite samples prepared from discrete samples collected over the entire site. Based on historical site use and data from previous investigations, the site was subdivided into 17 areas for MIS characterization: Areas 1A, 1B, 1C, 2A, 2B, 3A, 3B, 4, 5A, 5B, 6A, 6B, 6C, 6D, RS-1, RS-2, and RS-3 (Figure 3). Within each MIS area, 30 samples were collected via push boring at three depth intervals: 0-1 foot, 1-5 feet, and 5-10 feet bgs. For each depth interval within each sampling area, the 30 discrete samples were composited into a single sample and analyzed following the MIS method (Gerlach and Nocerino, 2003) to identify contaminants of concern for each depth interval within each area. The surface multi increment soil sampling (0-1 foot) was conducted to address three objectives:

- Obtain data on concentrations of COCs in soil;
- Use these data to evaluate the likely risk to human health and ecological receptors from direct contact with contaminated surface soil; and
- Evaluate the potential for contaminants in soils at the site to migrate via stormwater to adjacent river sediments at concentrations above acceptable risk levels for human and ecological receptors.

The objectives of the deeper multi-increment soil sampling (1-5 and 5-10 feet) were to:

- Obtain data on concentrations of COCs in soil, and
- Evaluate the risk of contaminants in soil leaching to groundwater that could migrate through the subsurface to the Willamette River.

AMEC conducted additional site characterization studies, including additional MIS sampling, as part of a *Data Gaps Investigation* in 2009 and 2010 (AMEC Geomatrix, 2010b). The purpose of the *Data Gaps Investigation* was to refine the understanding of the nature and extent of contamination with regard to:

- MIS Areas 2A, 3B, 6D, and RS-1, which were further subdivided and sampled based on the 2006 investigation (Figure 3);
- Discrete hot spots outside the areas of the further MIS investigations that may require removal action; and
- Groundwater downgradient of areas where elevated concentrations of COCs are present in soil.

Contaminants and contaminant classes detected in hotspots and in MIS samples within each sampling area are illustrated on Figure 5 and Figure 6, respectively.

During both the 2006 and the 2009/2010 MIS investigations, supplemental discrete soil/waste samples were also collected at the discretion of AMEC where visible contamination or waste material was observed. Any MIS sample with visible contamination was excluded from the MIS composite samples, and was instead analyzed separately as a discrete waste sample. Analytical results for these samples were used to identify additional potential hot spot source areas beyond those previously identified in the 2005 ROD. These potential hot spot areas are shown on Figure 5 and discussed in greater detail in Section 2.6.2 below.

Relevant data from investigations conducted at the site, including historical investigations, the AMEC E&E (2006) MIS investigation, and the AMEC Geomatrix (2010) Data Gaps Investigation, are presented in this document in support of the EE/CA removal action objectives and options. Results are summarized in Section 2.6.1, which describes the nature and extent of contamination at the site.

2.5 PREVIOUS CLEANUP ACTIVITIES

Cleanup activities have been implemented at the site in the past. In 1984, soil contaminated with PCBs was excavated from a location near North Bluff Street on the southeast edge of the site. A soil removal plan was approved by DEQ in December 1987, but no file information supports whether any cleanup ensued (DEQ, 2011). RCRA Closure certifications were accepted by DEQ on January 31, 1989. In March 1993, EMCON supervised the removal of two 8,000-gallon gasoline USTs from Area 2B and one 10,000-gallon diesel UST from Area 5A (EMCON, 1995). According to DEQ, additional cleanup activities completed at the site prior to UP's ownership include removal of waste storage tanks, waste drums, and some sandblast grit and miscellaneous debris from the site (supervised by

EMCON); removal of petroleum USTs from the Sakrete area of the site by Hahn & Associates; and backfilling of a sludge pond near the former Sakrete facility (DEQ, 2011).

In addition, as part of the BFPPA with EPA, UP implemented aboveground cleanup of the site in 2009. Cleanup included the following activities:

- Demolition of remaining buildings at the site;
- Removal of asbestos, lead-based paint, and PCB-containing light ballasts from these structures;
- Removal of remaining concrete building pads and foundations;
- Removal of an old aboveground oil storage tank and contaminated surface soil; and
- Removal of junk, trash, and weeds from the site.

Waste generated during 2009 demolition and cleanup activities was managed according to applicable standards and requirements. Recycling of the waste was maximized to the extent possible. General demolition wastes, including concrete, wood, and metal building materials, were sorted on site following building demolition. Metal building materials and debris (including concrete reinforcements) were transported off site to Bob's Metals and/or Greenway Recycling (both in Portland, Oregon) for recycling. Concrete rubble was crushed and stockpiled on site for possible future use as fill or grading material. Oil recovered from the cleanout of the former aboveground oil storage tank on site was transported to Thermo Fluids, Inc., in Portland, Oregon, for recycling. Other wastes generated during the storage tank cleanout and removal (including oil-stained concrete from the associated concrete containment area) were disposed of at Hillsboro Landfill in Hillsboro, Oregon. Additionally, treated wood pilings, demolition debris containing lead-based paint, and asbestos waste from the site were also disposed of at Hillsboro Landfill. PCB-containing light ballasts from the demolished structures were disposed of by Clean Harbors, Inc., in Clackamas, Oregon.

For security reasons, the site was also fenced as part of this action and lighting was installed. This work was completed consistent with a *Building Demolition Work Plan* (AMEC Geomatrix, 2009). A summary report documenting this activity was submitted to EPA in February 2010 (AMEC Geomatrix, 2010a).

2.6 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

This section describes the nature and extent of contamination remaining at the site based on the available analytical data from previous investigations, as described in Section 2.4. This section describes potential contamination at the site in three different contexts:

1. MIS Areas, broad areas of the site containing concentrations of COCs in soil that are relatively low but that potentially exceed risk-based action levels;
2. Discrete hot spots characterized independently from the MIS areas that may require removal action; and
3. Groundwater and the potential for further groundwater contamination due to soil impacts.

A summary of the distribution of major classes of COCs are presented in Figure 5 for each potential hot spot and in Figure 6 for each MIS investigation area.

2.6.1 MIS Areas

As noted in Section 2.4, MIS investigations were conducted to characterize potential risks arising due to widespread impacts of COCs at low levels identified in earlier studies. For the purposes of the MIS investigations, the site was subdivided into investigation units (subareas) based on information from previous investigations, site history, and anticipated contaminants (Figure 3). Analytical results from the various MIS investigations conducted at the site are presented in Tables 1 and 2. MIS investigations were conducted in 2006 and in 2009/2010 to further evaluate the nature and extent of widespread COCs present at the site. The COCs detected in the MIS areas typically have relatively low mobility in the environment compared to other pollutants.

In planning the MIS investigation, EPA recognized that the area of the site along the Willamette River shoreline presented a potential for migration of COCs directly into the river via stormwater runoff, wind erosion, and/or river bank erosion. For this reason, the river shoreline was further divided into units that extend from the edge of the river high water mark up the bank for a distance of approximately 50 to 100 feet. These units were assigned the identifier RS for river shoreline, followed by a sequential number (Areas RS-1, RS-2, and RS-3). The rest of the site was not considered to present an immediate risk for transport of contaminants to the river and are therefore referred to in this report as the Uplands Areas.

Results in this section are discussed separately for MIS areas in the Uplands Areas versus the river shoreline (RS) areas. These categories of areas are considered separately throughout this EE/CA because they represent different anticipated receptors and different potential exposure pathways/scenarios. RS areas pose a higher risk of COC migration directly to the river and river

sediments, potentially exposing ecological and human receptors. Different action levels based on different potential exposure scenarios therefore apply to the RS areas (see Section 3.3).

2.6.1.1 MIS Quality Assurance Sampling

For quality assurance (QA) purposes, the 2009/2010 MIS investigation included collection of a triplicate sample in one of the MIS areas. Area 2A1 was chosen as the location for collection of the triplicate sample, because this area presented the greatest likelihood for the presence of most or all of the COCs. The triplicate sample was collected from the 0-1 foot depth interval in Area 2A1. The triplicate composite MIS sample was collected using a sampling grid with a different random starting location than the primary and duplicate samples within this MIS unit. The triplicate sample was analyzed for lead, PAHs, PCBs, and several additional metals.

The data quality review for the 2009/2010 MIS investigation revealed that the relative standard deviations (RSDs) showed that the compositing procedure resulted in precise analytical results, except for analyses of several PAHs. The higher RSDs for these select PAH compounds may be attributed to the fact that PAH results from the primary, duplicate, and triplicate samples were reported from varying dilutions, as those results reported from analyses using the same dilution agreed well with each other. The RSD could not be calculated for several PAHs where at least two of the three results were less than 5 times the method reporting limit (MRL). Analyses for metals and PCBs, for which the primary, duplicate, and triplicate were all reported from an undiluted analysis, provide a more representative measure of RSD. All of the RSDs for these results were less than the project-specific control limit of 30 percent. Based on this information, it appears that the triplicate sampling procedures in Area 2A1 generally yielded precise results, and it is therefore assumed that the same would be true for other MIS units in which triplicate sampling was not performed.

2.6.1.2 MIS Results for Uplands Areas

Uplands areas of the site include Areas 1A, 1B, 1C, 2A, 2A1, 2B, 3A, 3B (subdivided into subareas 3B1, 3B2, 3B3, and 3B4 for assessment of PCBs), 4, 5A, 5B, 6A, 6B, 6C, and 6D (subdivided into subareas 6D1, 6D2, and 6D3 for assessment of tetrachlorodibenzo-p-dioxins [TCDDs or dioxins]). Analytical results for these areas are presented in Table 1. Major classes of COCs detected within each sampling area are summarized on Figure 5.

Based on past site investigation results and the 2009/2010 sampling effort (AMEC Geomatrix, 2010b), the following COCs or classes of COCs were detected in MIS uplands areas: hydrocarbons (diesel and heavy-oil range), PCBs (Aroclor 1248, 1254, and 1260), tributyltin, metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), PAHs [acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene, and pyrene], cPAHs [pentachlorophenol, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene,

indeno(1,2,3-cd)pyrene, and naphthalene], and dioxins. The RI and FS reports (MFA, 2002a, 2004b) found that many of these contaminants tended to be widely dispersed across the site at concentrations that were highly variable outside a few isolated source areas (hot spots) and generally characterized the concentrations as "low." As part of the BFPPA process, EPA determined that the MIS protocol was the best approach for sampling these areas to evaluate risks to human health and the environment posed by COCs that are widely dispersed and not linked to an identifiable source area.

Contaminants detected in the MIS results for upland areas were distributed as follows (Table 1).

- Hydrocarbons, including diesel range and motor oil range hydrocarbons, have been detected via MIS at low concentrations in all the upland MIS areas, to depths of up to 10 feet and to a maximum concentration of 340 milligrams per kilogram (mg/kg) diesel (Area 6A) and 470 mg/kg motor oil (Area 6C).

- PCBs have been detected via MIS in Areas 1C, 2A, 2A1, 2B, 3A, 3B (including subareas 3B1, 3B2, and 3B3), 5B, 6A, 6B, 6C, and 6D. Most areas contain PCBs at relatively low concentrations, with the highest concentrations in Area 3B. In Area 3B, the maximum concentration of total PCBs was measured at 643.9 micrograms per kilogram (µg/kg) in 2006, with values up to 360 µg/kg measured during additional sampling in 2009/2010. PCBs were not detected in samples deeper than the 0-1 foot sample except in Area 2A1 (to a maximum depth of 14 feet) and 6C (to a maximum depth of 5 feet). Concentrations of PCBs at these depths were 25 µg/kg or less.

- Tributyltin has been detected only in Area 6A at a concentration of 81 µg/kg.

- Metals have been detected in samples from all upland areas. Maximum detected concentrations of each metal are as follows: arsenic, 7.8 mg/kg in Area 2B; cadmium, 0.6 mg/kg in Area 2A; chromium, 28 mg/kg in Area 6C; copper, 86.5 mg/kg in Area 6C; lead, 201 mg/kg in Area 6A; nickel, 32.5 mg/kg in Area 1C, and zinc, 330 mg/kg in Area 6C.

- PAHs have been detected in samples from all upland areas except 1A and 3A. No cPAHs have been detected in Areas 4 and 5A. Most MIS samples contain concentrations of cPAH and other PAH compounds lower than 500 µg/kg and typically lower than 100 µg/kg. The highest concentrations of these compounds were detected in samples from the following upland areas.

  – **Area 1B:** The highest concentrations of PAHs in any upland MIS sample were detected in Area 1B. The cPAHs detected include benzo(a)pyrene (up to an estimated 2,100 µg/kg), benzo(a)anthracene (up to an estimated 2,100 µg/kg), benzo(b)flouranthene (up to an estimated1,600 µg/kg), and indeno(1,2,3-cd)pyrene (up to an estimated at 640 µg/kg). The highest concentrations were generally found in the sample from the depth range of 1-5 feet. Most non-carcinogenic PAH compounds analyzed have been detected in MIS samples from Area 1B, with maximum detected concentrations above 500 µg/kg and up to 11,000 µg/kg (phenanthrene in the sample

for depth range 1 to 5 feet). Concentrations of PAHs were also elevated, though at lower concentrations, in the samples for 0-1 foot and 5-10 feet.

  - **Area 2A:** The cPAH compound benzo(a)pyrene (560 µg/kg) was identified at elevated concentrations in the 0-1 foot sample interval. Concentrations of selected PAHs above 1,000 µg/kg have also been detected in shallow samples from Area 2A.

  - **Area 6A:** The cPAH compounds benzo(a)pyrene (710 µg/kg), benzo(a)anthracene (870 µg/kg), benzo(b)fluoroanthene (590 µg/kg), and others were detected at elevated concentrations in the 0-1 foot sample interval. Concentrations above 1,000 µg/kg have also been detected in shallow samples from Area 6A for other select PAH compounds, including flouranthene and pyrene.

- **Dioxins** have been detected in samples from Areas 4, 5A, 5B, 6B, 6C, and 6D (including subareas 6D1, 6D2 and 6D3). Concentrations of dioxins were generally below 10 picograms per gram (pg/g), except in shallow samples (0–1 foot) from Area 6D. Area 6D is located on the western edge of the site and borders the McCormick & Baxter CERCLA site that is a known source of dioxins. Area 6D was subdivided into three subareas (6D1, 6D2, and 6D3) during the MIS investigation in 2009/2010 for further assessment of dioxins. The maximum detected concentration of dioxins was measured at 49.8 pg/g in the shallow (0-1 foot) MIS sample from subarea 6D1.

One upland area (6A) was found to contain detectable concentrations of all six contaminant groups. Otherwise, a maximum of five contaminant groups was detected in any MIS upland area (Areas 6B, 6C and 6D). The lowest number of contaminant groups detected in any MIS area was two (Area 1A).

2.6.1.3 MIS Results for River Shoreline Areas

This section describes conditions in areas located directly adjacent to the river referred to as the river shoreline areas or RS areas. This discussion includes results from the most recent MIS sampling work conducted in 2009/2010 (AMEC Geomatrix, 2010b). As shown on Figure 3, river shoreline areas of the site include Areas RS-1 (further subdivided into Areas RS-1a, RS-1b, RS-1c, and RS-1d for assessment of dioxins), RS-2, and RS-3. Contaminated soils in these areas present a greater potential for migration of COCs into the Willamette River and to contaminate sediments due to their proximity to the river and to impact ecological receptors. Table 2 summarizes the analytical data discussed in this section.

Based on historical results and the 2010 Data Gaps sampling effort (AMEC Geomatrix, 2010b), samples from areas adjacent to the river contained detectable concentrations of the following compounds and contaminant groups: diesel range hydrocarbons, heavy-oil range hydrocarbons, PCBs, tributyltin, metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), PAHs, and dioxins. Contaminants detected in areas abutting the river were distributed as follows (Table 2).

- **Hydrocarbons**, including diesel range and motor oil range hydrocarbons, have been detected in MIS samples from all RS areas, to depths of up to 10 feet. The maximum concentrations were 91 mg/kg diesel and 370 mg/kg motor oil in Area RS-1.

- **PCBs** have been detected via MIS in all three areas, with detected concentrations of total PCBs ranging from 28 to 192 µg/kg. The maximum concentration of total PCBs was 192 µg/kg in the 0-1 foot sample from Area RS-2. The only detections of PCBs below the 0-1 foot interval were measured in samples from Area RS-1, where the 1-5 foot and 5-10 foot samples contained concentrations of PCBs of 68 and 69 mg/kg, respectively.

- **Tributyltin** has been detected in Areas RS-1 and RS-2 to depths up to 10 feet. All detected concentrations were below 15 µg/kg, except in the 5-10 foot sample from Area RS-2, which contained the maximum concentration of tributyltin among all MIS samples adjacent to the river at 26 µg/kg. In both areas, the highest concentration of tributyltin was detected in the 5-10 foot interval.

- **Metals** have been detected in MIS samples from all areas adjacent to the river. The maximum detected concentrations of each metal are as follows: arsenic, 3.8 mg/kg in Area RS-1; cadmium, 0.3 mg/kg in Area RS-2; chromium, 15 mg/kg in Area RS-1 and Area RS-2; copper, 71.3 mg/kg in Area RS-1; lead, 37 mg/kg in Area RS-3; nickel, 24.2 mg/kg in Area RS-1, and zinc, 107 mg/kg in Area RS-1.

- **PAHs** have been detected in MIS samples from all areas adjacent to the river. The MIS samples from Area RS-1 contained the highest detected concentrations of these compounds, including the cPAHs benzo(a)anthracene (460 µg/kg), benzo(a)pyrene (520 µg/kg), indeno(1,2,3-cd)pyrene (210 µg/kg), and others. Concentrations of cPAHs increased with depth. In MIS samples from Areas RS-2 and RS-3, no PAH compound was detected at a concentration above 120 µg/kg, with most concentrations well below 100 µg/kg.

- **Dioxins** have been detected in MIS samples from all areas adjacent to the river. The highest concentrations of dioxins were detected in Area RS-1, which was subdivided into four subareas (RS-1A, RS-1B, RS-1C, and RS-1D) during the MIS investigation in 2009/2010 to further assess the nature and extent of dioxins. The maximum detected concentration of dioxins was 29.6 pg/g in the 0-1 foot MIS sample from subarea RS-1D. Concentrations of dioxins generally decline with depth.

MIS samples from Areas RS-1 and RS-2 were found to contain detectable concentrations of all six contaminant groups. Five contaminant groups were detected in Area RS-3.

2.6.2 "Hot Spot" Potential Removal Action Areas

Within the MIS areas, 34 smaller areas have been identified for potential removal action due to elevated concentrations of COCs detected by discrete sampling or based on visible evidence of potential contamination observed during demolition activities (Figure 5; Tables 3-5). Six areas were identified in the DEQ's 2005 ROD as hotspot areas planned for excavation. Seventeen areas were identified in the DEQ ROD as hotspot areas planned for capping. An additional 11 potential hotspot areas were identified and characterized as part of the UP CERCLA Removal Action investigations. In order to evaluate the nature and extent of hot spots, analytical results for discrete samples collected during historical investigations were reviewed. Discrete "waste" samples were collected during the 2006 and 2010 MIS investigations, as described in Section 2.4, in order to further characterize the nature and extent of the potential hot spots. The general locations of these hot spot areas are shown on Figure 5. Analytical results for these potential hot spot areas are presented in Tables 3–5 and further described in the following subsections.

2.6.2.1 Hot Spots Identified in the 2005 DEQ ROD

The 2005 ROD identified six hot spot areas for excavation and removal of the affected soil. The locations of these areas are shown on Figure 5. These areas are deemed to require active response based on the ROD that requires excavation of each of these areas.

- **Area A2-1:** Area A2-1 was proposed for excavation in the DEQ ROD based on elevated concentrations of diesel, motor oil, and PAHs, identified during historical investigations (Table 3). This localized hot spot is located largely within Area 2B, but extends slightly into Area 2A (Figure 5). A soil sample collected at a depth of 1.3 feet below ground surface in Area A2-1 showed a diesel concentration of 26,000 mg/kg, compared to a commercial risk-based concentration (RBC) cleanup level of 23,000 mg/kg. The originally proposed excavation Area A2-1 was revised to encompass the area of former sample location WS-2A-16 (Area 2A), where diesel and motor oil were detected at concentrations above residential RBCs, but below the commercial RBCs. The eastward extent of the excavation area was established during the 2009/2010 data gaps investigation that revealed no elevated concentrations of diesel/heavy oil at location RC-4 (AMEC Geomatrix, 2010b). The estimated extent of potential excavation at Area A2-1 is approximately 2,400 square feet from the contaminated surface to an average depth of 7 feet below ground surface.

- **Area A2-3:** Area A2-3 is an isolated lead hot spot within Area 2B (Figure 5). Samples from 1996 showed lead concentrations as high as 4,260 mg/kg (Table 3). The estimated extent of potential excavation for Area A2-3 is approximately 706 square feet of surface area excavated to a depth of 4 to 6 feet.

- **Area A5-11:** Area A5-11 is located within Area 5A (Figure 5). Elevated concentrations of PAHs, including benzo(a)pyrene at concentrations as high as 610,000 µg/kg, are present at depths of 5 feet and 8 feet bgs (Table 3). Selected PAH compounds are also present at elevated concentrations as deep as 11.5 feet, though the concentrations are several orders of magnitude lower at this depth than those seen at shallower depths. Nevertheless, concentrations of PAHs in these deeper soils are still in some cases more than an order of magnitude greater than the Oregon cleanup level. Based on these findings, the hot spot represented by Area A5-11 is estimated to be approximately 1,100 square feet in area and 12-14 feet deep. Area A5-11 has been extended to the south from its original boundary described in the DEQ ROD, because results from RC-5, collected in 2009, indicate that contamination extends at least as far as sample location RC-5 (AMEC Geomatrix, 2010b).

- **Area A5-12A/B:** Area A5-12A/B (Figure 5) contains elevated concentrations of PCBs, diesel, and arsenic. This potential excavation area is located within 50 feet of the river in Area 5A, but extends into Area RS-2 and a small portion of Area 5B. Samples collected at a depth of 0.5 foot showed total PCB concentrations of up to 1,300 µg/kg, which is above both the Joint Source Control Strategy (JSCS) screening level values (SLVs) (EPA/DEQ, 2007) and EPA Regional Screening Levels (RSLs) (EPA, 2011a) (Table 3). The area of elevated PCB concentrations is estimated to be approximately 6,500 square feet and 1 to 2 feet deep. In this area, arsenic was also found at elevated concentrations in deep samples (depths of 12 and 14 feet bgs); however the actionable level identified in the DEQ ROD for arsenic is 160 mg/kg. Therefore the depth of removal was established based on the PCB concentrations.

- **Area A5-13**: Area A5-13 (located in Area RS-2; Figure 5) was proposed for excavation by DEQ in the ROD based on elevated PCB concentrations (Table 3). Samples collected at 0.5 feet bgs contained elevated concentrations of PCBs (total PCBs at a concentration of up to 2,400 µg/kg, compared to a JSCS SLV of 0.39 µg/kg). Samples collected at and below 2 feet of depth in this subarea did not contain detectable concentrations of PCBs. This potential excavation area is estimated to be approximately 500 square feet in area and 1 foot to 2 feet deep, based on results from discrete samples.

- **Area A4-5:** Area A4-5 is located in Area RS-3 (Figure 5). Analytical results showed a PCB concentration of 5,020 µg/kg for the sample collected at a depth of 5 feet at GP-73, which is well above the JSCS SLV, and low-level PAHs in the samples collected at a depth of 4 feet at GP-149 and 6 feet at DP-A4-17 (Table 3). The PAHs were deemed a concern due to this area's proximity to the river.

2.6.2.2 Defining Additional Hotspots

Oregon Administrative Rules (OAR) 340-122-0115 define *hot spots of contamination*:

> For media other than groundwater or surface water, (e.g., contaminated soil, debris, sediments, and sludges; drummed wastes; "pools" of dense, non-aqueous phase liquids submerged beneath groundwater or in fractured bedrock; and non-aqueous phase liquids floating on groundwater), if hazardous substances present a risk to human health or the environment exceeding the acceptable risk level, the extent to which the hazardous

substances: (A) Are present in concentrations exceeding risk-based concentrations corresponding to: (i) 100 times the acceptable risk level for human exposure to each individual carcinogen; (ii) 10 times the acceptable risk level for human exposure to each individual noncarcinogen; or (iii) 10 times the acceptable risk level for exposure of individual ecological receptors or populations of ecological receptors to each individual hazardous substance. (B) Are reasonably likely to migrate to such an extent that the conditions specified in subsection (a) or paragraphs (b)(A) or (b)(C) would be created; or (C) Are not reliably containable, as determined in the feasibility study. OAR 340-122-0115

Hot spots were identified by DEQ and in the RI/FS based on the presence of COCs at concentrations significantly elevated compared to other areas on site. Samples from each potential hot spot generally contain COCs at concentrations at least an order of magnitude higher than the maximum concentrations of those COCs in MIS samples. The six hot spots identified in the 2005 ROD were evaluated as part of the removal action process under EPA, and the boundaries were extended if warranted by observed concentrations of COCs. Areas were also identified as potential removal action areas if significant staining or other evidence of contaminated material was observed. During the 2006 and 2010 MIS investigations, if samples were found that contained visual evidence of contamination, these samples were not included in the composited MIS samples. Instead a discrete sample was collected for analysis, and the results were evaluated to assess if a potential removal action was warranted for the area.

COCs vary from hot spot to hot spot and include mostly petroleum products, but also include PCBs, PAHs/cPAHs, dioxins, and metals. The hot spot areas generally represent the most impacted areas on the site and therefore present the highest risk to the environment. Some of these areas represent greater risk based upon the magnitude of COC concentrations, the mobility of the COC, location near the river bank, and/or the depth of the impacts (proximity to the surface representing a greater risk).

2.6.2.3 Potential Hotspot Areas Not Identified in the ROD

Potential hot spot areas are deemed to require active response actions if they meet the Oregon definition of a hot spot. If they do not, the areas are considered as part of the larger MIS areas they fall within and which were evaluated using the MIS methods and stream-lined risk evaluation. Summarized below is the status of the 11 additional potential hot spots not identified in the ROD:

- **Former Smokestack Area**: A potential hot spot was identified at the location of the former smokestack in Area 2A, where black ashlike material was discovered during demolition of the building in July 2009. The ashlike material was characterized and disposed of following sampling and laboratory analysis, but belowgrade excavation was not conducted (AMEC Geomatrix, 2010a). Several metals were detected in the sample, including beryllium at a concentration of 1.0 mg/kg, chromium at 25 mg/kg, copper at 59.2 mg/kg, lead at 75 mg/kg, mercury at 0.15 mg/kg, nickel at 53 mg/kg, and zinc at

153 mg/kg. These concentrations do not fit the Oregon state definition of a hot spot as they are not greater than 10 times the screening levels. The location where the ashlike material was found is shown on Figure 5. Since the concentrations of COCs in this area are also below actionable levels for the uplands, no further action is required of this area.

- **Area WS-3A-2A**: Diesel was detected at a concentration of 4,800 mg/kg in waste sample WS-3A-2A (located in Area 3A) collected in 2006 at the depth range of 9-10 feet (Figure 5; Table 4). Results for nearby sample GP-139, similarly showed diesel present at depth and not in shallow soils. All concentrations in both samples are below the commercial RBCs, although the concentration of diesel in the waste sample was slightly greater than the residential screening level. This area, therefore, is not considered a hotspot. Because MIS Area 3A does not exceed calculated residential risk criteria, but waste sample WS-3A-2A exceeded residential screening levels, a risk evaluation was conducted consistent with the methods described in more detail in Section 2.7 for Area WS-3A-2A to determine whether the area exceeds the residential risk threshold (Table 6). The results of the evaluation indicate that at depth (9-10 feet), Area WS-3A-2A exceeds uplands actionable levels, specifically a total residential risk of 1×10^{-5}, as well as an individual COC risk of 1×10^{-6} for diesel and benzo(a)pyrene. Although WS-3A-2a is not a hot spot, this area is actionable.

- **Stained Soil under Slab**: Stained soil was observed in Area 5A in 2009 following removal of a concrete slab incidental to the data gaps study. The area of observed stained soil measured approximately 15 to 20 feet in diameter. The location of the stained soil is shown in Figure 5. This area was identified as a hotspot for removal action based on the uncertainty of actual COC concentrations. Since this area is still considered a hot spot, excavation is assumed.

- **Area WS-6A-23**: Diesel at 3,600 mg/kg was detected in waste sample WS-6A-23 (located in Area 6A) in the depth range of 3 to 4 feet (Table 4). This concentration is below the DEQ commercial RBC screening level of 23,000 mg/kg and the residential RBC screening level of 3,900 mg/kg. Due to the low-level concentrations, this area is not considered a hot spot, and because concentrations are below the RBC screening levels, the area is not considered actionable. As a result no action is required to address this area.

- **Area WS-6A-8/9**: Waste samples WS-6A-8B, -8C, and -9A (located in Area 6A) showed elevated for diesel, motor oil, and selected PAH compounds over an area of approximately 1,600 square feet to a depth of 8 to 9 feet. All concentrations of COCs were well below the threshold level of 10 times commercial RBCs and industrial RSLs, except for the PAH compound benzo(a)pyrene, detected at a concentration of 1,400 µg/kg compared to an EPA industrial RSL of 210 µg/kg (6 times the RSL). Concentrations of several PAH compounds also exceed residential RSLs and RBCs. This area does not, however, meet the criteria of a hot spot area. This area will be included with Area 6A (which also exceeds industrial risk levels) in the evaluation of removal alternatives, and will be evaluated for the range of removal action options including capping, institutional controls, and excavation.

- **Area A6-14B**: Area A6-14B (located in Area 6C and Area RS-1; Figure 5) was originally identified as having concentrations of PAHs and PCBs above RBCs and RSLs. This subarea also extends into Areas RS-1d and RS-1c. Construction by EPA contractors in 2005 of a ramp to the Willamette River appears to have resulted in the removal of most, if not all, of the contaminated soil in the area of the ramp. Samples collected from the area of the former ramp by AMEC E&E in 2005 did not contain concentrations of PCBs above detection, or of PAHs above RBCs, RSLs, or JSCS SLVs (AMEC E&E, 2006c). Based on the current data, this area does not meet the criteria of a hot spot, and a removal action is therefore not required in this area.

- **Area WS-6D-8**: Discrete waste soil sample WS-6D-8, collected in Area 6D2 at a depth of 2 to 2.5 feet (Figure 5), contained concentrations of motor oil above the DEQ commercial RBC and diesel above the residential RBC (Table 4). The maximum concentration of motor oil of 24,000 mg/kg exceeds the DEQ commercial RBC screening level of 23,000 mg/kg by substantially less than an order of magnitude. Due to the relatively low exceedance, this area is not considered a hot spot based on the Oregon criteria. The calculated occupational/industrial risk for MIS Area 6D2 does not exceed the acceptable risk threshold, but concentrations of COCs in potential hot spot WS-6D-8 slightly exceed occupational/industrial screening levels. Therefore, a risk evaluation was conducted for Area WS-6D-8 to assess whether that area exceeds the occupational risk threshold (Table 6). The results of the evaluation indicate that potential hot spot WS-6D-8 does not exceed a total occupational risk of 1×10^{-5}, a HI of 1, or an individual COC risk of 1×10^{-6}. As in surrounding Area 6D2, the calculated risk for potential hot spot WS-6D-8 does not exceed the occupational risk threshold, but exceeds the residential risk threshold. Area WS-6D-8 will therefore be included as part of Area 6D2 in the evaluation of removal action options.

- **Area WS-6D-13/14**: Area WS-6D-13/14 is located in the vicinity of waste samples WS-6D-13A, -13B, and -14B in Area 6D (Figure 5). These samples showed concentrations of benzo[a]pyrene above the Oregon commercial RBC and EPA industrial RSL in an area of approximately 1,900 square feet at a depth of 4 to 5 feet. No contaminant was detected in these soils at concentrations greater than 10 times the commercial RBCs or industrial RSLs. This area is located in Area 6D. This area does not meet the criteria of a hot spot, and it will therefore be included as part of Area 6D1 (which is in exceedance for industrial risk) in the evaluation of removal action options.

- **Area WS-RS-1-24**: Waste sample WS-RS-1-24 (located in Areas RS-1a and RS-1b; Figure 5) contained concentrations of the PAH compounds indeno(1,2,3-cd)pyrene (150 µg/kg) above the JSCS SLV of 100 µg/kg, and benzo[a]pyrene (280 µg/kg) above the industrial RSL of 210 µg/kg (Table 5; Figure 7. Based on the relatively low concentrations identified, this area is not considered a hot spot but will be included as part of Areas RS-1a and RS-1B in the evaluation of removal action options.

- **Area A4-8:** Analytical results for hot spot A4-8 (Figure 7; Table 5) showed low-level PAHs, mostly below JSCS SLVs. This potential hot spot area, located in Area RS-3, is estimated to be approximately 650 square feet in area, and most contaminants with elevated concentrations are present at depth only, at approximately 5 to 14 feet bgs. Based on the relatively low concentrations identified, this area is not considered a hot spot but will be included as part of the evaluation of Area RS-3.

- **Area WS-RS-3-1:** Arsenic and lead were detected above Oregon commercial RBCs and EPA industrial RSLs in waste sample WS-RS-3-1, collected at a depth of 5 to 8 feet in Area RS-3 (Figure 5). Neither arsenic nor lead was detected at a concentration greater than 10 times the commercial RBCs or EPA industrial RSLs (Table 5). Area WS-RS-3-1 is not therefore considered a hot spot and will be included with Area RS-3 in the evaluation of removal action options.

In short the stained soil under the slab in Area 5A is the only additional identified location found to fit the definition of a *hot spot* based on occupational/industrial RSLs and RBCs, using the Oregon state definition (an area with concentrations of COCs 10 times greater than screening levels for non-carcinogens and 100 times greater than screening levels for carcinogens, or having COCs that are likely to be mobile). Specifically this stained soil area must be removed. In addition, Area WS-3A-2A was found to exceed uplands actionable levels based on residential exposure, and will therefore require a removal action. The remaining potential hot spot areas have concentrations of contaminants similar to the surrounding MIS area, and will therefore be considered for removal actions as part of the MIS area where they are located.

2.6.3 Groundwater

Groundwater sampling has been conducted during different stages of the site investigation at both monitoring wells and direct-push borings, as summarized in Table 7, and results are compared to various screening levels. Groundwater sampling locations and relevant data above screening levels are shown in Figure 7. Contaminants detected in groundwater at the site include PAHs, TPH (gasoline, diesel, and motor oil range), and metals (antimony, arsenic, beryllium, chromium, copper, lead, nickel, and zinc). Selected VOC compounds were also detected sporadically in groundwater samples, but no VOCs were detected consistently in groundwater samples from wells on site. The most recently collected groundwater samples (2009) support findings from earlier investigations that showed low-level concentrations of COCs in the shallow groundwater slightly above screening levels for select contaminants, including metals, PAHs, and TPH. Benzo(a)pyrene, arsenic and copper have been found to sporadically exceed MCLs over the various sampling events that have been conducted over the years.

Under the DEQ PPA with Triangle Park LLC, Triangle Park LLC was not liable for groundwater under state law. Groundwater is evaluated in this section in order to establish current groundwater conditions, particularly to establish whether soil on site is likely to impact groundwater in the future and whether monitoring of groundwater is necessary. The 2005 DEQ ROD indicates that if any new discovery of soil contamination is made, which may have a significant impact on groundwater, the DEQ will re-evaluate the selected remedy to determine whether it continues to meet criteria for site cleanup, but no groundwater response actions were found necessary.

The groundwater COC most consistently observed at the site at concentrations above screening levels is TPH, predominantly TPH-D and TPH-O. TPH-D has been measured at concentrations up to 26,000 µg/L, and TPH-O has been measured at concentrations up to 9,940 µg/L, compared to the screening level for both contaminants of 90 µg/L. Elevated concentrations of TPH do not necessarily appear to be directly adjacent to hot spots identified on site.

Concentrations of metals are below screening levels in groundwater monitoring wells in all areas except in samples collected from MIS Areas 1A, 6A, 6B, 6D, and in samples taken from scattered direct push borings from MIS Area 4. Groundwater samples from wells MW-1 and MW-2 in Area 1A were found to contain the most elevated concentrations of metals on site during sampling in 1993 (Figure 7). For the most part, concentrations of metals from groundwater samples from wells near the river are below screening levels, except in Area 6, where numerous metals were measured above screening levels. However, groundwater samples where these concentrations were measured were collected from direct-push borings, influenced by excessive sample turbidity, thereby artificially inflating metals concentrations. These results are therefore not considered representative of the aquifer conditions.

Concentrations of cPAHs measured in groundwater during previous investigations on site are typically below detection, or, where detected, very low. Benzo(a)pyrene is considered an indicator cPAH and is typically present where cPAHs/PAHs are found at the site. Concentrations of benzo(a)pyrene have typically been lower than the maximum contaminant level (MCL) of 0.2 µg/L in water samples collected at the site (Table 7). Elevated concentrations of cPAHs have been measured in only two samples: sample SB15-W [6 µg/kg benzo(a)pyrene], collected in 1993 in Area 2B, and sample SB1A-W-0923 [31 µg/kg benzo(a)pyrene], collected in 1993 in Area 5A (Figure 7). Sample SB15-W was collected in an area where an adjacent groundwater sample (RC-1) and downgradient sample (RC-3) collected in 2010 contained concentrations of cPAHs below the EPA RSL and mostly below the detection limit, suggesting no remaining impact is present in this area. Sample SB1A-W-0923 was collected immediately adjacent to and downgradient of hotspot A5-11, the hot spot with the highest measured concentrations of cPAHs at the site. These elevated concentrations of cPAHs are likely related directly to the hot spot and are expected to decline following excavation and removal of the highly affected soils.

Scattered detections of VOCs in groundwater at concentrations above the applicable screening levels have been documented during historic sampling. These VOCs include 1,1-dichlorethane, benzene, carbon disulfide, naphthalene, tetrachloroethene, and vinyl chloride. Most of these analytes were present above screening levels in single individual samples over the history of groundwater sampling on site and were not found to exceed screening levels in prior or following sampling events. 1,1-Dichlorethene was detected above screening levels in only two samples, and vinyl chloride in

three samples over the many sampling events conducted. Analysis of groundwater quality and consideration of potential actions in the EE/CA focus primarily on potential future impacts to groundwater due to residual contaminants in soil at the site.

DEQ's 2005 ROD concluded that although some impact to shallow groundwater is present on site, residual soil contamination remaining on site following soil cleanup is not expected to significantly impact groundwater in the future. This conclusion was based on evaluations of the potential for contaminants present in soil to leach into groundwater conducted as part of historical investigations. These investigations used a weight-of-evidence approach that considered depth of soil where COCs were detected, concentrations of COCs in soil, and observed concentrations of COCs in groundwater downgradient of known soil hot spots. These investigations also included assessment of the vertical distribution of contaminants. Recent results from MIS sampling support earlier findings that show that most of the COCs that exist at the site are present in near-surface and shallow soils, with concentrations decreasing with depth. Typically, contaminant concentrations in soil decrease to low or nondetectable levels at depths above the water table (9-25 feet bgs) (AMEC Geomatrix, 2010b).

MFA (2004b) concluded that available data lent no support to the potential for leaching of COCs from soil to groundwater. That assessment was done by:

- Comparing concentrations of COCs in soil to screening levels using a dilution-attenuation factor of 20 to account for natural processes that lower contaminant concentrations in soil; and
- Comparing dissolved concentrations of COCs in groundwater to screening levels protective of aquatic life.

More recently, analytical results of MIS soil samples show that given a dilution factor of 20, only benzo(a)pyrene and dioxins are potential candidates to evaluate for potential future leaching into shallow groundwater. Both of these contaminant groups have low solubility and a high affinity to adsorb to soil and are, therefore, unlikely to be mobile and reach surface water via groundwater transport (see Section 2.6.4).

In order to further assess risk to groundwater from soil, concentrations of contaminants in MIS samples were compared to EPA soil screening levels (SSLs) protective of groundwater (Tables 1 and 2). Of the contaminants detected at the site, concentrations of the following compounds exceeded these screening levels in at least one MIS sample: Aroclor 1254, Aroclor 1260, arsenic, and all cPAHs for which SSLs are established. Exceedances of the SSLs for the PCB congeners were nominal, at much less than an order of magnitude, except in Area 3B, where Aroclor 1254 reached a maximum value of 150 µg/kg (the SSL of 8.8 µg/kg). Concentrations of Aroclor 1260 reached a maximum value of 490 µg/kg compared to the SSL of 8.8 µg/kg. Because the mobility

of PCBs tends to be extremely low, it is unlikely that these compounds will contribute to groundwater contamination (see Section 2.6.4.2).

Arsenic exceeds natural background concentrations in only one MIS sample (7.8 µg/kg in the sample from 0 to 1 foot in MIS Area 2B compared to a natural background concentration of 7 µg/kg [see Section 2.7.4]). Arsenic in soil in the MIS areas is therefore unlikely to affect groundwater at the site.

Concentrations of cPAHs in MIS soil samples significantly exceed SSLs based on protection of groundwater. The maximum exceedance is of benzo(a)pyrene in Area 1B, at a concentration of 2,100 µg/kg compared to the SSL of 3.5 µg/kg. However, an empirical evaluation of groundwater indicates that these concentrations of cPAHs in MIS areas are unlikely to impact site groundwater. Concentrations of cPAHs measured in groundwater during previous investigations at the site are typically below detection, or, where detected, very low, with concentrations of benzo(a)pyrene typically lower than 0.2 µg/L (Table 7). Elevated concentrations of cPAHs have been measured in only two samples: sample SB15-W [6 µg/L benzo(a)pyrene], collected in 1993 in Area 2B, and sample SB1A-W-0923 [31 µg/L benzo(a)pyrene], collected in 1993 in Area 5A (Figure 7). Sample SB15-W was collected in an area where an adjacent groundwater sample (RC-3) collected in 2010 contained concentrations of cPAHs below detection, suggesting no remaining impact is present in this area. Sample SB1A-W-0923 was collected immediately adjacent to and downgradient of hot spot A5-11, the hot spot with the highest measured concentrations of cPAHs at the site. The elevated concentrations of cPAHs in this are likely related directly to the hot spot and are expected to decline following excavation and removal of the highly affected soils. Based on these considerations and the earlier risk analysis (MFA and EMS, 2004), cPAHs remaining in soils at the site following removal actions are not anticipated to impact groundwater.

Eight monitoring wells, MW-1 through MW-8, are located near the waterfront, as shown in Figure 3. These monitoring wells are available to monitor concentrations of contaminants over time in groundwater that may flow into the Willamette River.

2.6.4 Physical and Chemical Attributes of COCs

The mobility and persistence of the COCs identified in soil and groundwater at the site are discussed in this section. These characteristics can be inferred from the physical properties of each compound.

2.6.4.1 Petroleum Hydrocarbons

Petroleum hydrocarbons are a complex mixture of hundreds of chemicals, each with individual fate and transport characteristics (Potter and Simmons, 1998). Gasoline, diesel, and motor-oil range hydrocarbons have been detected at the site. Gasoline-range petroleum hydrocarbons are typically

fairly mobile within the environment, while diesel and motor oil range hydrocarbons are typically less mobile. Solubility and volatility of all compounds generally decrease with increased molecular weight, and the more volatile and water soluble compounds are lost most rapidly from source areas.

Degradation and biodegradation of petroleum hydrocarbons have been documented for numerous sites under a wide variety of geochemical conditions, indicating these processes are likely to occur at most sites (Wiedemeier et al., 1999). When a mixture of petroleum hydrocarbons is released into the environment, the composition changes with time due to natural attenuation processes often referred to as *weathering*. The type and degree of weathering depend on the initial composition of the petroleum mixture and on site-specific environmental conditions, because different types of hydrocarbons weather differently under different conditions. Petroleum compounds are also degraded readily in the subsurface by naturally occurring microbes under a wide variety of conditions. While petroleum compounds are typically degraded more quickly under aerobic conditions, anaerobic degradation can be equally effective at attenuating the concentrations of petroleum compounds. Because petroleum contains a complex and variable mixture of hydrocarbon compounds, all of which eventually break down to carbon dioxide and water, or to methane (depending on the degradation environment), the breakdown processes produce no telltale daughter products that can be used as evidence that petroleum biodegradation is occurring.

2.6.4.2 PCBs

PCBs, marketed under the name Aroclor until commercial production in the United States was stopped in 1977, are mixtures of different congeners of chlorinated biphenyl. The PCB compounds Aroclor 1242, 1254, and 1260 have been detected at the site. The relative importance of various environmental fate mechanisms generally depends on the degree of chlorination (HSDB, 2011). In general, the persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di-, and trichlorinated biphenyls (Aroclor 1221 and 1232) biodegrade relatively rapidly; tetrachlorinated biphenyls (Aroclors 1016, 1242 and 1248) biodegrade slowly; and higher order chlorinated biphenyls (Aroclors 1254 and 1260) are resistant to biodegradation. Biodegradation of higher order chlorinated congeners may occur very slowly due to natural environmental processes, but no other degradation mechanisms have been shown to be important in natural water and soil systems. If released to soil, PCBs adsorb strongly to soil particles with adsorption generally increasing with the degree of chlorination of the PCB congener.

2.6.4.3 Tributyltin

Compounds containing tributyltin are typically used as pest control products, often on wood as part of paint formulations, and may be released to the environment from anthropogenic sources (United Nations Environment Programme, 2006). Tributyltin compounds include tributyltin oxide, tributyltin benzoate, tributyltin chloride, tributyltin fluoride, tributyltin linoleate, tributyltin methacrylate, and

tributyltin naphthenate. Tributyltin was detected in soil samples collected at the site. When released to soil, tributyltin is expected to bind strongly to soil and be immobile (HSDB, 2011). Tributyltin is susceptible to biodegradation and is reported to have a half-life in soil of 15 to 20 weeks. Tributyltin on the soil surface may also slowly photodegrade but will not volatilize from near-surface soil.

2.6.4.4 Metals

Metals are found naturally in the environment at varying concentrations and may also be introduced to the environment via anthropogenic releases. Arsenic, cadmium, chromium, copper, lead, nickel, and zinc have been detected in soils at the site.

A number of physical, chemical, and biological processes influence the concentrations of metals in an aqueous system. These processes include chemical speciation, hydrolysis, volatilization, sorption, bioaccumulation, and biodegradation. The mobility of each metal in soil and groundwater is dependent upon a number of factors, including soil organic matter content and geochemical conditions, such as pH and redox conditions. Each metal behaves differently in a particular environment due to its unique chemical nature. Evaluation of the mobility of metals is especially difficult given their ability to form ions and interact with water, minerals, biota, and organic materials.

2.6.4.5 PAHs and cPAHs

PAHs occur in the environment both naturally and as a result of anthropogenic releases, including releases of petroleum products and as by-products of partial combustion (HSDB, 2011). A number of PAH compounds, including acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, flouranthene, flourene, phenanthrene, and pyrene, and carcinogenic PAHs (cPAHs), including pentachlorophenol, benzo(a)pyrene, benzo(b)flouranthene, benzo(k)flouranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene, were detected at the site.

With the exception of naphthalene, PAHs are typically fairly immobile in the environment because of their low water solubilities, low volatilization potential, and strong tendencies to adsorb to soil. Biodegradation is the primary natural mechanism of reduction of PAH concentrations in soil. PAH half-lives on the order of 0.5 to 1 year are typically reported (HSDB, 2011). Naphthalene is similar to benzene in mobility and also readily biodegradable.

Biodegradation is likely to reduce PAH concentrations over time, and strong adsorption of PAH compounds to soil is likely to prevent leaching of PAHs to groundwater in the future. PAHs have not been detected consistently in groundwater at the site and are generally at low concentrations where detected except immediately downgradient of PAH/cPAH hotspots, confirming the limited groundwater impacts and the low mobility of these compounds.

2.6.4.6 Dioxins

Polychlorinated dibenzo-p-dioxins, often referred to as dioxins, occur as 75 different isomers, with 22 possible isomers of tetrachlorodibenzo-p-dioxin. The mixture of these 22 isomers is referred to as dioxins. Dioxins are found in emissions from combustion, including the incineration of wood and other wastes, and as a by-product of industrial processes (HSDB, 2011). Dioxins have been detected at the site.

Dioxins are expected to adsorb strongly to soils and sediment and be immobile (HSDB, 2011). Degradation and biodegradation processes are slow, with the half-life of dioxin isomers in subsurface soil ranging from 25 to 100 years.

2.7 STREAMLINED RISK EVALUATION

A streamlined risk evaluation (SRE) is part of the site characterization process. The SRE is based on a conceptual site model (CSM) for the site that is presented in this section. The CSM combines the hydrogeologic conceptual model for the site with an analysis of contaminant migration pathways and potential receptors. The scope of the SRE is between that of the limited risk evaluation conducted for emergency removals and that of the baseline risk assessment conducted for remedial actions.

The following guidance was used to complete the SRE.

- Guidance on Conducting Non-Time-Critical Removals Under CERCLA (EPA, 1993);
- Streamlined Site Characterization Approach for Early Actions and Impact on Risk Assessment Data Requirements (DOE, 1994); and
- Non-Time-Critical Removal Risk Evaluation (EPA, 1997).

The SRE presented here focuses on existing or imminent threats to human health or the environment that the removal action is designed to address. This section describes the contaminant sources and exposure mechanisms at the site and then presents human health and ecological risk evaluations. This section evaluates the risk in light of those conditions. A more thorough discussion of the COCs present and their distribution is presented in Section 2.6.

2.7.1 Conceptual Site Model

The conceptual site model combines a hydrogeologic conceptual model with contaminant migration pathways and analysis of potential receptors. The CSM identifies human and environmental receptors based on land use and activities at and near the site, and characterizes the nature of their contact with impacted media at and near the site. If a receptor has the potential to contact impacted media, a potentially complete exposure pathway is considered to exist. Separate pathways are included in the CSM for human health and ecological receptors that may have complete pathways

linked to these releases. A block diagram visually depicting the CSM is presented in Figure 8. The block diagram illustrates the current understanding of the potential sources and releases of contaminants, generalized hydrogeologic pathways, and contaminant distribution and transport at the site.

The CSM shown in Figure 8 is based on assumed future land use as part of the University and its location bordering the Willamette River (see Section 2.3.2).

2.7.1.1 Sources

Releases of hazardous contaminants have occurred at the site historically as a result of long-term industrial use of the site and the import of potentially impacted fill materials, primarily affecting shallow soils. The nature and distribution of these COCs is well characterized from previous investigations. Impacts have been observed in soil and groundwater, with soil generally impacted with widespread but low concentration of COCs. A number of hotspot areas have also been identified that represent historical source areas containing higher concentrations of COCs, particularly hydrocarbons and PAHs.

Contaminants in soil could migrate through the unsaturated zone soils and into the underlying groundwater. However, potential migration of COCs from soil to groundwater is expected only in hot spots, where higher concentrations of contaminants have been measured. Site characterization has shown that the majority of COCs present at the site are at concentrations too low to be likely to impact groundwater, or the COCs are relatively immobile in the subsurface (Section 2.6.4). With the exception of VOCs in a few of the hot spot areas, COCs on the site (metals, PCBs, dioxins, and PAHs) have very low mobility in the subsurface.

2.7.1.2 Transport and Exposure Mechanisms

Contaminants in soil may leach into groundwater due to infiltration of precipitation into impacted soil. COCs in surface soil may also mobilize in fugitive dust in areas of the site that are not vegetated or capped (such as with a layer of clean soil, a building, or pavement). COCs in groundwater may have the potential to migrate to surface water (the Willamette River). The more volatile COCs could potentially volatilize from soil or groundwater into soil gas, which could migrate to ambient air. Based on the extensive characterization of the site, volatile contaminants are present only in a couple of the hot spot areas. For the remainder of the site the potential for soil vapors to migrate to outdoor or indoor air is negligible. Groundwater at the site is not a current source of drinking water. However, drinking water is a potential beneficial use of groundwater. In addition, shallow groundwater could migrate downward to deeper water-bearing zones, which could potentially be used as a drinking water source. Drinking groundwater is therefore a potential exposure mechanism. Since groundwater discharges to the Willamette River, exposure of ecological receptors to surface water will be

considered a potentially complete pathway. The soil and groundwater data collected during the data gaps investigation (AMEC Geomatrix, 2010b) and historical investigations support the conclusion that the risk of COC migration from soil to groundwater is considered low, except possibly for groundwater immediately downgradient of the more impacted hot spot areas. The removal action in these hot spot areas needs to address potential migration of COCs via groundwater. For the remainder of the site, soil is not expected to produce impacts to groundwater at levels of concern for surface water or drinking water, as discussed in Section 2.6.3 above.

Potential receptors and pathways, human and ecological, differ for different areas of the site. Contaminants in RS areas have a greater potential to migrate to the Willamette River via stormwater runoff, wind erosion, and/or river bank erosion. Exposure for the RS areas is therefore anticipated to be greater for both human and ecological receptors. Potential receptors and exposure pathways are evaluated in the following sections.

2.7.2 Human Health Assessment

Figure 8 summarizes the potential human receptors and complete exposure pathways. Based on the CSM presented in Section 2.7.1, the following exposure pathways and receptors are considered complete or potentially complete:

- Neighborhood residents/recreational users may be exposed to COCs in fugitive dust via inhalation or have direct contact with COCs in uncovered surface soil, resulting in exposure via dermal contact or incidental ingestion. The frequency of such visits is expected to be much lower than that of students and staff, and as well the duration of any visit would also be much less. However, neighbors living in the area could be visiting the site for many years. Assumptions used for the Portland Harbor Superfund site (Kennedy/Jenks Consultants, 2009) regarding recreational users are conservatively assumed for the River Campus property in this EE/CA, and such users are assumed to include both adults and children.

- Occupational users (university students, staff, etc.) would have similar risks as neighborhood residents and recreational users, but exposure frequency and duration would be expected to be higher as these groups could be regular users of the site. Student exposure would occur for a relatively short period, whereas UP staff could be exposed to COCs over the long term.

- Temporary construction workers, present at the site for short durations, may be exposed to COCs in surface and subsurface soil via direct contact while completing construction activities involving excavation, resulting in incidental ingestion, dermal contact, and/or inhalation of fugitive dust. These workers could also potentially have direct contact with shallow groundwater, resulting in incidental ingestion and/or dermal contact during excavation work, although the depth to groundwater is greater than most excavation work.

- Few permanent residents live on the campus and no residences are planned for the River Campus site. Students live in dorms on the upper portion of the campus for at most 4 to 6 years and generally for less than 9 months a year. The River Campus area (the site) is not planned for dorms or any other form of residential housing in the near term or long term.

2.7.3 Ecological Assessment

The site has been used for industrial purposes for many years and has remained mostly vacant for all practical purposes for the last decade. Most of the site has been cleared of vegetation, although low brush and similar vegetation occurs sporadically across the site and could serve as habitat for other plants and wildlife. The site is anticipated to be redeveloped as part of the UP campus, with the entire site, except along the river shoreline, being converted to building, parking lot, sports fields, or landscaped areas. UP may consider setting aside parts of Areas 2A and 3B as native white oak habitat consistent with discussions between UP and the City of Portland.

The Willamette River, bordering the site on the west, is used as a maritime shipping channel maintained by the US Army Corps of Engineers with a depth of approximately 40 feet (MFA, 2002a). The river provides habitat for ecological receptors, such as fish (including salmonids, sturgeon, and lamprey), aquatic invertebrates, aquatic mammals (including muskrats and otter), terrestrial mammals, and birds, including fish-eating species, such as herons, eagles, and osprey.

Figure 8 charts the potential ecological receptors and complete exposure pathways at the site. Complete or potentially complete ecological exposure pathways at the site comprise the following scenarios:

- Direct contact pathway - Small birds, rodents, and rabbits, terrestrial biota that live and feed at the site could be exposed to contaminants of concern through contact with, ingestion of, or inhalation of particulates from soil.
- Soil to Surface water pathway– Since impacted portions of the site border the Willamette River, aquatic biota can potentially ingest contaminants from the site that migrate to the river and/or to river sediments.

Both these pathways could result in food chain accumulation.

2.7.4 Summary of Calculated Risks

To aid in the determination of where a removal action is warranted, AMEC calculated total and individual COC risk for each MIS decision unit area. An occupational/industrial use scenario of the property and application of EPA's relevant Regional Screening Levels (RSLs) (EPA, 2011a) best represent anticipated long-term use of the property and risks that are likely to occur (Section 2.3) and is the same approach utilized by DEQ for the Triangle Park ROD. The site is not going to be

used by UP for residential use but will be used for specific campus activities as previously described above. The site may be used recreationally by both students, staff and neighborhood visitors but an occupational/industrial use scenario is considered more conservative as it assumes long term exposure to COCs by UP staff.

The method applied to calculate risk is consistent with EPA guidance and was based on formal comments and recommendations from EPA after their review of the draft EE/CA. The results of the calculations are provided in full in Table 8, and a summary is provided in Table 9.

The calculated values shown in Table 8 were completed using the existing MIS data applied to each decision unit. The decision units were defined for the entire MIS sampling interval from 0 to 10 ft. The calculations were performed via the following steps:

1. For each decision unit the highest concentrations of detected carcinogenic compounds for the various MIS sampling depths were divided by the carcinogenic EPA RSL (both residential and industrial values) (EPA, 2011a) and then multiplied by 1×10^{-6}. Those values were then summed to come up with a total carcinogenic risk value for the decision unit under residential and industrial scenarios and individual risk values for each COC. The results of these calculations are shown under the column headed *Risk* in Table 8.

2. For each decision unit, the highest detected concentrations of non-carcinogenic COCs for the various MIS sampling depths were divided by the non-carcinogenic EPA RSL (both residential and industrial values) (EPA, 2011a). Those values were then summed to come up with a total non-carcinogenic HI value for the decision unit under residential and industrial scenarios. These values are shown under the column headed *Hazard* in Tables 8.

3. The results from Steps 1 and 2 were compared to a total risk of 1×10^{-5} for carcinogenic compounds, a HI of 1 for non-carcinogenic compounds, and a risk of 1×10^{-6} for individual carcinogenic compounds based on the highest detected concentration of any individual COC. EPA generally considers a risk in the range between 1×10^{-6} and 1×10^{-4} to be acceptable and therefore not trigger a removal action (EPA, 1991); however for the River Campus property, a cumulative cancer risk of 1×10^{-5} and a HI of 1 may be applied by EPA based on Oregon law and rules. Oregon Administrative Rule 340-122 stipulates acceptable risks. Under OAR 340-122-0115, acceptable risks include “cumulative lifetime excess cancer risk for multiple carcinogens and multiple exposure pathways of less than or equal to one per one hundred thousand at an upper-bound exposure.” In addition, based on Oregon Law, the risk for each individual carcinogen may not exceed 1×10^{-6}. The results of these comparisons are summarized in Table 9.

4. The results of the risk calculations were evaluated to determine the main drivers for risk in each area. In some MIS areas, risk was driven entirely by arsenic and/or by compounds where the laboratory reporting limit exceeds EPA RSLs. At the River Campus property, arsenic concentrations generally range from 1 to 4 mg/kg, which is below the Portland Harbor area background concentration of 7 mg/kg. Since arsenic appears to be naturally occurring at the property and levels are below the Portland area background concentration,

arsenic concentrations should not be used as a driver for removal actions at this site. This approach is consistent with OAR 340-122, which indicates that in areas where concentrations of metals such as arsenic are above DEQ cleanup levels but below background levels, these metals should not be used to determine the need for cleanup. This rule indicates that the background level should be used as a standard for cleanup. Similarly, if concentrations of all COCs were below the limits of detection in an area, the area was not considered to require action.

Table 9 summarizes the results of the calculations from steps 1 through 4. Figure 9 summarizes these results for the property, and Figure 10 illustrates the results for each MIS decision unit area considered.

Using the methods described above, Areas 1B, 1C, 2A, 2A1, 2B, 3B (including all subareas), 5A, 5B, 6A, 6B, 6C, 6D (including subareas 6D1, 6D2, and 6D3), RS-1 (including subareas RS-1A, RS-1B, and RS-1C), RS-2, and RS-3 exceed either a cumulative cancer risk of 1×10^{-5} using residential RSLs, or a risk for an individual compound using residential RSLs of 1×10^{-6}. As noted above under step 4, in some decision units, risk exceeded the threshold values for residential risk, but the risk was driven only by arsenic concentrations and/or only by a laboratory detection limit exceeding RSLs for non-detected analytes.

Areas 1B, 2A, 6A, 6B, 6D, and RS-1 exceed a risk of 1×10^{-6} for an individual carcinogens using occupational RSLs or a cumulative cancer risk of 1×10^{-5} based on occupational RSLs. Only Area 1B exceeds a carcinogenic risk greater than 1×10^{-4}. Areas 1A, 3A, and 4 were found not to exceed threshold risk using either residential or occupational RSLs, except for Area 4 arsenic and compounds with elevated detection limits.

Use of risk evaluations in determining removal actions should consider the fact that the risk assessment process is based on many assumptions that can result in either an over or under-estimate of actual risks.

2.7.5 Summary of DEQ ROD Risk Assessment

The DEQ ROD assessed occupational/industrial human health and ecological risk. Unacceptable risk of greater than 1×10^{-4} was calculated for area AOC5 (Table 3 of the DEQ ROD). AOC5 encompasses Areas 5A, 5B, and RS-2 as defined in this EE/CA, and includes three of the ROD defined hot spots. The estimated risk at all other areas of the site evaluated as part of the DEQ ROD was less than 1×10^{-4}. Risk was primarily from metals and PAHs. The ROD also determined that there may be an unacceptable risk to avian and mammal populations due to lead, PAHs, PCBs, and dioxins. The results of the risk assessment performed as part of the work under the ROD were used to develop screening level values used for assessing hot spots that required action. Figure 5 shows the hot spots identified for action in the DEQ ROD, for both excavation and capping.

2.7.6 General Conclusions

Addressing the most direct pathways for human health and ecological exposure at the site will greatly reduce the risks posed by the COCs present at the site. The risk of exposure of human and/or ecological receptors at the site is summarized below for each of the three types of areas (see Figure 9):

1. **The MIS Upland Areas:** These areas represent relatively large areas of several acres, most of which have relatively low concentrations of COCs. The COCs in these areas include metals, PCBs, dioxins, and/or PAHs, which all have low mobility in the subsurface environment and present a minimal risk to groundwater and the river. The primary exposure pathways are direct contact and dust inhalation. Given the academic campus setting, these pathways present an exposure period that is much shorter in duration on both a daily basis and a long-term basis than residential exposure. As a result, the residential risk scenario is not considered applicable for this exposure pathway. Exposure of university workers and students is a more appropriate scenario to consider for evaluation of the human risk exposure.

2. **The MIS River Shoreline (RS) Areas along the Willamette River bank:** These long, narrow areas border the river and present a high potential risk for COCs present in these areas over time (without runoff control) to migrate to the river, via the primary pathways of stormwater runoff and erosion. For these areas, the receptors include both human (ingestion of fish, and direct contact) and ecological.

3. **The potential "hot spot" areas:** Direct releases have resulted in soil contamination in localized areas, and these are generally considered source areas. The COCs vary from hot spot to hot spot and include mostly petroleum products, but also include PCBs, dioxins, and metals. Six of these locations were identified previously in the DEQ's 2005 ROD and under the terms of the ROD have been selected for excavation and off-site disposal. Seventeen locations were identified in the DEQ ROD and under the terms of the ROD have been selected for capping. Other potential hot spot areas were identified and characterized in subsequent investigations. The hot spot areas generally represent the most impacted areas on the site and present therefore the highest risk to the environment. Some of these areas represent greater risk based upon the magnitude of COC concentrations, the mobility of the COC, location near the river bank, and/or the depth of the impacts (proximity to the surface representing a greater risk).

2.7.7 Basis for Action

The EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30, "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions," provides guidance on how to use the baseline risk assessment to make risk management decisions such as determining whether remedial action under CERCLA Sections 104 or 106 is necessary. It states "Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10(-4) lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for

both current and future land use is less than 10(-4), action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk (e.g., MCLs) is violated or unless there are non-carcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable due to site specific reasons and that remedial action is warranted."

For the River Campus uplands property, only one MIS sample had COCs posing a residential risk in excess of 1×10^{-4}, and one area from the DEQ ROD had occupational risk in excess of 1×10^{-4}; however, there are site-specific reasons for taking action at a lower risk level. Under the terms of the BFPPA entered into between UP and EPA, the parties have agreed that, at a minimum, the removal action work at the site must meet the objectives of the 2005 ROD. The state cleanup standards require cleanup where the potential human health risk exceeds a cumulative cancer risk of 1×10^{-5}, individual chemical cancer risk of 1×10^{-6}, non-cancer risk exceeds an HI of 1, or risks to ecological receptors are unacceptable. Based on the results of site characterization and risk evaluations described in previous sections and the criteria above, response actions for soils appear to be warranted at this site.

For the RS areas, contaminated soils have a significant potential to erode or migrate into the Willamette River, thereby contaminating sediments and impacting ecological receptors. Comparison of MIS sampling results to the draft Portland Harbor preliminary remediation goals (PRGs) results in estimated potential human health risks greater than 1×10^{-4} , HI greater than 1, and/or ecological risks exceeding an HI greater than or equal to 1, such that action appears to be warranted for the RS areas.

No action appears to be warranted for groundwater except to ensure that site COCs are not increasing in groundwater.

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3.0 REMOVAL ACTION SCOPE, OBJECTIVES, AND GOALS

As summarized in previous sections, based on site conditions, risks posed at the site, and terms of the BFPPA entered into between UP and EPA, response actions appear to be warranted at this site.

This section describes the scope, objectives, and preliminary remediation goals for the proposed response action and the basis for each of them. It also discusses the proposed approach evaluated in this EE/CA, including areas on site where action is needed based on these criteria.

3.1 DETERMINATION OF REMOVAL SCOPE

The response actions evaluated in this EE/CA are intended to be a final action for this property and to be consistent with potential future remedial action at the wider Portland Harbor site. To serve as the final action, the response action selected will need to be protective (addressing the human health and ecological risks identified within the streamlined risk evaluation provided in Section 2.7), based on current and reasonably anticipated future land use, comply with applicable or relevant and appropriate requirements (ARARs), and be consistent with the 2005 DEQ ROD, Oregon PPA, and federal BFPPA. This EE/CA assumes all areas identified for response action in the DEQ ROD and other areas of contamination exceeding PRGs where new information has become available through site investigations and this EE/CA will be addressed by the removal to be selected in the Action Memorandum unless otherwise noted.

Other significant factors in planning the scope and objectives of the proposed response actions are that the site is currently fenced and unused, the reasonably anticipated future land use for the site is as a campus and recreation area, and that the site will not be used for residential purposes.

Groundwater contamination at the site based on the most recent sampling slightly exceeds screening levels for select contaminants, including metals, PAHs, and TPH. Groundwater samples that have been taken historically have had sporadic exceedances of MCLs for benzon(a)pyrene, arsenic and copper. DEQ's 2005 ROD concluded that although some impact to shallow groundwater is present on site, residual soil contamination remaining on site following soil cleanup is not expected to significantly impact groundwater in the future. Recent results from MIS sampling support earlier findings that show that most of the COCs that exist at the site are present in near-surface and shallow soils, with concentrations decreasing with depth. Typically, contaminant concentrations in soil decrease to low or nondetectable levels at depths above the water table Therefore the scope and objective of response actions associated with groundwater evaluated in this EE/CA is limited to preventing migration of further contamination from soils to groundwater.

3.2 GOALS AND OBJECTIVES OF REMOVAL ACTION

Removal action objectives (RAOs) provide a general description of what a response action will accomplish. They are written in terms of the contaminants and media of concern, potential exposure pathways, and removal goals. RAOs have been developed for the site based on the objectives of the DEQ ROD and an analysis of the sources of contamination, the nature and extent of contamination, and the results of the human health and ecological risk evaluations. The potentially exposed populations of concern include construction and maintenance workers, faculty and students, neighbors and other recreational users of the property, and ecological receptors (birds and mammal populations). Following the narrative of RAOs is a discussion of the preliminary remediation goals associated with the RAOs and the basis for them. These preliminary remediation goals have been used in this EE/CA to identify the areas of the site which appear to warrant action and to evaluate and compare alternative actions to achieve the RAOs. EPA's Action Memorandum will specify the areas of the site which require action and select final cleanup levels as the goals to be achieved by the response actions in those areas.

3.2.1 Removal Action Objectives

The RAOs for the property used to evaluate alternatives in this EE/CA are as follows:

- Prevent human exposure, through ingestion, direct contact, or inhalation, to site COCs in soils above concentrations that allow for unrestricted use and unlimited exposure;
- Prevent the spread or migration of contaminated soil at the site into surface water and sediments, protect aquatic receptors from exposure to unacceptable levels of contaminants, protect humans consuming fish or other biota, and comply with ARARs;
- Prevent migration of site COCs above acceptable levels to groundwater to protect drinking water resources and potential human and aquatic receptors, and comply with ARARs; and
- Prevent or minimize the potential for ecological receptors (birds and terrestrial mammals) to be exposed through ingestion of or direct contact with site COCs in soils that pose unacceptable risks.

3.2.2 Preliminary Remediation Goals

This section presents the PRGs associated with the RAOs described above and the basis for them. Following public comment on the EE/CA these PRGs will be refined in final contaminant-specific cleanup levels that will be documented by EPA in the Action Memorandum. CERCLA and the NCP require that removal actions be protective of human health and the environment and comply with ARARs to the extent practicable. Given the intention to make this the final action for the River Campus property, the removal actions will need to fully comply with ARARs (or justify a waiver) and be consistent with potential future remedial action at the wider Portland Harbor NPL Site. Furthermore, under the terms of the BFPPA entered into between UP and EPA, the parties have

agreed that the removal action work at the site also must meet the objectives of the 2005 ROD but may require additional removal actions.

The requirement to also be consistent with the potential future remedial action at the wider Portland Harbor NPL Site does not affect the PRGs and cleanup levels for most Upland soils, as they are not expected to migrate to the river. However, the PRGs and cleanup levels for the River Shoreline areas also need to comply with the Portland Harbor PRGs dated March 27, 2009, due to the potential for contaminated soils to migrate or be released from the shoreline into river sediments. Because they are sediment-based, the Portland Harbor PRGs are in some cases more stringent than the Oregon Cleanup rules and other ARARs, so there is one set of PRGs for the Upland Soils (Table 10) and a second set of PRGs for RS soils (Table 11). Table 11 indicates the current minimum and maximum range of risk based screening levels for contaminants in river sediment. EPA will select a cleanup level within the range of risk indentified by the draft Portland Harbor PRGs in the Action Memorandum.

The lowest of the following screening criteria and potential ARARs, as shown on Tables 10 through Table 12, have been used in this EE/CA to develop preliminary remediation goals based on RAFLU.

- EPA Regional Screening Levels (EPA, 2010), which are risk-based screening levels, calculated using the latest toxicity values, default exposure assumptions, and physical and chemical properties, for which default parameters can be changed to reflect site-specific risks. The calculation of cumulative risk level, as described in Section 2.7.4, employs EPA RSLs for soil under occupational/industrial and residential scenarios to determine calculated risk for MIS decision unit areas and to determine screening levels for soils to be protective of groundwater;
- Portland Harbor draft PRGs; and
- Potential ARARs used in this EE/CA to develop preliminary remediation goals and for the evaluation of alternatives:
  - Federal Safe Drinking Water Act (42 U.S.C. § 300f et seq., 40 CFR §141): The primary drinking water standards address toxicity and are termed maximum contaminant levels (MCLs) (Table 12). MCLs are potential ARARs for actual and potential drinking water sources, which for this site include groundwater beneath the site and surface water in the adjacent Willamette River.
  - RCRA regulations [40 CFR § 265.111 (Closure Performance Standards), CFR § 265.117 (Post Closure Care), and 40 CFR §265.310 (Landfill Closure)] are potential ARARs for any response actions involving capping and/or disposal of contaminated soils or debris.

- Clean Water Act (33 U.S.C. §§ 1313, 1314; 40 CFR §131) Ambient Water Quality Criteria: Federal Water Quality Criteria form the basis of Oregon water quality standards (OAR 340-041) and are potential ARARs for protection of surface water, ecological receptors, and people exposed to either.

- Clean Water Act Section 401 (33 USC §1341), Section 402 (33 USC §1342), and Section 404 (33 USC §1344).Endangered Species Act (16 U.S.C. §1531 et seq.) is a potential ARAR for response actions involving critical habitat on or adjacent to the site for listed threatened and endangered species.

- OAR Oregon Environmental Cleanup Rules (OAR 340-122) are the basis for the cleanup standards in the DEQ ROD and potential ARARs for response actions required by the EPA Action Memorandum following consideration of public comment. OAR 340-122-0040(2) requires that hazardous substance response actions achieve one of the following standards:

  - Acceptable risk levels defined in OAR 340-122-0115, as demonstrated by a residual risk assessment; or

  - Numeric cleanup standards developed as part of an approved generic remedy identified or developed by the Department under OAR 340-122-0047, if applicable; or

  - For areas where hazardous substances occur naturally, the background level of the hazardous substances, if higher than those levels specified in subsections (2)(a) through (2)(b) of this rule.

Acceptable risk levels as set forth in OAR 340-122-0115 stipulate that acceptable risk levels include:

- "for human exposure to individual carcinogens… a lifetime excess cancer risk for each carcinogen of less than or equal to one per one million [1×10^{-6}] for an individual at an upper bound exposure;" or "a cumulative lifetime excess cancer risk for multiple carcinogens and multiple exposure pathways of less than or equal to one per one hundred thousand [1×10^{-5}] at an upper-bound exposure;" and

- for noncarcinogens, "a hazard index less than or equal to one for an individual at an upper-bound exposure."

The 1×10^{-6} level is also the risk level the NCP says shall be used as the point of departure for determining removal goals and cleanup levels for known or suspected carcinogens, once action has been determined to be warranted.

3.3 PROPOSED APPROACH

As described more fully in Section 6, in order to guide the development and evaluation of the effectiveness, implementability, and cost of each alternative to achieve the RAOs and statutory requirements for this Site, subareas have been developed and grouped based on COC concentrations and comparison to PRGs and RAOs in accord with the NCP, ARARs, and the 2005 DEQ ROD. Based on these criteria, five groups of areas/subareas have been identified (Figure 9):

- **No Action Areas:** Upland areas with soils below unlimited use and unrestricted exposure levels appear to be acceptable as is without any response action.
- **Limited action areas**: Upland area soils with COC concentrations below active response thresholds but above levels that allow for unlimited use/unrestricted exposure (risks between 1×10^{-5} and/or HI greater than 1 based on occupational/industrial use and 1×10^{-6} and/or HI greater than 1 assuming residential use) appear to warrant only limited action. A subset of the upland area soils fall into this category.
- **Active response action areas**: Areas with soils which exceed certain thresholds described below appear to warrant active responses, such as treatment, excavation and/or capping, and if the active response leaves waste in place above levels that allow for unlimited use/unrestricted exposure, ICs would also be required. Active response action areas include:
  - **River Shoreline (RS) Areas**: For the RS areas, response actions need to be protective of public health and the environment, comply with the DEQ ROD cleanup requirements, comply with ARARs to the extent practicable (or comply completely for this to be a final action), and be consistent with and contribute to the efficient performance of anticipated long-term remedial actions for the greater Portland Harbor NPL Site, which encompasses this Site. Because RS soils have the potential to slough or migrate into the river and affect sediments, EPA has determined that RS area actions should also comply with the draft Portland Harbor NPL Site PRGs (March 2009). All the RS areas exceed the most stringent of the above criteria, as shown in Table 2, including the draft Portland Harbor Site PRGs as of March 2009, and appear to warrant active response action;
  - **Portions of the Upland Areas**: Active response actions are evaluated for those upland areas where the DEQ ROD requires active response, or subsequent sampling and risk assessment has identified soils posing potential carcinogenic risk greater than 1×10^{-4}, or non-cancer risks greater than an HI = 1. Note that upland area soils are not considered likely to migrate to river sediments, so Portland Harbor PRGs have not been used to guide response action decisions in Upland Areas.
- **Hot spot areas**: All areas that were designated as Hot Spots in the DEQ ROD will require an active response. One additional area that was found during the removal assessment is also subject to the Hot Spot criteria requiring excavation.

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4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION TECHNOLOGIES

This section identifies available and appropriate technologies for potential response actions, consistent with the scope, role, and RAOs for the site described in Section 3.0. It is assumed that excavation and disposal will be the likely option to address hot spot areas that warrant a removal action. For the large, less-impacted areas, removal action technologies have been identified based in part on the 2005 DEQ ROD (DEQ, 2005). The main technologies identified in the ROD and identified in this EE/CA as appropriate for the site are described below.

4.1 NO ACTION

Under this alternative, no action would be taken to remove, treat, or contain contaminated media at the site. Contaminated media would remain on site, and the potential for migration of contaminants or exposure to site receptors would not be addressed.

4.2 INSTITUTIONAL CONTROLS

Institutional controls may be implemented as a stand-alone removal action technology or be combined with other measures or technologies as part of an option. EPA defines *institutional controls* as non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy.

For the River Campus property, soils that contain concentrations of COCs that pose a potential risk exceeding the threshold risk level based on the residential exposure scenario will need to be considered for removal action in this EE/CA. These areas will require, at minimum, institutional controls to reduce exposure to contamination by limiting land use where and for as long as COCs remain at the site above these residential threshold risk levels. An additional objective of institutional controls at the site would be to reduce the potential for disturbance or spread of soils left in place following any removal action that contain concentrations of contaminants above residential or occupational risk levels, so as to reduce the risk of contaminant migration.

This section describes the institutional controls that will be evaluated for the River Campus property.

4.2.1 Institutional Controls Identified in the 2005 Record of Decision

As described in Section 2.2.4, the 2005 DEQ ROD recommended the implementation of specific institutional controls at the site, including a deed restriction and DEQ-approved Soils Management Plan. The deed restriction or proprietary control would take the form of an EPA and DEQ-approved *Easement and Equitable Servitude* pursuant to State law that identifies the site remedy and ongoing management requirements on the property. The *Easement and Equitable Servitude* provision would become part of the deed to the property and be enforceable by DEQ and/or EPA. The EPA and

DEQ-approved *Soils Management Plan* would address (1) notice to site workers of the presence of soil contamination; (2) how soil stockpiles that may be generated at the site will be characterized, managed, and disposed of; (3) maintenance of residual contaminant concentrations in newly exposed surface soil (0-3 feet bgs) at levels protective of human and terrestrial and aquatic ecological receptors; and (4) site health and safety requirements regarding currently existing contaminated soil for any future site redevelopment activities.

4.2.2 Zoning Restrictions

Zoning restrictions would prevent site land uses, such as residential uses, that are not consistent with the level of cleanup at the site. As previously mentioned, the zoning designation for the site has recently been changed from Heavy Industrial (IH) to General Employment 2 (EG2) to accommodate UP's future use of the site. General Employment zones do not allow for residential uses, except those approved through the conditional use review process. Daycare facilities, however, are allowed in EG2 zones. Since the zoning designation for the site has already been changed to accommodate redevelopment plans, implementation and maintenance of this institutional control would require little to no effort and would have no associated costs.

4.2.3 Hazard Communication Plan

The UP could adopt a hazard communication plan that notifies university staff, students, visitors, and the surrounding community regarding the areas where contaminated soils are contained on site such as contaminated areas that are capped. This plan would help to further reduce potential human exposure to COCs and damage or disturbance of the cap. Development, implementation, and maintenance of a hazard communication plan would be the responsibility of UP. Methods for communicating site hazards may include training for university staff, disclosures in campus and community publications, and/or posting of signage at the site.

Institutional controls are not generally a stand-alone alternative, though potentially, in the areas where soils exceed residential and occupational risk thresholds (i.e., soils containing COCs at levels that create a total risk greater than 1×10^{-5} or an individual COC risk greater than 1×10^{-6} or an HI of 1), but are below active response thresholds (i.e. soils containing COCs at levels that create a total risk greater than 1×10^{-4} or an HI greater than 1), institutional controls may be determined to be sufficient to meet the removal action objectives.

Institutional controls may serve as the final action on a large portion of the site, but may also be implemented in combination with other technologies, including capping, on other parts of the site. All removal action options that include leaving soil on site above levels exceeding residential RSLs will likely include institutional controls.

4.3 EXCAVATION AND OFF-SITE DISPOSAL

In areas where excavation and off-site disposal is the selected alternative, soil exceeding action level criteria would be excavated, loaded into haul trucks, and transported to an approved, off-site waste disposal facility. Excavated areas would be backfilled with imported suitable clean soil.

Excavation is an effective method for physically removing subsurface material containing contaminants exceeding concentrations that represent unacceptable risk to human and/or ecological receptors. Excavation is required to remove source-level concentrations that have been identified as hot spots in the DEQ ROD, and will also be an appropriate technology for those other areas that fit the Oregon definition of a hot spot (exceeding 10 to 100 times DEQ commercial RBCs, EPA RSLs, or, in shoreline areas, Portland Harbor PRGs, JSCS SLVs, or representing a clear risk to groundwater or surface water). In areas where this technology is selected, soils above the risk threshold would be excavated and removed from the location. Because excavation and removal to an off-site facility involve the use of standard construction equipment, there are few practical limitations on the types of waste that can be excavated and removed.

Soil above the removal action levels in any designated area or subarea may be excavated as long as side slopes of 1.5 horizontal to 1 vertical (1.5:1) are maintained to access the deeper excavation areas. Confirmation samples will be expected to be taken to confirm soils remaining in place meet cleanup criteria unless other technologies, such as capping or institutional controls, are combined with excavation to reduce risk of exposure by potential receptors.

Excavation and off-site disposal has the advantage of completely removing the contamination from the site and eliminating any need for further actions, including institutional controls, maintenance, or monitoring. On the negative side, excavation and off-site disposal does not eliminate the risk from these soils by permanently destroying the COCs but simply transfers them to a disposal site where they will need to be managed long term. In addition, truck traffic and the nuisance and safety risks of traffic are a concern for both the removal of soil and import of replacement clean fill.

In some areas, excavation may be chosen to remove the most highly impacted soils only, as opposed to removing all soils above residential-based exposure levels. In these cases, institutional controls would need to be included at a minimum to protect human health and the environment.

4.4 EXCAVATION AND ON-SITE MANAGEMENT (RE-USE ON SITE)

Excavation can be implemented in some areas of the site with excavated soils relocated to another area of the site and reused as backfill material. This technology is applicable where soils have levels of contamination that are either below residential exposure criteria for the area proposed for reuse, or that the soils will be managed accordingly, such as implementation of institutional controls or,

depending on the concentrations, capping to prevent exposure. This technology is particularly viable as an option to manage soils from areas adjacent to the river. In most cases, these soils exceed draft Portland Harbor PRGs applied to areas adjacent to the river, but do not exceed hot spot criteria, and levels of contamination are similar to areas being addressed in the uplands. If soils meet the residential and ecological risk-based criteria, they could be used on site, without restrictions, for any purpose, including use as cap material. If soils exceed PRG levels, the use of these soils must be consistent with the removal actions chosen for soils exceeding upland PRG levels.

4.5 CAPPING

This technology involves placement of a permanent cap above the soils with concentrations of COCs that exceed cleanup levels. The cap would consist of either:

1. A clean layer of soil a minimum of 2 feet thick, topped with a grass/vegetative cover;
2. An equivalent cap, such as gravel (e.g., a gravel parking lot), paved parking lot, concrete, or building; or
3. A combination cap, such as clean soil overlain by asphalt or part of the area covered with a soil cap and part of the area covered with an equivalent cap.

Establishing a cap protects human health and the environment by:

- Eliminating direct contact of human and ecological receptors with contaminants exceeding cleanup levels in shallow soils;
- Isolating soils containing contaminants exceeding cleanup levels, thereby eliminating dispersion by wind and/or surface water runoff; and
- Minimizing the potential for construction worker exposure to soils containing contaminants exceeding cleanup levels during daily site work.

Capping does not protect workers during deeper trenching preparation or utility installation activities.

To eliminate the risk of simple dermal exposure to contaminated soils, capping with clean soil a minimum of 2 feet thick is sufficient as this thickness minimizes the risk of direct exposure pathways. A 2-foot-thick cap is also sufficient to provide the following benefits:

- Protect against minor erosion of the cap;
- Allow minor, shallow ground disturbance, such as to allow landscaping and planting of shrubs and flowers;
- Eliminate surface water contact with COCs and the potential migration of COCs via surface water;

- Provide a necessary buffer for minor damage or erosion; and
- Eliminates the airborne (dust) exposure pathway for COCs.

For a migration pathway such as air inhalation or migration to groundwater and ultimately to surface water, a thicker cap or a low-permeability cap would normally be required. However, except in the hot spot areas that are assumed to require excavation and off-site disposal, air inhalation and migration to groundwater and ultimately to surface water are not considered significant exposure pathways at the site due to the characteristics of the specific COCs present, as discussed in Section 2.6.4. For the purposes of this EE/CA and cost analysis, a 2-foot-thick cap has been assumed as appropriate for all capping necessary at the site.

RCRA regulations [40 CFR § 265.111 (Closure Performance Standards), CFR § 265.117 (Post Closure Care), and 40 CFR § 265.310 (Landfill Closure)] establish performance standards that may be relevant and appropriate for the construction and maintenance of caps to the extent that the caps are being designed to prevent direct contact with surface soil contamination. These regulations are potential ARARs for consideration in the final cap design.

The need for capping of a particular area would be based on the risk calculated for that area. In general, if an area requires action to address contamination, capping or another removal action option is likely to be required to eliminate the risk. Capping as outlined above may not provide sufficient protection if COC concentrations are extremely high such that a risk exists for mobility of COCs to groundwater or air (soil vapors). Although it is assumed in the EE/CA that capping would utilize clean imported soil only, other capping options may be appropriate. Since the role of the cap, in most of the areas, is simply to minimize potential contact with soils that are above cleanup levels, other capping forms can meet the same objective. At the time of this EE/CA, UP has not developed nor obtained permits to develop the River Campus property. However, the site development plans include many areas of the site that are expected to be covered (capped) by a building structure, sports field, or parking lot (Figure 4). Building foundations and or asphalt/concrete parking lots would serve an equivalent function as a 2-foot-thick soil cap. Design of sports fields, such as practice fields or a planned new baseball stadium, could potentially incorporate a soil cap. Alternative cap designs will be evaluated in more detail during the design phase of the removal action process following selection of the recommended removal action.

For the purposes of this EE/CA, the soil cap technology is assumed to consist of a minimum 2-foot-thick layer of clean soil placed and compacted consistent with City of Portland fill requirements. The soil used in the cap must be deemed “clean” based on a protocol expected to be established during the design phase. A vegetative layer, such as landscaping soil, would not be included as part of the thickness of the soil cap but is assumed to be required in addition to the soil cover. The 2-foot-thick

soil cap would be placed over the contaminated soil with a separation layer of a geotextile. The geotextile is intended to provide a visible indicator to distinguish the capping soil from the underlying contaminated soil during activities that could disturb the cap, such as landscaping, and thereby prevent the cap from accidentally mixing with the underlying contaminated soils. The geotextile also prevents erosion of the underlying soils in the potential case of surface water erosion through the cap layer. The exception to this is the areas identified for capping in the 2005 DEQ ROD. They would be capped with a two-inch asphalt cap, as specified in the DEQ ROD, or an equivalent action.

Long-term monitoring of the cap's structural integrity along with regular maintenance of the cap would be required to preserve the integrity of the cap over time. Monitoring would be documented in a long-term operation and maintenance (O&M) plan as part of the final implementation design. The O&M plan would include a cap monitoring schedule.

This technology would leave soils in place with concentrations of COCs above residential threshold risk levels. Therefore, institutional controls as described in Section 4.2 would also be required with this technology.

4.6 GROUNDWATER AND LONG-TERM MONITORING

Soil remedies that contain soil on site with COC concentrations that present a known risk to groundwater are typically accompanied by long-term groundwater monitoring to confirm that migration of COCs is not occurring. It is not anticipated that this will be the case for this site in areas where contaminated soils remain on site and are capped. Contaminants that remain on site would be COCs with low potential for subsurface groundwater migration. Metals, PCBs, dioxins, and PAHs are the COCs that are likely to remain, and each of these classes of COCs has low mobility. Hot spots are the most likely areas to present a risk to groundwater; however the hot spots are assumed to be areas requiring excavation and off-site disposal consistent the 2005 ROD. Monitoring of groundwater wells flanking the river would be necessary following implementation of the removal actions in order to assess whether migration of remaining COCs toward the river is occurring. Wells along the shoreline area would be necessary for this purpose, and a groundwater monitoring plan would be included as part of the removal action design phase.

5.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION OPTIONS

This section describes and evaluates alternative removal actions for the River Campus property. The options described in this section are evaluated based on the short- and long-term aspects of three criteria: effectiveness, implementability, and cost. These criteria are described in Section 5.1. The individual options are described in Sections 5.2 through 5.6.

In evaluating removal action options for the River Campus site, it is critical to recognize that site characterization using the MIS approach divided the site by historic use into 22 distinct sampling areas and subareas. The MIS approach, which is a statistical risk-based approach to the site, also divides the individual areas up vertically, resulting in different depth intervals; however, the risk-based approach used to determine the need for removal actions for this EE/CA as described in Section 2.7.4 evaluated each MIS Area for the entire depth of the MIS investigation and not by depth interval. Each sampling area contains different COCs with different action levels and potential ARARs. Accordingly, it is likely that the ultimate removal action will differ in different areas. Depending on the action being considered, the evaluation of a removal action also evaluated depth of contamination. For example, if excavation was being considered as a removal action for a given area, the depth intervals were reviewed to determine the necessary depth to excavate to address soils above the cleanup levels based on active response action thresholds.

To facilitate the evaluation of options, this report has combined the key technologies into likely viable removal options. Each option is evaluated generically as if it would be applied to the entire site. In practice, some options better address some of the areas/subareas, while other options would be more appropriate to implement at other areas/subareas. As a result it is possible that most if not all of the individual options described in this section could be used in different areas/subareas on the site. Section 6.0 identifies the option(s) that apply to individual areas and groups of areas. In general, options are developed and evaluated in Section 6.0 for groups of areas/subareas where COCs, concentrations, potential ARARs and other removal action goals are similar.

5.1 EVALUATION CRITERIA

This section describes the criteria that guide the evaluation of the various removal action options.

5.1.1 Effectiveness

Effectiveness is evaluated in terms of protectiveness and ability to achieve removal action objectives. The protectiveness of the options can be assessed in terms of how well they protect public health, protect workers during implementation, protect the environment, and comply with ARARs. Effectiveness includes the following evaluation factors:

- **Overall Protection of Human Health and the Environment:** Assesses the ability of the alternative to be protective of human health and the environment under present and future land-use conditions.
- **Compliance with ARARs:** Identifies whether or not implementation of the alternative would comply with all chemical-specific, action-specific, and location-specific ARARs.
- **Long-term Effectiveness:** Addresses the magnitude of residual risk remaining at the conclusion of removal activities; that is, addresses the adequacy and reliability of controls established by a removal action alternative to maintain reliable protection of human health and the environment over time.
- **Reduction of Toxicity, Mobility, and Volume through Treatment:** Identifies whether or not implementation of the alternative would reduce contaminant toxicity, contaminant mobility (e.g., preventing contaminated soil from reaching human receptors), or actual volume of the hazardous substances.
- **Short-term Effectiveness:** This criterion addresses the effects of an alternative during the construction and implementation phase until the removal action objectives are met. This criterion includes the time in which the remedy achieves protectiveness and the potential for adverse impacts on human health and the environment during construction and implementation of the alternative.

5.1.2 Implementability

The implementability of an alternative depends on technical feasibility, administrative feasibility, and the availability of necessary resources to support the alternatives. Implementability is evaluated in accordance with the following criteria:

- **Technical Feasibility:** Evaluates construction and operational considerations, as well as demonstrated performance/useful life.
- **Administrative Feasibility:** Evaluates factors such as statutory limits, off-site permitting requirements, easements/rights of ways, and impact on adjoining properties.
- **Availability of Service and Materials:** Considers availability of qualified contractors to handle off-site treatment; site preparation, design, equipment, personnel, services and materials, and excavation requirements; capacity for timely transportation and disposal capacity needed to maintain the removal schedule; and availability of disposal facilities licensed to accept hazardous and nonhazardous liquid/solid waste.

5.1.3 Cost

The estimated cost of the options described in this EE/CA is summarized in Table 13 for uplands areas/hot spots and in Table 14 for RS areas. Detailed cost estimates are provided in Appendix C. Estimated cost includes estimated disposal facility costs and the cost of soil reuse or clean import fill to backfill excavated areas, as noted.

5.2 OPTION 1: NO ACTION

Under this option, no action would be taken to remove, treat, or contain contaminated media at the site. Contaminated media would remain on site, and the potential for migration of contaminants or exposure to site receptors would not be addressed.

This site-wide No Action option has been included as a requirement of the NCP and in order to provide a basis for comparison for remaining options. No costs would be involved in this option and no implementation would be necessary. However, this option is not considered effective in protecting human health and the environment for areas of the site that have been determined to require removal action based on the SRE or comparison to screening levels.

5.3 OPTION 2: INSTITUTIONAL CONTROLS

Option 2 would use institutional controls to prevent residential use (and any other unacceptable uses) of all areas where COCs remain on site above levels that would allow unrestricted use/unlimited exposure (UU/UE) (based on risk under a residential exposure scenario), as well as additional controls to restrict disturbance of capped areas so as to prevent human exposure and prevent the spread or migration of COCs remaining on site under caps.

Institutional controls would consist of both administrative and legal controls. Administrative controls would include development of hazard communication plans for the campus to provide notice of contaminated soils present at the site and development of a health and safety plan for campus workers and contractors. Legal controls would include preparing and recording deed restrictions on the title to the property, such as a DEQ-approved EES. The deed restrictions would not allow residential development on the River Campus area of the University. Although large areas of the River Campus property are not contaminated, implementing a patchwork of deed restrictions on different portions of the property may not be optimal.

Institutional controls would meet overall site RAOs for those areas of the site with concentrations of COCs above the residential or occupational/industrial-based calculated cumulative risk of 1×10^{-5} (or individual compounds exceeding residential risk of 1×10^{-6} or an HI of 1), but below active response thresholds where total carcinogenic risk is greater than 1×10^{-4}, or non-cancer hazard is greater than1. Active response action thresholds were developed in Section 3.3 and Section 3.4

based on the results of the streamlined risk evaluation (Section 2.7), which in turn was based on the most likely scenario for use of the River Campus area. Based on the development of these levels, the site has been divided into three areas: (1) areas where active response is likely (exceeding threshold risk) or human health and ecological risk based on the Portland Harbor draft PRGs that apply only to the river shoreline areas;, (2) areas where limited response action is likely, such as institutional controls (exceeding threshold risk based on residential or industrial exposure, but less than carcinogenic risk of 1×10^{-4}, or non-cancer hazard of 1); and (3) No action areas (exceeding no established risk-based thresholds for either human or ecological receptors for the site). No residential development is planned for the River Campus property for the foreseeable future. Since the University will not use the property for residential use, soils containing COC concentrations above residential risk levels would likely require at a minimum institutional controls to protect the public over the longer term. Institutional controls would include language preventing residential use (and any other unacceptable uses) of all areas where COCs remain on site above levels that allow for UU/UE and additional controls restricting disturbance of capped areas so as to prevent unacceptable exposure or the spread of contamination.

5.3.1 Effectiveness

Administrative institutional controls are expected to be immediately effective at protecting the public from unacceptable exposure to COCs for soils that are below risk-based levels for the expected site users: campus employees, students, campus visitors, and recreational users (the occupational scenario). To assist in ensuring effectiveness, the University would develop a Hazard Communication Plan as described in Section 4.2.3.

Institutional controls alone would not meet all project ARARs. In particular, where concentrations of COCs exceed the active response threshold, institutional controls would not be adequate unless combined with an active cleanup technology, such as capping or excavation.

5.3.2 Implementability

Institutional controls may be quickly implemented both administratively and technically. Institutional controls are the weakest controls to maintain and enforce, and would require life-cycle maintenance and management until contaminants are degraded. As such, institutional controls would impose some long-term cost, and, if not maintained properly, could result in breach of the ICs.

Implementation of the majority of the recommended specific institutional controls at the site would require minimal effort, although long-term management may be more complicated. There are no unique technical requirements for implementing institutional controls. The services and materials needed to implement institutional controls are readily available and exist within the UP organization.

As described in Section 4.2.2, the zoning designation for the site has already been changed to accommodate redevelopment plans; therefore, implementation and maintenance of this institutional control would require little to no effort initially or long-term. Proprietary institutional controls are routinely written for contaminated sites using standard language developed by both EPA and DEQ. Hazard communication management is also easily implemented, although may be more difficult to manage long term. Development of a *Soils Management Plan* would involve a greater initial effort by UP to establish procedures for notification of site workers; characterization, management, and disposal of soil; maintenance of residual contaminant concentrations in newly exposed surface soil; and site health and safety requirements. Similarly, development of a hazard communication system would require some effort by UP initially, including determination of the most effective methods for providing information to employees, students, and the public. This effort may include development of a training program and development, production, and installation of disclosures and/or signage at the site. Implementation of the *Soils Management Plan* and hazard communication system would be more difficult to manage long-term due to the tendency for staff turnover to result in loss of institutional memory. To minimize this concern, management of institutional controls would be the responsibility of the UP facility maintenance department. Campus security would be part of the UP process to enforce the controls. The presence of these organizational structures is a distinct advantage in planning removal actions for a university campus.

5.3.3 Cost

Compared to active cleanup options, the cost to implement the institutional controls option is negligible. Costs involved in maintaining institutional controls over time are generally considered relatively low compared to the capital costs associated with more aggressive actions, particularly excavation and off-site disposal. However, unlike more intrusive action, institutional costs are long term. Institutional controls would need to be maintained for as long as soils remain on site above residential threshold risk levels.

Cost would be incurred to develop the *Soils Management Plan* and *Hazard Communication Plan*. In addition, a staff person with UP facility maintenance would need to have part of their role dedicated to ensuring compliance with the ICs. The majority of the costs would be borne during implementation of the removal action, with the long-term costs estimated to be less than $5,000 per year to maintain and comply with the ICs. Initial implementation costs could be on the order of $30,000 to $50,000.

5.4 OPTION 3: CAPPING

Option 3 assumes that soils impacted with COCs above cleanup levels would be capped and not excavated. This option assumes a cap with a minimum thickness of 2 feet of soil (or an equivalent alternative cap) to be placed over contaminated soils. The cap would be placed and compacted consistent with City of Portland requirements. The cap would be separated from the underlying

contaminated soil by a geotextile. The purpose of the geotextile is to provide a visible separation between the capping soil and the underlying contaminated soil. This visible separation would help prevent mixing of the cap and underlying soils during activities that disturb surface soils, such as landscaping. The geotextile would also prevent erosion of the underlying soils that could potentially result due to surface water erosion through the soil cap layer. The cap would also be covered with a vegetative layer or other surface to prevent erosion of the capping material.

Alternatives to a soil cap could be used that perform an equivalent function. These alternatives include a building pad, asphalt or concrete parking lot, or sports field. In the case of a sportsfield, a natural grass field would still require the two foot thick soil cap below the vegetative layer; however, an artificial turf field typically is underlain by asphalt or concrete that would replace the soil layer. These alternatives would need to be sufficient to fulfill the function that a soil cap would fulfill (i.e., minimizing direct contact [direct human contact and surface water/wind contact]) with COCs.

Other components of this option would include institutional controls in the form of proprietary institutional controls to prevent residential use of the site and regular inspections and maintenance of the cap.

The effectiveness, implementability, and cost of Option 3 are detailed below.

5.4.1 Effectiveness

Option 3 is expected to be effective in protecting human health and the environment under present and future land use conditions. Soils with residual concentrations of COCs that exceed cleanup levels but do not represent a risk of migration to groundwater (and potentially to receptors in the river) nor otherwise represent a high risk to human health and the environment would be capped with clean soil to a minimum depth of 2 feet. The soil cap would eliminate mobility of COCs due to surface water runoff and eliminate direct contact of humans with soils exceeding cleanup levels based on anticipated future use of the site. Capping any soils with concentrations of COCs above cleanup levels would eliminate the risk of migration of COCs to surface water, since the COCs would not have direct contact with surface water and the COCs have low mobility in the subsurface and specifically in groundwater.

This option would meet potential ARARs for the specific area being addressed. Because some contaminated soils would remain on site, institutional controls would be necessary for short-term and long-term effectiveness. Recommended institutional controls, including proprietary institutional controls, for the site under the various options are described in detail in Section 5.3. Regular soil cap inspections and maintenance would ensure long-term effectiveness. Regular (annual) inspections of the cap would be performed to assess whether the soil cap has eroded or if areas of subsidence have

appeared. The proposed geotextile separation layer would serve to minimize accidental mixing of the underlying COC-impacted soils with the cap layer, protecting against potential erosion due to major stormwater events, and minimize the potential for erosion to expose underlying soil.

This option is effective for addressing metals, PCBs, dioxins, and low-mobility (heavy) PAHs at concentrations exceeding cleanup levels. Metals, PCBs, PAHs, and dioxins have very low relative water solubility and low volatility, as discussed in Section 2.6.4, and pose low risk to groundwater (Section 2.6.3). These contaminants typically accumulate in soils and are typically considered soil/sediment contaminants rather than water contaminants. The low mobility of these contaminants supports the use of capping as an acceptable method of reducing exposure risk. Capping would remove the likelihood of dermal exposure during most uses of the site. Due to their low mobility, the higher molecular weight PAHs, PCBs, and dioxins present in soil at the River Campus property are not expected to migrate to either the groundwater, other portions of the site, or off-site areas. Lead is the primary metal present at elevated concentrations in soils on site and also has low mobility in groundwater. Arsenic can have high mobility in groundwater, and was detected at a concentration slightly above site background (7.8 µg/kg compared to the site background level of 7 µg/kg) in the MIS sample from Area 2B in the depth range 0-1 foot. However, the very low exceedance of the background level in soils in Area 2B support the conclusion that no groundwater impact from these soils would occur due to arsenic.

5.4.2 Implementability

The capping option is technically feasible and readily implemented. All necessary service and materials are expected to be available. Capping is straightforward and done routinely at CERCLA sites. Qualified contractors are available to handle site preparation, equipment, personnel, services and materials, earthwork, and transportation. No off-site treatment is expected to be necessary. Clean soil used for the 2-foot cap is assumed to be available at a cost of $15/ton; however, a cheaper or free source of clean soil may also be available and would be considered during final planning for this option. The primary implementability issue is the availability of clean soil at the time of construction; however, soil availability is more of a timing and cost issue than a true constraint to implementability.

For most areas of the site, no obstacles to administrative feasibility are anticipated for this option. Statutory and permitting requirements, easements/rights of way and impacts on adjoining property are considered part of administrative feasibility. The property is owned in its entirety by the University of Portland, and no impacts to adjoining properties are anticipated. CERCLA response actions are exempted by law from the requirement to obtain federal, state, or local permits related to any activities conducted completely on site 42 U.S.C. § 9621(e). The CERCLA permit exemption applies only to CERCLA response actions, and does not apply to activities that occur off-site, such as disposal.

However, response actions conducted on CERCLA sites must still meet or waive the substantive provisions of permitting and other regulations that are ARARs. The substantive requirements of Oregon permitting requirements for work on or near water and wetlands must be fulfilled as part of the selected removal alternative.

5.4.3 Cost

A summary of costs for Alternative 3 is provided in Tables 13 and 14 (for uplands and RS areas, respectively), which provide a cost breakdown by area as well as total cost. A detailed breakdown of costs by area is provided in Appendix C. If Option 3 is applied in all upland areas of the site where action levels are exceeded (whether occupational or residential), the total estimated cost would be $4,151,000. The costs to cap only the upland areas where active responses are needed (areas that exceed action levels based on exceeding an occupational or residential risk of 1×10^{-4} or HI = 1) are $431,000. Capping of the DEQ ROD required areas will cost an additional $190,000. Alternative 3 does not apply to the river shoreline areas, as the RS areas are expected to require at least some excavation and will not be addressed by capping only. The costs for Option 3 are relatively high due largely to the cost of import of clean capping soil. The costs for clean imported soil was assumed to be $15/ton based on an average haul distance. If a cheaper or free source of fill soil can be found, the total cost of this option may be dramatically reduced. This could include using soil excavated from areas (RS-1, RS-2, and RS-3) in the uplands on site.

5.5 OPTION 4: EXCAVATION AND OFF-SITE DISPOSAL

Under Option 4, areas of the site that require a removal action for soil that exceeds cleanup levels would be excavated and disposed of off site at a permitted, confirmed, and approved disposal facility. The excavated areas would include:

- Uplands MIS areas that exceed the applicable occupational or residential-based risk thresholds;
- RS areas that exceed Portland Harbor PRGs or the applicable residential-based risk thresholds; and
- Hot spots areas.

A sub-option, Option 4A, is also considered. Under Option 4A, only soils exceeding action levels based on active response action thresholds (areas exceeding an occupational or residential risk of 1×10^{-4} or HI = 1) would be excavated and removed (as well as hot spots and RS areas), as opposed to all soils exceeding action levels (active response action areas and limited action areas).

5.5.1 Effectiveness

Option 4 would meet the RAOs and make areas where this option is implemented “clean” and available for unrestricted use, meeting all requirements for UU/UE. The excavated area would not require institutional controls or long-term maintenance. If this action is chosen, it is assumed that remaining soils left in place would meet cleanup levels including those protective of residential use and that all material with concentrations of contaminants exceeding cleanup levels would be completely removed from the area. Option 4 would be effective in protecting human health and the environment under present and future land-use conditions, would comply with all potential ARARs, and would protect human health and the environment in both the short and long term. Because no contaminants above cleanup levels would remain in place with the excavated areas, no further risk of contaminant mobility nor impact to adjoining areas, such as the Willamette River, would be present. Option 4 is therefore expected to be highly effective in protecting human health and the environment.

5.5.1.1 Option 4A

Option 4A is essentially the same approach as Option 4; however, under Option 4A, only soils that require an active response (areas exceeding an occupational or residential risk of 1×10^{-4} or HI=1) would be removed. In this scenario, some soils that exceed risk levels for residential and occupational exposure would not be excavated; and institutional controls would be needed. Option 4A protects all likely users of the site (recreational users, students, and campus workers) by removing or controlling through ICs all contaminants at concentrations likely to cause a risk to these receptors. This option is expected to be effective in protecting human health and the environment under present and future land-use conditions, since residential use would be prohibited. The option would also comply with all potential ARARs, and would protect human health and the environment in both the short and long term. However, long-term effectiveness would be lower than in Option 4, due to the need to maintain institutional controls over the life cycle of contaminant degradation. This option would therefore require long-term management.

5.5.2 Implementability

Removal Option 4 is technically feasible and readily implementable, and all necessary service and materials are expected to be available. Excavation and removal are straightforward, and many qualified contractors are available to handle site preparation, equipment, personnel, services and materials, excavation, disposal capacity, and transportation. No off-site treatment is expected to be necessary. Disposal facilities licensed to accept nonhazardous solid waste are available for all excavated soil. Clean soil used as backfill is assumed to be available at a cost of $15/ton; however, a cheaper or free source of clean soil may also be available and would be considered during final planning for this option. Due to the large volume of soil that would be removed during this option,

the availability of clean backfill may represent an issue for timing, potentially increasing implementation schedule and/or costs.

No obstacles to administrative feasibility are anticipated for this option in any area of the site. Statutory and permitting requirements, easements/rights of way, and impacts on adjoining property are considered part of administrative feasibility. The property is owned in its entirety by the University of Portland, and no impacts to adjoining properties are anticipated. CERCLA response actions are exempted by law from the requirement to obtain federal, state, or local permits related to any activities conducted completely on site. The CERCLA permit exemption applies only to CERCLA response actions, and does not apply to activities that occur off site, such as disposal. However, response actions conducted on CERCLA sites must still meet or waive the substantive provisions of permitting and other regulations that are ARARs. Option 4 must meet the substantive requirements of the permits discussed in full for Option 3 (Section 5.4).

5.5.2.1 Option 4A

Option 4A, which assumes only soils above active response threshold risk levels are excavated, is similar in implementability to Option 4, except that institutional controls would be required. The implementability concerns outlined in Section 5.3.2 would therefore apply to this option.

5.5.3 Cost

A summary of costs for Option 4 is provided in Tables 13 and 14, which provide a cost breakdown by area and a total cost. A detailed breakdown of costs by area is provided in Appendix C. If Option 4 were applied to all upland areas of the site that require active responses (i.e., areas that exceed risk thresholds for both residential and occupational scenarios), the total estimated cost is an estimated $57,432,000. If RS areas are also excavated and disposed offsite, an additional estimated $8,686,000 will apply, assuming that the RS areas are excavated to a 5:1 slope (Table 14) and capped with clean soil.

The cost of this option is extremely high and is the highest of all options considered. The high cost of this option is primarily due to the high cost of disposal of contaminated soil ($65/ton). The cost of import of clean soil is also very high; however, if a cheaper or free source of clean soil could be identified, the costs of this option may be reduced somewhat.

The very high cost for this option is a significant impediment to successfully achieving the removal action objectives in a timely manner since UP anticipates that raising sufficient funds would be a challenge, and perhaps not possible.

5.5.3.1 Option 4A

Option 4A, which assumes that only soils requiring active responses (exceeding an occupational or residential risk of 1 x 10^{-4} or HI=1) are excavated, is substantially less expensive than Option 4. Costs of this option would differ depending on whether clean soil is used as backfill and capping material, or soil is reused from excavations conducted on site. Under the clean soil scenario, if Option 4A were applied to all upland areas of the site, the total estimated cost is an estimated $6,905,000. Depending on the amount of soil from the RS areas that can be reused, the cost for excavation and disposal of soil exceeding active response threshold risk levels could be significantly reduced.

5.6 OPTION 5: EXCAVATION AND RE-USE OF SOIL ON SITE

Option 5 is a variation of Option 4. In this option, soils within the RS areas that require an active response due to the risk of shoreline soils eroding and migrating to the river are excavated, but instead of being disposed of offsite, these soils would be reused as backfill in other parts of the site. Implementation of Option 5 would possibly require temporary stockpiling (double handling of soils). Option 5 could be used only for soils that have COC concentrations that do not represent a risk to groundwater and are not above a regulatory limit, such as hazardous waste classifications under the RCRA or the Toxic Substances Control Act (TSCA). This option is designed to be used specifically for soils along the shoreline (Areas RS-1, RS-2 and RS-3) that have COC concentrations above the draft PH PRGs levels but that are generally not highly contaminated.

If relocated soils exceed risk-based threshold levels for the uplands, actions for placing these soils would need to be consistent with removal action decisions chosen for the uplands area where the soil was to be placed. Soil excavated from the RS areas as part of the removal action that exceed the cleanup levels for the uplands would need to be addressed consistent with the EE/CA decision for the uplands. Soils in the RS areas have only been characterized to a 10 ft depth and it may be necessary as part of design to evaluate the need for additional characterization or confirmation sampling depending on the grading required for this area for final development**.** Depending on the slope selected for grading a stable slope, the action may or may not address all remaining contamination to acceptable levels. For the purposes of this EE/CA, slopes of 5:1 have been assumed for stability. It is also possible that contamination above the cleanup levels for the shoreline area will extend deeper than will be needed for shoreline stability. In this case it may be necessary to evaluate other options such as capping.

5.6.1 Effectiveness

This option is expected to be effective as much of the soil present in the areas along the riverfront (Areas RS-1, RS-2 and RS-3) do not exceed active response action thresholds or potential cleanup levels that are likely to be applied to the upland areas and do not exceed levels that would present

either a risk of migration to groundwater or levels that would require the soil to be disposed of offsite as hazardous waste. If soils exceed the cleanup levels and are excavated it is assumed they can be reused on site consistent with removal action decisions made for upland soils. Soils excavated from areas along the river and reused as backfill are not anticipated to present greater risk to human health or the environment than soils left in place in upland areas under the capping option (Option 3) or the institutional controls option (Option 2). This option would be effective in protecting human health and the environment.

5.6.2 Implementability

Soils excavated from areas along the river and reused as backfill would not be expected to present any additional technical or administrative implementability challenges compared to the capping and excavation options. Similar equipment and technologies would be used. Implementability issues include the likely need to temporarily stockpile the soil prior to final placement and the need for double handling of the material. An area on the site would need to be designated for stockpiling, and appropriate stormwater controls would need to be put in place to prevent mobilization of these soils during storm events while the stockpiles are maintained.

5.6.3 Cost

A summary of costs for Option 5 (excavation and reuse of soil onsite) is provided in Table 13, which provides a cost breakdown by area and a total cost. A detailed breakdown of costs by area is provided in Appendix C. If Option 5 were applied in areas RS-1, RS-2, and RS-3 of the site, the total estimated cost for excavation of those areas would be an estimated $1,431,000 assuming all soil can remain on site compared to a cost of $8,683,000 for Option 4 (excavation and offsite disposal for the RS areas). In addition to these direct savings for cleanup of the RS areas, reusing this soil will decrease backfill costs in the hotspot excavations, and some of this soil could also be used as capping material further reducing the cost of this option. Finally, the cost estimate has assumed that it would be necessary to temporarily stockpile soils from the RS areas as opposed to direct placement. If construction timing can be efficient, not all the RS Area soils would need stockpiling, resulting in additional cost savings. The reuse of stockpiled soils makes the cost of this option significantly lower compared to the options in which clean soil is uniformly used as backfill and in which affected soil is disposed off site.

6.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION OPTIONS

This section presents a comparative analysis to evaluate the relative performance of each removal option in relation to the performance criteria (effectiveness, implementability, and cost). Key trade-offs affecting the final remedy selection are discussed. This comparative analysis identifies the advantages and disadvantages of each option relative to the others for each area of the site.

In order to consider the effectiveness, implementability, and cost of each option within different areas of the site, all of the subareas have been grouped based on action levels and the degree to which COC concentrations exceed these levels within each subarea. Based on these criteria, five groups of areas/subareas have been identified:

- **No action areas:** Areas where COC concentrations in soil do not exceed residential exposure threshold risk (cumulative risk of 1×10^{-5}, an HI of 1, or risk for an individual contaminant of 1×10^{-6}, based on residential RSLs). No areas of the site met this criteria;
- **Limited action areas:** Areas where COC concentrations are below active response thresholds, but above levels that allow for UU/UE (cumulative risk of 1×10^{-5}, an HI of 1, or risk for an individual compound of 1×10^{-6}, based on residential or occupational RSLs): Areas 1C, 2A, 2A1, 2B, 3B (including subareas 3B1, 3B2, 3B3, and 3B4), 5A, 5B, 6A, 6B, 6C, 6D1, 6D2, 6D3, as indicated in Table 8; Areas with areas considered not to exceed threshold risk, but where undetected COCs in soils have detection limits exceeding residential RSLs include: Areas 1A, 3A, 4, and individual depth units for other areas, as indicated in Table 8;
- **Active response action areas:**
  - Upland areas where COC concentrations in soil exceed active response levels (exceeding an occupational or residential risk of 1×10^{-4} or HI=1): Area 1B;
  - Areas along the riverfront where COC concentrations in soil exceed draft PH PRGs: Areas RS-1, RS-2, and RS-3.
- **Hot spots.**

The No Action alternative (Option 1) would not be effective in addressing removal action objectives and will therefore not be considered further in this comparative analysis. The remaining alternatives are:

- Option 2: Institutional controls;
- Option 3: Capping;
- Option 4: Excavation and off-site disposal; and
- Option 5: Excavation and re-use of soil on site.

The use of each option or combination of options is assessed for each of the groups of site areas.

Criteria for the comparative analysis are based on EPA guidance (EPA, 1993).

6.1 AREAS WITH SOILS BELOW RESIDENTIAL RISK

Three areas of the site (1A, 3A, and 4) as shown in Table 8 are not considered to exceed residential threshold risk (residential cumulative risk of 1×10^{-5}, an HI of 1, or an individual compound exceeding residential risk of 1×10^{-6}, using residential RSLs) based on detected contaminants. However, some undetected COCs in these areas have detection limits exceeding residential RSLs. No active response action is warranted in these areas; however, due to uncertainty regarding the exact concentration of COCs in these areas, they will be considered to require a limited action of institutional controls. Further characterization of soils in these areas could be considered in order to obtain additional information on the nature and extent of COCs in these soils. However, with institutional controls in place, no risk to human health or ecological risk is anticipated in these areas.

6.2 AREAS WITH SOILS EXCEEDING RESIDENTIAL OR OCCUPATIONAL RISK BUT BELOW ACTIVE RESPONSE THRESHOLD LEVELS

The following areas have soils with COC concentrations exceeding action levels based on residential and occupational risk thresholds, but are below active response threshold levels based on concentrations exceeding an occupational or residential risk of 1×10^{-4} or HI=1: Areas 1C, 2A, 2A1, 2B, 3B (including subareas 3B1, 3B2, 3B3, and 3B4), 5A, 5B, 6A, 6B, 6C, 6D1, 6D2, and 6D3, as well as selected depth units of other areas as indicated in Table 8.

6.2.1 Effectiveness

Effectiveness addresses overall protection of human health and the environment; compliance with ARARs; long-term effectiveness; reduction of toxicity, mobility and volume; and short-term effectiveness.

All the options except Option 1 (No Action) are expected to be protective of human health and the environment for areas with soils exceeding residential risk-based threshold levels and soils exceeding the occupational risk-based thresholds but less than the active response threshold. All the options except Option 1 prevent residential use on the site or prevent people from coming into contact with these soils. If institutional controls (Option 2) are used as the sole remedy, human users may come into contact with soils containing concentrations of COCs exceeding action levels. However, if the institutional controls prevent residential use, risk is anticipated to be low since the majority of the site will be developed and covered with ballfields, parking lots, sidewalks, buildings, or landscaping and site use will be controlled through ICs. Since the exposure to contaminated soils with concentrations

below the active response threshold are limited due to the planned site development, the institutional controls option (Option 2) is therefore as effective as other options.

Compliance with ARARs differs for each of the options for these areas. Option 3 (capping) and Option 5 (excavation and re-use of site soils from near the river as capping material in uplands areas) would comply with ARARs only for surface soils; soils exceeding residential and occupational threshold risk levels would remain, but would be capped by 2 feet of clean soil or an equivalent cap. Institutional controls would still need to be included with these options to prevent exposure to underlying soils at any time in the future. Under Option 2 (institutional controls only), surface soils would remain with concentrations of COCs above residential and occupational threshold risk levels. However, with institutional controls in place, the soils in these areas would meet all potential risk-based ARARs for expected users of the site. Option 4 is considered most effective at complying with potential ARARs, because all soil exceeding residential levels would be removed completely from the site.

All the options are considered likely to be effective in the long term. However, the relative long-term effectiveness of the options differs slightly. The most effective option over the long-term would be Option 4, since soils would be completely removed from the site, and there would be no risk to site receptors even if residential use were permitted. Options 3 and 5 are considered the next most effective over the long term, as contaminated soils would remain on site and be managed accordingly and would require institutional controls. Option 2 (institutional controls) may appear less effective than Options 3 and 5 but is nevertheless considered equally protective. Institutional controls would prevent residential development and control use for the soils posing lower risk and, therefore, this option is protective of human health and the environment.

No option considered in this EE/CA provides an absolute reduction in total toxicity, mobility, or volume of COCs in soils. Soils would contain the same contaminant concentrations and volume even if moved off site, where they would need to be managed at the disposal facility. This consideration suggests that if the soils can be managed effectively on site without risk to site receptors, this may be preferable to adding increased volume to a disposal facility such as a landfill. Off-site disposal of soils would reduce the mobility of contaminated soil by moving the soil to a disposal facility that prevents contaminant migration. An off-site facility would also eliminate the management issues of contaminated soils (administrative issues associated with ICs). The COCs present in those site soils exceeding only residential screening levels but not the active response threshold of 1×10^{-4} occupational risk or HI=1 (metals, PCBs, dioxins, and heavy PAHs) are considered to have low mobility due to their chemical properties. Migration of these COCs from soils at the site is considered unlikely and management requirements for institutional controls would be minimal.

All options are considered equally effective for these areas in the short term, during construction and implementation. Short-term exposure to COCs exceeding only residential screening levels is not considered a health risk to likely short-term receptors, such as construction workers and disposal crews.

Few differences in effectiveness are anticipated between the four options being considered for areas of the site that exceed residential threshold risk levels but do not exceed the action levels based on occupational site use. If Option 3 (capping) or Option 5 (re-use of site soils for capping) is used for these areas, potential site ARARs would not be met and these options would need to be combined with institutional controls (Option 2). ICs would involve a proprietary control preventing residential development, which could also be used as a sole remedy for these areas. Option 4 (excavation) is slightly more effective than all other options in meeting all potential site ARARs and in long-term effectiveness, as all soils above the most conservative cleanup level (the residential action level) would be completely removed from the site, allowing for UU/UE.

6.2.2 Implementability

Implementability includes technical feasibility, administrative feasibility, and the availability of necessary resources to support the alternative.

For areas exceeding only the residential and occupational risk threshold, but not the active response threshold, Option 2 (institutional controls) is most technically feasible as no equipment or construction is necessary to implement this option. Institutional controls may, however, be difficult to maintain over a long period of time, which includes the period required for contaminants to degrade below a risk threshold. Since the compounds present at the site break down extremely slowly in the natural environment, the time period should be considered at least 100 years. Permanent structures (such as a building or parking lot) may aid in demarcating areas with institutional controls. Options 3 (capping) and 5 (re-use of excavated site soils for capping) are the next most technically feasible options, as the only requirement would be the import and/or excavation and transport of backfill soil. Option 3 would require identification of a clean soil source, which may present an obstacle to technical feasibility. Option 4 (excavation) is least technically feasible as it requires the excavation, transport, and disposal of massive quantities of soil. Public safety and nuisance would result from both Options 3 (capping) and 4 (excavation and off-site disposal) due to truck and equipment traffic in the neighborhood and through the campus.

Administratively, Option 2 (institutional controls), is most implementable for these areas. Proprietary institutional controls are routinely placed on contaminated sites using standard forms developed by both EPA and DEQ. Specifically proprietary control would be in the form of an EPA and DEQ-approved *Easement and Equitable Servitude* (EES) pursuant to Oregon State law.

The EES would identify the site remedy and ongoing management requirements on the property deed and would be enforceable by DEQ and/or EPA. A DEQ-approved *Soils Management Plan* would also be developed that would address long-term operation and maintenance requirements. Administrative implementation of Options 3, 4, and 5 would require that the substantive components of permits for waterfront development be met (Section 5.4.2). No substantive differences are present in administrative feasibility between these options.

Services and materials are considered to be available for all the options. Option 2 (institutional controls) is the only option that requires no construction-related services and materials.

In summary, Option 2 (consisting of institutional controls preventing residential development) is the most implementable option for areas exceeding limited action risk criteria. Options 3 and 5 are fairly similar to one another in implementability and are not expected to pose major implementation obstacles for these areas. Option 4 is the least implementable option due to the requirement for import, transport, and disposal of large amounts of soil and the safety considerations of truck traffic.

6.2.3 Cost

Cost estimates for the different options for these areas are summarized in Tables 13 and 14; a detailed breakdown of cost estimates is presented in Appendix C. In summary, the cost of each option is as follows:

- Option 2 – Institutional Controls: $50,000 to implement which is negligible compared to other options plus all other options except Option 4 would require institutional controls;
- Option 3 – Capping of material exceeding threshold risk levels based on residential exposure is an estimated $4,151,000;
- Option 4 – Excavation and offsite disposal of material exceeding residential and occupational-based threshold risk levels is on the order of approximately $57,432,000 for upland areas, with an additional $8,683,000 for RS areas; and
- Option 5 – Excavation with re-use of site soils from the RS Areas as backfill and capping material could reduce overall project cleanup costs by as much as $8 Million. The costs of this option cannot be directly compared to other options since this option, really only applies to the RS areas and is not appropriate for the upland areas.

These costs do not include the additional required action to comply with the DEQ ROD. These include $190,000 for capping and $568,000 for hot spot excavation. The most cost-effective option is Option 2, followed by Option 3, Option 5, and Option 4; however, the cost differential between Option 2 and the other options is significant.

6.2.4 Summary and Recommendation

For areas with concentrations of COCs exceeding residential and occupational threshold risk levels but lower than active response threshold levels based on exceeding an occupational or residential risk of 1×10^{-4} or HI greater than 1, there is little meaningful difference in effectiveness among the options. All active options are considered to be effective in protecting human health and the environment in these areas over both the short and long term. However, Option 2 (institutional controls to prevent residential development) is considered much more implementable and can be implemented for a much lower cost than other options. Option 2 is therefore recommended for Areas 1C, 2A, 2A1, 2B, 3B, 5A, 5B, 6A, 6B, 6C, 6D1, 6D2, 6D3 and, soils from river shoreline Areas RS-1, RS-2,and RS-3, if reused in the uplands areas, as they exceed cleanup levels based on residential and occupational use but do not exceed levels based on active response action levels (exceeding an occupational or residential risk of 1×10^{-4} or HI greater than 1).

6.3 UPLAND AREAS WITH SOILS EXCEEDING ACTIVE RESPONSE LEVELS

The following upland area has soils with COC concentrations requiring action based on calculated risk using active response levels (exceeding an occupational or residential risk of 1×10^{-4} or HI=1): Area 1B. This area is deemed to require an active response action (EPA, 2011b).

6.3.1 Effectiveness

For areas of the site where concentrations of COCs in soils require action based on active response criteria, Option 2 (institutional controls only) is not expected to be sufficiently protective of likely users of the site, including campus employees, students, campus visitors, and recreational users. In addition, institutional control used as a sole remedy would not meet potential site ARARs. Option 2 is therefore not considered further for this group of areas, except in that institutional controls are used in conjunction with other options.

In general, if soils in an area contain COC concentrations above the action levels based on exceeding an occupational or residential risk of 1×10^{-4} or HI=1, one of the more active removal action alternatives will be required to eliminate unacceptable risk (Options 3, 4A, or 5). Capping may not provide sufficient protection if COC concentrations are sufficiently greater than action levels and COCs represent a risk for mobility to groundwater or air (soil vapors). At the site, the only areas that represent such a risk are within the identified hot spots. All the MIS areas are impacted with contaminants that have very low mobility in the environment, and capping would sufficiently address the direct contact risks.

Options 3 (capping), 4A (excavation and offsite disposal for soils that exceed cleanup levels based on active response threshold [exceeding an occupational or residential risk of 1×10^{-4} or HI greater than 1]), and 5 (re-use of site soils) are each effective in overall protection of human health and the environment for these areas. These options would all prevent exposure of site receptors to surface soils containing concentrations of COCs above cleanup levels based on active response threshold (exceeding an occupational or residential risk of 1×10^{-4} or HI greater than 1). These three options all include the need for institutional controls.

Option 5 (excavation and re-use of soils from river shoreline areas [RS areas]) could be used in conjunction with either Option 4A (excavation and off-site disposal for soils above cleanup levels based on exceeding the active response threshold with an occupational or residential risk of 1×10^{-4} or HI greater than 1) or Option 3 (capping) for these areas. Option 3 (capping) and Option 5 (excavation and re-use of site soils) would leave soil in place that do not meet potential ARARs without additional controls. Institutional controls imposed in conjunction with these options to prevent exposure of users of the site to soils would meet potential ARARs. These options would still require the use of institutional controls, a soil management plan, and a hazard communication plan in case of future construction that could expose these soils. Option 4A (excavation and offsite disposal) would remove all soils that exceed cleanup levels based on exceeding the active response threshold with an occupational or residential risk of 1×10^{-4} or HI greater than 1, and is therefore more effective than the other options with regard to assuring potential ARAR compliance.

All the options are considered to be effective in the long term. However, Options 3 and 5 have the potential to be less effective over the long term, since a clean soil cap over soils exceeding active response thresholds could erode or be damaged over time and would require maintenance, including annual inspections. In addition, institutional controls would be necessary to prevent exposure of site users to these soils in the case of future construction or other subsurface activity. The most effective option over the long-term would be Option 4A, since soils in exceedance of cleanup levels would be completely removed from the site and there would be no risk to site receptors under any future-use scenario for the site.

As discussed in Section 6.2.1, no option considered in this EE/CA provides an absolute reduction in total toxicity, mobility, or volume of COCs in soils, as the soils will contain the same contaminant concentrations and volume even if moved off site. Thus, soils managed effectively on site without risk to site receptors is preferable to adding increased volume to a disposal facility such as a landfill. COCs present in soils exceeding occupational use risk levels (metals, PCBs, dioxins, and heavy PAHs) are considered to have low mobility due to their chemical properties. Migration of these COCs from soils at the site is considered unlikely.

All options considered for these areas are equally effective in the short term, during the construction and implementation phase. Construction workers, disposal crews, and other site workers have the potential to be exposed to soils exceeding recreational and commercial/industrial screening levels under all the options and should take necessary precautions. These precautions include wearing appropriate personal protective equipment and following short-term institutional controls established during the implementation phase. Option 4A, which requires excavated soil to be disposed of offsite, would result in high volumes of truck traffic through the campus and neighborhood increasing the risk of accidents involving the public.

In summary, Option 2 (institutional controls only) is not considered an effective remedy for these areas. If Option 3 (capping) or 5 (excavation and re-use of site soils) is used for these areas, these options both assume the need for institutional controls for long-term effectiveness. Option 4A (excavation and off-site disposal) is slightly more effective than all other options in meeting all potential site ARARs and for its long-term effectiveness, as all soils above occupational threshold risk levels would be completely removed from the site.

6.3.2 Implementability

Options 3 (capping) is the most technically implementable, as the only requirement is the import of clean capping soil. Availability of clean soil in the volumes required may represent a scheduling obstacle as large volumes of clean soil may not be immediately available; however, alternative caps, such as use of parking lots or buildings, could greatly reduce the need for imported soil. Option 4A (excavation and off-site disposal for soils that exceed cleanup levels based on exceeding the active response threshold of an occupational or residential risk of 1×10^{-4} or HI greater than 1) is the least technically feasible as it would require the excavation, transport, and disposal of large quantities of soil and still require a massive clean soil source for backfilling the excavation. The truck traffic for Option 4A through the campus and neighborhood would likely be viewed by the public as a major inconvenience and a safety and noise hazard. Services and materials are considered to be generally available for all the options.

Administratively, Option 3 (capping) and 5 (excavation and reuse of soil) would require institutional controls. Administrative implementation of all the options considered for these areas (Options 3, 4A, and 5) would additionally require that the substantive components of permits for waterfront development be met (Section 5.4.2).

Options 3 and 5 are fairly similar in implementability and are not expected to pose major implementability obstacles for areas where soils exceed occupational threshold risk levels. Since Option 5 (excavation and reuse of soil) would provide soil that can also be suitable for capping, Options 3 and 5 are somewhat complementary options. Option 4A (excavation and off-site disposal

of soils that exceed cleanup levels based on exceeding the active response threshold of an occupational or residential risk of 1 x 10^{-4} or HI greater than 1) is the least implementable option due to the requirement for import, transport, and disposal of large amounts of soil and the impact on the neighborhood residents due to the high volume of truck traffic.

6.3.3 Cost

Cost estimates for the different options for these areas are summarized in Tables 13 and 14; a detailed breakdown of cost estimates is presented in Appendix C. In sum, the cost of each option is as follows:

- Option 2 – Institutional Controls: Not considered for these areas;
- Option 3 – Capping of soil exceeding cleanup levels based on the active response threshold with an occupational or residential risk of 1 x 10^{-4} or HI greater than 1 for the upland soils: $431,000;
- Option 4A – Excavation and offsite disposal of soil exceeding cleanup levels based on the active response threshold with an occupational or residential risk of 1 x 10^{-4} or HI greater than 1: $6,905,000; and
- Option 5 – Excavation with re-use of site soils from the RS areas as backfill could reduce the cost of backfill material required in the Uplands Area where Option 4A is being implemented. This reuse of soil could reduce the costs of Option 4A by approximately $9 per ton (i.e., approximately $342,000 for re-use of the 38,000 tons assumed to be excavated from the RS areas).

The most cost-effective option is Option 3, followed by Option 5 and then Option 4A.

6.3.4 Summary and Recommendation

For areas with soils having concentrations of COCs exceeding cleanup levels based on the active response threshold with an occupational or residential risk of 1 x 10^{-4} or HI greater than 1, the use of Option 2 (institutional controls) as a sole remedy is not an effective option and has been removed from further consideration. The remaining Options 3, 4A, and 5 are considered effective in protecting human health and the environment in these areas over both the short and long term. However, Options 3 and 5 would need to be combined with institutional controls to ensure long-term effectiveness. Option 4A is less technically implementable and much more expensive than the other options.

A combination of Options 3 and 5 is recommended for these areas based on cost and implementability. It is recommended that the areas be capped, re-using stockpiled soils excavated from the riverfront areas for backfill where feasible. The cost specified above for capping assumes imported material is used for capping. If excavated soils from the riverfront can be used for some of

this capping material, costs for imported fill would be reduced. Institutional controls would be required for both Options 3 and 5.

For areas of the site where Option 3 (Capping) is used, the preference should be, where possible, to use an alternative form of cap, including asphalt parking lots, building foundations, and sports fields. These types of caps require less maintenance, are less likely to result in accidental penetration, and are more definable to the public. Figure 13 shows the current proposed plan for development of the UP River Campus area (the site) and the areas that will likely be capped by an alternative cap versus a soil cap. Although the exact location of these alternative cap locations may change with long-term planning, this layout shows the approximate extent of alternative caps that may be placed.

6.4 RIVER SHORELINE AREAS

The draft Portland Harbor PRGs Values for Soil/Stormwater Sediment (EPA and DEQ, 2007, Table 3.1) are considered a potential ARAR for the site that must be applied in the EE/CA for all decision unit areas that border the Willamette River (i.e., RS-1, RS-2, and RS-3). Contaminated soils in these areas present a greater potential for migration to the river sediments. Soil in the shoreline area that is known to be above the draft PH PRGs needs to be addressed. Soil removed from the shoreline area that meets uplands area cleanup levels based on the active response threshold with an occupational or residential risk of 1×10^{-4} or HI greater than 1 can be reused as backfill in upland areas consistent with decisions made for uplands areas.

Given the sensitivity of the river shoreline areas, it is assumed that Option 4 (excavation and off-site disposal) or Option 5 (excavation and on-site re-use) will be used where appropriate. Clean soil may be used as backfill if required. Capping (Option 3) combined with excavation could also be appropriate assuming that the combination of excavation and capping eliminates the risk of migration of COCs to the river sediments. The remaining options are not considered to be effective for these areas as they are not likely to meet the draft PH PRGs if implemented individually.

Cost projections for both Option 4 and Option 5 assume that the three RS areas would be excavated to a depth of 10 feet below existing grade, or to a stable slope of approximately 5:1 based on the University's preliminary discussions with NOAA Fisheries and anticipated mitigation measures for potential ESA impacts. Cost estimate for excavation of the RS areas are shown in Table 14. The shoreline would be altered from the existing near-vertical bank to a stable bank sloped to a gradient of approximately 5:1 horizontal to vertical, as shown in Figure 14. Capping could be used in combination with Option 4 or Option 5. Specifically, if excavation removes soil to below a depth of 10 feet but contaminated soil still remains above draft PH PRGs, capping can be used to eliminate the soil to surface water pathway. It is not known at this time if capping will be necessary, but that

scenario could be identified during design or upon obtaining confirmation samples during implementation.

Estimated costs for Option 4 and Option 5 for the riverfront areas are presented in Table 14; a detailed breakdown of cost estimates is presented in Appendix C. Total cost for excavation and off-site disposal of the excavated soil for the three RS areas as described above is $8,683,000, assuming excavation to a 5:1 slope. If the material excavated is re-used as backfill or cover material in the uplands (disposal costs not incurred) then the cost would be reduced to approximately $1,431,000.

6.5 HOT SPOTS

A total of 17 potential hot spot areas were evaluated in Section 2.6.2 regarding the need for removal action. The locations of the hotspot areas are shown on Figure 5. Of those, eight potential hot spot areas are expected to require an active response action based on the on the 2005 ROD and/or on the concentrations of COCs present. Additionally, 17 areas require capping to meet requirements of the DEQ ROD.

Six of the hotspot areas were identified in the ROD as areas planned for excavation (Section 2.6.1.1). These six hot spots are presumed to require excavation and off-site disposal to meet requirements of the 2005 ROD.

Additional potential hot spots were identified as requiring an active response action based on review of available data (Section 2.6.1.2). One of these areas (an area of stained soil in Area 5A) met the Oregon state definition of *hot spot,* and the preferred remedy for this area is excavation and off-site disposal. The second area (Area WS-3A-2a), while not fitting the definition of a hot spot, exceeds residential screening levels in an area that otherwise has been found only to have undetected contaminants above RSLs (Area 3A). This area will therefore likely require a minimum of institutional controls. Other potential hot spot areas that were designated during the MIS sampling as “waste” areas were determined not to be hot spots and will be managed consistent with the MIS areas. Specifically several areas have concentrations below residential risk levels and require no action, and the remaining areas have been included within the MIS areas for actions.

The six areas identified for excavation in the ROD (A2-1, A2-3, A5-11, A5-12A/B, A5-13, and A4-5) will be excavated and backfilled. The portion of A5-12A/B located within RS-2 area and partly in upland area 5A, does not meet the definition of a hot spot but is above cleanup levels relative to draft PH PRGs for the shoreline portion. The single non-ROD specific hot spot (the stained soil under the slab in Area 5A) is also assumed to require excavation and disposal off-site (Option 4).

Under Option 4 (excavation and off-site disposal), backfill may be either clean, imported soil or re-used soil that has been excavated from areas along the river (Option 5). The decision to excavate or cap hinges in part on the mobility and concentration of the COCs present in these soils. In general, the hot spot areas are deemed source areas with high concentrations of COCs representing a risk to groundwater and off-site migration of COCs. In some cases the COCs are limited to one or two low-mobility COCs, and capping is a demonstrated effective alternative to excavation. Additionally, 17 hotspots will be capped with 2 inches of asphalt in accordance with the 2005 ROD, or an equivalent action.

The effectiveness, implementability, and cost of various options to address the hot spot areas are compared in this section.

6.5.1 Effectiveness

Hot spots are areas that have been identified as representing a possible source area of contamination with high concentrations of COCs. For the areas where elevated concentrations of COCs are present, capping or excavation will be required to eliminate the risk. Capping may not provide sufficient protection if the COC concentrations are sufficiently high that COCs represent a risk for mobility to groundwater or air (soil vapors). Excavation will likely be required in these areas. However, capping (Option 3) is anticipated to be an effective option in other cases, especially in the hot spot not previously identified in the DEQ 2005 ROD, and for several hot spots identified as requiring capping under the 2005 ROD.

Option 5 (re-use of soils from areas along the river) could be used in conjunction with either Option 4 (total excavation) for the hot spots as soils from the shoreline area could potentially be used as backfill. This combination of removal action approaches is an effective option in overall protectiveness of human health and the environment. The effectiveness of using stockpiled soils has been described in earlier sections.

The use of Option 3 (capping) would leave soil in place that does not meet potential ARARs. Institutional controls would therefore need to be used in conjunction with these options to prevent current or future exposure of users of the site to soils exceeding potential ARARs. Institutional controls, including an EES and/or hazard communication plans, could be used in case future construction occurs that could expose these soils. However, soils in the hotspot areas could represent a risk of contaminant mobility; therefore Option 3 as a sole remedy for the hotspots is not considered effective at meeting Removal Action Objectives. Option 4 (excavation) would remove all soils exceeding potential ARARs from the site, and is therefore more effective than the other options with regard to meeting potential site ARARs at hot spots.

Only Option 4 (excavation and offsite disposal) and Option 4 combined with Option 5 (re-use of suitable soil from the shoreline area as backfill) are considered likely to be effective in the long term. The most effective option over the long-term would be Option 4, since soils in exceedance of cleanup levels would be completely removed from the site and there would be no risk to site receptors under any future use of the site.

Remaining comparative considerations for effectiveness are similar to those discussed in earlier sections of this EE/CA.

6.5.2 Implementability

The implementability of the options for the hot spot areas is similar to implementability considerations described under Section 6.2.2.

6.5.3 Cost

Cost estimates for the different options for these areas are summarized in Table 13; a detailed breakdown of cost estimates is presented in Appendix C. The projected cost of each option is as follows:

- Option 2 – Institutional Controls: Does not meet RAOs as a stand alone option;
- Option 3 – Does not meet RAOs as a stand alone option and does not alone meet commitments in DEQ ROD ($190,000 to cap ROD required areas);
- Option 4 – Excavation of ROD hot spots: $568,000;
- Option 4 –the additional hot spot (stained soil) and area WS-3A-2A, which exceeds uplands cleanup levels based on residential use: $81,000.

6.5.4 Summary and Recommendation

Table 15 provides a detailed description of removal actions recommended for each hotspot area. For hot spots, Option 2 (institutional controls) is not appropriate due to the high concentrations of COCs and the threat of mobilization of COCs to groundwater and ultimately to the Willamette. Similarly by definition, hot spots may not be containable and they may have COCs mobile in groundwater. As a result, Option 3 (capping) is not considered effective in meeting removal action objectives, except for areas specified in the 2005 DEQ ROD as requiring only capping. For this reason, only Option 4 (excavation of off-site disposal) is considered effective for the majority of hot spots and this option is also consistent with the DEQ ROD. Soils from the river shoreline areas could be used as backfill (Option 5) following implementation of Option 4. However, area WS-3A-2A, which does not fit the definition of a hot spot but is located in an MIS area that otherwise exceeds site criteria only due to undetected contaminants with detection limits above RSLs, will require institutional controls.

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7.0 RECOMMENDED REMOVAL ACTION

This section summarizes, for each designated area and subarea of the site, the recommended removal action. A complete comparative analysis of alternatives for each area was provided in Section 6. In recommending an action from the various available alternatives for each area, several factors were considered. First, each recommended action was considered in light of effectiveness, implementability, and cost. Second, on-site management of soils was preferred when possible, so long as such management would remain highly protective of human health and the environment. On-site management is preferred because it would minimize the neighborhood nuisance and safety concerns of transport to and storage at a disposal facility/landfill, where the soils would continue to require long-term management and maintenance.

Table 16 summarizes the recommended alternative and the cost of the recommended alternative for each area. The recommended alternative is described below for each subset of site areas:

- **Upland Areas:** where soils do not exceed any action levels, but contain undetected COCs with detection limits above residential RSLs (Areas 1A, 3A, and 4, as indicated in Table 9): Due to uncertainty regarding the exact concentrations of contaminants in these areas, institutional controls are the recommended action.

- **Limited Action Areas:** In these areas, soils exceed action levels based on residential or occupational exposure but do not exceed active response action levels based on an occupational or residential risk of 1×10^{-4} or HI = 1 (Areas 1C, 2A, 2A1, 2B, 3B [including subareas 3B1, 3B2, 3B3, and 3B4], 5A, 5B, 6A, 6B, 6C, 6D1, and 6D2, and 6D3 as indicated in Table 9). Institutional controls (Option 2), consisting of an EES that would prevent residential development, is the recommended alternative for these areas. This alternative is recommended because it poses significantly fewer obstacles to implementability and is much less expensive than other options considered in this EE/CA. In addition, compared to other options, this alternative is considered equally effective in protecting human health and the environment over both the short and long term. UP is not proposing to use the site for residential use and plans to cover much of the property as part of future redevelopment. Therefore, leaving soils in these areas is consistent with the planned site use where risk is based on occupational use. Institutional controls provide equal protection of human health and the environment without the construction risks and costs of more aggressive actions.

- **Active Response Action Areas:**

  – **Upland Areas where soils exceed action levels based on risk of 1×10^{-4} or HI=1** (Area 1B,): A combination of capping (Option 3) and re-use of excavated site soils (Option 5) is recommended for this areas, based on cost and implementability (Table 16). It is recommended that the area be capped with 2 feet of clean soil, re-using stockpiled soils excavated from the riverfront for any required backfill and for capping where soils meet cleanup levels based on the active response threshold with an occupational or residential risk of 1×10^{-4} or HI greater than 1. If the planned future use of an area includes placement of an equivalent cap, such as a building or parking

lot, this alternative cap will be proposed in lieu of a soil cap as part of cleanup design. This recommended action will need to be combined with additional institutional controls in order to maintain long-term effectiveness. However, with institutional controls in place (such as an EES, a soil management plan, a hazard communication plan, and monitoring and maintenance of the cap), this alternative is considered equally protective of human health and the environment over both the short and long term compared to other options.

– **Areas along the waterfront where draft Portland Harbor PRGs cleanup levels apply** (Areas RS-1, RS-2, and RS-3): A combination of excavation of soil (Option 4) with re-use of the soil that is below upland risk levels on site (Option 5), and potential capping (Option 3) is the recommended alternative for river shoreline areas of the site. Clean, imported soil will be used as backfill as required to meet ESA requirements. It is assumed that most of the soil along the riverbank will be removed to eliminate potential migration of COCs from the shoreline into the river and river sediment. Applying the draft Portland Harbor PRGs as cleanup levels for these areas eliminates the other options. Soil from Areas RS-1, RS-2, and RS-3 should be compared to upland cleanup levels based on the active response threshold with an occupational or residential risk of 1×10^{-4} or HI greater than 1 and used in the uplands to the degree such use is consistent with decisions made for the uplands. Soils that do not exceed risk thresholds may be used as backfill or cap material in upland areas of the site (Option 5). If used as backfill or cap material in upland areas, institutional controls will be established to prevent unacceptable use and limit disturbance of capped areas. Capping within the RS areas may be used in combination with excavation if soils above Portland Harbor PRGs or other cleanup levels are left in place.

- **Potential excavation areas (hot spots):** Hot spots by DEQ definition are source areas that have high COC concentrations (10 to 100 times screening levels) and therefore present a risk of mobility of COCs to groundwater. The recommendations for removal action are presented on a case-by-case basis for each hot spot in Table 15, and the estimated cost for the recommended action for each hot spot is shown in Table 16. Hot spots identified in the DEQ 2005 ROD are required as a condition of the ROD to be excavated and the soils disposed of off-site (Option 4). The only additional hot spot not identified in the 2005 ROD presents similar concerns of COC mobility, since it fits the DEQ definition of a hotspot, and as such is recommended to be excavated and removed for off-site disposal (Option 4). Additionally the DEQ 2005 ROD identified 17 hot spot areas for capping only. These areas will be capped as prescribed in the ROD.

It should be noted that, except for area 1B, the RS and hot spot areas most of the site will only have ICs; however, while not part of the CERCLA response action(s), further development of the site by UP will result in construction of buildings and hard surfaces such as sidewalks and parking lots that will serve as effective barriers to prevent exposure to or migration of any residual soil contamination. In anticipation of such redevelopment, the eventual site ICs and/or O&M plans will specify that proper health and safety precautions be taken by workers, that no action be taken that could compromise the integrity of the remedy where waste is being contained or managed in place on site, and best management practices be used to minimize the release, spread or exposure to soils with residual contamination

Total estimated costs to implement the proposed removal actions described above are $2,700,000.

The final recommended alternative for each area will be selected by EPA after an opportunity for input from stakeholders and the public comment period of at least thirty days in accordance with the NCP.

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8.0 SCHEDULE

UP plans to complete the removal action process, including implementation of the final removal action, as soon as practical given the constraints of the process and the University's ability to fund future development. The University seeks to confirm as soon as possible the likely future costs of removal and thereby focus its fund-raising efforts to complete both the cleanup and subsequent development.

Once EPA approves the EE/CA and issues it for public review and comment, and then EPA issues the Action Memorandum selecting the removal action, consistent with the Statement of Work attached to the Order, UP will submit a draft *Conceptual Design Report* within 60 days of EPA's signature on the Action Memorandum. UP hopes to begin implementation in spring 2012.

At the present time, implementation of the entire proposed removal action in a single action starting in 2012 will not be possible by UP due primarily to budget constraints, the need for adoption of University Master Plan updates, and approval of development plans by the City of Portland. To accommodate several major new developments on its upper bluff campus (library expansion in 2012 and a new Recreation/Wellness Center ground-breaking in 2013), UP plans to construct a new sports practice field with associated paved parking areas on the northern and northwestern end of the River Campus property beginning in the spring of 2012. In addition, UP has begun discussions with its Athletic Department administrators to finalize plans to begin construction of a new NCAA Division 1 baseball field in the northwest quadrant of the River Campus in the summer of 2012. The field will be enhanced with lighting, outfield fences, batting facility, team dugouts, temporary bleacher seating, and adjacent paved parking lots. UP hopes to have the new baseball field and other amenities ready to host practices and games by the summer of 2013. Construction of a new baseball stadium with permanent seating would hopefully follow in 2 to 3 years, depending on the availability of funds.

Other projects envisioned by UP in the first 1-3 years following EE/CA approval include paved parking areas in the northeast quadrant of the River Campus, concrete pads marking potential future siting and construction of a Physical Plant complex involving several new buildings, and additional athletic-related facilities. All of the projects mentioned above are intended for areas of the River Campus where removal actions are expected and in which UP hopes to initiate activity early in 2012. The conceptual vision plan UP has produced for its River Campus is designed to phase new development activities to match the availability of funds with a goal of 50 percent to 75 percent completion within 10 to 15 years of final EE/CA approval.

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TABLES

TABLE 1

MULTI-INCREMENT SAMPLING RESULTS - UPLANDS AREAS[1,2,3]
University of Portland River Campus Property
Portland, Oregon

Area	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1254* (µg/kg)	PCBs Aroclor 1260* (µg/kg)	PCBs Total PCBs* (µg/kg)	Tributyltin (µg/kg)	Metals Arsenic* (mg/kg)	Metals Cadmium (mg/kg)	Metals Chromium (mg/kg)	Metals Copper (mg/kg)	Metals Lead (mg/kg)	Metals Nickel (mg/kg)	Metals Zinc (mg/kg)
EPA RSL - Protection of Groundwater SSL						8.8	24	NE	NE	1.3	1400	180,000,000	46,000	14000	48,000	680,000
1A	MIS A	10/20/2006	0-1	57	170	3.8 U	3.8 U	ND	--	1.6 J	0.02 U	8.3	20.7	14	14.1	53
	MIS B	10/20/2006	1-5	10	57	3.8 U	3.8 U	ND	--	1.7	0.02 U	10	19.6	15	15.6	54
	MIS C	10/20/2006	5-10	6	11	3.8 U	3.8 U	ND	--	1.6	0.02 U	9.3	16.7	5	14.9	47
1B	MIS A	10/26/2006	0-1	53 J	130 J	4.0 UJ	4.0 UJ	ND	--	1.5	0.02 U	10	19.1	15	14.5	68
	MIS B	10/26/2006	1-5	28 J	94 J	4.0 UJ	4.0 UJ	ND	--	1.9	0.02 U	10	19.4	19	14.1	68
	MIS C	10/26/2006	5-10	15 J	38 J	4.0 UJ	4.0 UJ	ND	--	1.5	0.02 U	10	15	5	14.2	49
1C	MIS A	10/25/2006	0-1	12	60	4.0 UJ	81 J	81	--	1.3	0.2	11	26.8	14	31.3	66
	MIS B	10/25/2006	1-5	7.1	40	4.0 UJ	4.0 UJ	ND	--	1	0.02 U	13	16.4	11	32.5	52
	MIS C	10/25/2006	5-10	0.4 U	11 U	4.0 UJ	4.0 UJ	ND	--	1.5	0.02 U	7	11.1	3	10.7	37
2A	MIS A	10/27/06	0-1	67 J	310 J	4.0 UJ	58 J	58	--	2.6	0.6	13	40.6	84	17.1	133
	MIS B	10/27/06	1-5	43 J	240 J	4.0 UJ	4.0 UJ	ND	--	3	0.02 U	12	35.3	29	17	115
	MIS C	10/27/06	5-10	5 J	18 J	4.0 UJ	4.0 UJ	ND	--	2.6	0.02 U	11	27.5	6	14.5	51
2A1	PS-2A1(A)	10/21/2009	0-1	--	--	16	15	31	--	2.6	0.2	12.9	37.4 J	56 J	20.4	111
	PSD-2A1(A)	10/28/2009	0-1	--	--	13	12	25	--	2.7	0.2	12.5	44.7 J	89 J	19.9	108
	PST-2A1(A)	11/3/2009	0-1	--	--	13	13	26	--	3.0	0.3	14.1	41.4 J	56 J	23.4	129
	PS-2A1(B)	10/21/2009	1-5	--	--	10	15	25	--	--	--	--	--	50 J	--	--
	PS-2A1(C)	10/21/2009	5-10	--	--	4.2	7.3	11.5	--	--	--	--	--	31 J	--	--
	PS-2A1(D)	10/21/2009	10-14	--	--	3.9 U	4.3	4.3	--	--	--	--	--	12 J	--	--
2B	MIS A	10/26/2006	0-1	37 J	150	4.0 UJ	90 J	90	--	7.8 J	0.4	13	46.5 J	60	16.1	149 J
	MIS B	10/26/2006	1-5	21 J	68	4.0 UJ	4.0 UJ	ND	--	1.6	0.02 U	11	20.1	20	15.4	59
	MIS C	10/26/2006	5-10	8 J	26	4.0 UJ	4.0 UJ	ND	--	1.8	0.02 U	11	14.9	5	14.7	44
3A	MIS A	10/27/2006	0-1	25 J	110 J	36 J	130 J	166	--	1.3 J	0.3	12	25.9	17	19.4	67
	MIS B	10/27/2006	1-5	5 J	21 J	4.0 UJ	4.0 UJ	ND	--	1	0.02 U	9	18.3	5	13.8	55
	MIS C	10/27/2006	5-10	6 J	13 J	4.0 UJ	4.0 UJ	ND	--	1	0.02 U	9	18	3	11.9	56
3B	MIS A	10/30/2006	0-1	42 J	170	150	490	643.9	--	1.4	0.02 U	9.3	26.3	15	14	57
	MIS B	10/30/2006	1-5	35 J	160	4.0 U	4.0 U	ND	--	0.9	0.02 U	10	24.2	16	15.8	59
	MIS C	10/30/2006	5-10	18 J	66	4.0 U	4.0 U	ND	--	0.9	0.02 U	11	18.6	3	17	49
3B1	PS-3B1(A)	10/27/2009	0-1	--	--	20 U	29	29	--	--	--	--	--	--	--	--
3B2	PS-3B2(A)	10/27/2009	0-1	--	--	100	190	290	--	--	--	--	--	--	--	--
3B3	PS-3B3(A)	10/27/2009	0-1	--	--	150	210	360	--	--	--	--	--	--	--	--
3B4	PS-3B4(A)	10/20/2009	0-1	--	--	3.9 U	3.9 U	--	--	--	--	--	--	--	--	--
4	MIS A	10/12/2006	0-1	29	140	3.8 U	3.8 U	ND	--	2.9	0.02 U	18.1	45.3	36	16.6 J	92
	MIS B	10/12/2006	1-5	29 J	400	3.8 U	3.8 U	ND	--	3	0.02 U	15	31.7	36 J	18.7	95
	MIS B DUP	10/12/2006	1-5	--	--	--	--	--	--	2.6	0.02 U	11.2	35.8	12 J	18.9	125
	MIS C	10/12/2006	5-10	9	40	3.8 U	3.8 U	ND	--	2.3	0.02 U	14	22.8	15	19	72
5A	MIS A	10/17/2006	0-1	84 J	340	4.0 U	4.0 U	ND	1.5 UJ	2 J	0.2	17 J	37 J	52 J	18.2 J	90 J
	MIS B	10/17/2006	1-5	110 J	390	4.0 U	4.0 U	ND	1.5 UJ	2.4	0.02 U	14.2	38.8	32	18.4	73
	MIS C	10/17/2006	5-10	26 J	96	4.0 U	4.0 U	ND	1.5 UJ	2	0.02 U	12.5	20.2	24	16.6	65

Area	Sample ID/ Location	Date	Depth (feet)	PAHs Pentachlorophenol* (µg/kg)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene*	Benzo(a)pyrene*	Benzo(b)fluoranthene*	Benzo(g,h,i)perylene	Benzo(k)fluoranthene*	Chrysene*	Dibenz(a,h)anthracene*	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene*	Naphthalene*	Phenanthrene	Pyrene	Dioxins* (TEQ)[4] (pg/g)
EPA RSL - Protection of Groundwater SSL				2	22,000		360,000	10	3.5	35		350	1,100	11	160,000	27,000	120	0.47		120,000	
1A	MIS A	10/20/2006	0-1	--	24 U	22 U	28 U	25 U	23 U	34 U	40 U	38 U	27 U	34 U	26 U	26 U	40 U	23 U	29 U	39 U	--
	MIS B	10/20/2006	1-5	--	24 U	22 U	28 U	25 U	23 U	34 U	40 U	38 U	27 U	34 U	26 U	26 U	40 U	23 U	29 U	39 U	--
	MIS C	10/20/2006	5-10	--	25 U	22 U	28 U	25 U	23 U	35 U	40 U	38 U	27 U	35 U	27 U	26 U	40 U	23 U	29 U	39 U	--
1B	MIS A	10/26/2006	0-1	--	630 J	23 UJ	1,500 J	1,400 J	1,400 J	990 J	460 J	840 J	1,400 J	48 J	4,300 J	850 J	450 J	410 J	6,600 J	3,500 J	--
	MIS B	10/26/2006	1-5	--	1,000 J	40 J	2,400 J	2,100 J	2,100 J	1,600 J	640 J	1,100 J	2,200 J	76 J	5,900 J	1,400 J	640 J	810 J	11,000 J	5,800 J	--
	MIS C	10/26/2006	5-10	--	120 J	22 UJ	300 J	330 J	310 J	170 J	89 J	240 J	340 J	ND	970 J	160 J	78 J	23 UJ	1,300 J	870 J	--
1C	MIS A	10/25/2006	0-1	6.6 J	25 UJ	22 U	28 U	25 U	23 U	35 U	40 U	38 U	27 U	35 U	81	26 U	40 U	23 UJ	29 U	70	--
	MIS B	10/25/2006	1-5	4.3 U	25 UJ	22 U	29 U	84	120	92	88	88	110	ND	200	ND	79	ND	120	190	--
	MIS C	10/25/2006	5-10	4.4 U	25 UJ	23 UJ	29 UJ	26 UJ	24 UJ	36 UJ	42 UJ	39 UJ	28 UJ	36 UJ	28 UJ	27 UJ	42 UJ	24 UJ	30 UJ	41 UJ	--
2A	MIS A	10/27/06	0-1	--	260 J	22 UJ	420 J	510 J	560 J	370 J	240 J	380 J	610 J	34 UJ	1,300 J	310 J	230 J	200 J	1,900 J	1,200 J	--
	MIS B	10/27/06	1-5	--	25 UJ	22 UJ	29 UJ	25 UJ	24 UJ	35 UJ	40 UJ	38 UJ	40 J	35 UJ	51 J	26 UJ	41 UJ	24 UJ	35 J	54 J	--
	MIS C	10/27/06	5-10	--	25 UJ	22 UJ	28 UJ	40 J	23 UJ	35 UJ	40 UJ	38 UJ	38 J	35 UJ	66 J	26 UJ	40 UJ	23 UJ	29 UJ	66 J	--
2A1	PS-2A1(A)	10/21/2009	0-1	--	44 U	44 U	4.9 J	19 J	53	28 J	66	49	58	10 J	31 J	44 U	58	5.3 J	21 J	58	--
	PSD-2A1(A)	10/28/2009	0-1	--	46 U	4.6 J	6.9 J	50	28 J	23 J	24 J	23 J	60	46 U	73	7.3 J	20 J	16 J	50	78	--
	PST-2A1(A)	11/3/2009	0-1	--	44 U	44 U	5.8 J	22 J	25 J	22 J	29 J	17 J	33 J	44 U	38 J	44 U	16 J	7.5 J	26 J	44	--
	PS-2A1(B)	10/21/2009	1-5	--	46 U	7.4 J	83	60	56	46	46	46	100	12 J	88	5.1 J	32 J	12 J	74	120	--
	PS-2A1(C)	10/21/2009	5-10	--	45 U	4.5 J	14 J	54	50	36 J	38 J	32 J	77	9.9 J	86	45 U	28 J	5.9 J	45	120	--
	PS-2A1(D)	10/21/2009	10-14	--	6.7 J	48 U	20 J	32 J	24 J	20 J	19 J	18 J	52	6.2 J	67	9.5 J	15 J	4.8 J	67	71	--
2B	MIS A	10/26/2006	0-1	--	25 UJ	22 UJ	28 UJ	25 UJ	23 UJ	35 UJ	40 UJ	38 UJ	27 UJ	35 UJ	34 J	26 UJ	40 UJ	23 UJ	29 UJ	39 UJ	--
	MIS B	10/26/2006	1-5	--	25 UJ	22 UJ	29 UJ	49 J	33 J	35 J	41 UJ	38 J	61 J	35 UJ	100 J	26 UJ	41 UJ	24 UJ	80 J	100 J	--
	MIS C	10/26/2006	5-10	--	25 UJ	22 UJ	28 UJ	38 J	34 J	35 UJ	40 UJ	38 UJ	44 J	35 UJ	71 J	26 UJ	40 UJ	23 UJ	47 J	68 J	--
3A	MIS A	10/27/2006	0-1	--	25 UJ	22 UJ	29 UJ	25 UJ	24 UJ	35 UJ	40 UJ	38 UJ	27 UJ	35 UJ	27 UJ	26 UJ	40 UJ	24 UJ	29 UJ	39 UJ	--
	MIS B	10/27/2006	1-5	--	25 UJ	22 UJ	29 UJ	26 UJ	24 UJ	35 UJ	41 UJ	39 UJ	27 UJ	35 UJ	27 UJ	27 UJ	41 UJ	24 UJ	29 UJ	40 UJ	--
	MIS C	10/27/2006	5-10	--	24 UJ	22 UJ	28 UJ	25 UJ	23 UJ	35 UJ	40 UJ	38 UJ	27 UJ	35 UJ	26 UJ	26 UJ	40 UJ	23 UJ	29 UJ	39 UJ	--
3B	MIS A	10/30/2006	0-1	--	24 UJ	22 UJ	28 U	25 U	23 U	34 U	40 U	38 U	27 U	34 U	36 J	26 UJ	40 UJ	23 UJ	29 U	39 U	--
	MIS B	10/30/2006	1-5	--	25 UJ	22 UJ	28 U	43 J	40 J	35 U	40 U	38 U	57 J	35 U	93	26 UJ	40 UJ	23 UJ	75	89	--
	MIS C	10/30/2006	5-10	--	25 UJ	22 U	28 U	25 U	23 U	35 U	40 U	38 U	27 U	35 U	26 U	26 UJ	40 UJ	23 UJ	29 U	39 U	--
3B1	PS-3B1(A)	10/27/2009	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3B2	PS-3B2(A)	10/27/2009	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3B3	PS-3B3(A)	10/27/2009	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3B4	PS-3B4(A)	10/20/2009	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4	MIS A	10/12/2006	0-1	--	24 U	22 U	28 U	25 U	23 U	34 U	63	38 U	27 U	34 U	26 U	26 U	40 U	23 U	29 U	39 U	4.25
	MIS B	10/12/2006	1-5	--	24 U	22 U	28 U	25 U	23 U	34 U	40 U	38 U	27 U	34 U	26 U	26 U	40 U	23 U	29 U	39 U	--
	MIS B DUP	10/12/2006	1-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	--
	MIS C	10/12/2006	5-10	--	25 U	22 U	29 U	25 U	24 U	35 U	40 U	38 U	27 U	35 U	27 U	26 U	40 U	24 U	29 U	39 U	--
5A	MIS A	10/17/2006	0-1	--	24 UJ	22 U	28 U	25 U	23 U	34 U	40 U	38 U	27 U	34 U	64	26 U	40 U	23 UJ	29 U	39 U	6.78
	MIS B	10/17/2006	1-5	--	25 UJ	22 U	28 U	25 U	23 U	35 U	40 U	38 U	27 U	35 U	27 U	26 U	40 U	23 UJ	29 U	39 U	--
	MIS C	10/17/2006	5-10	--	24 UJ	22 U	28 U	25 U	23 U	34 U	40 U	38 U	27 U	34 U	26 U	26 U	40 U	23 UJ	29 U	39 U	--

TABLE 1

MULTI-INCREMENT SAMPLING RESULTS - UPLANDS AREAS[1,2,3]
University of Portland River Campus Property
Portland, Oregon

Area	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1254* (µg/kg)	PCBs Aroclor 1260* (µg/kg)	PCBs Total PCBs* (µg/kg)	Tributyltin (µg/kg)	Metals Arsenic* (mg/kg)	Metals Cadmium (mg/kg)	Metals Chromium (mg/kg)	Metals Copper (mg/kg)	Metals Lead (mg/kg)	Metals Nickel (mg/kg)	Metals Zinc (mg/kg)	PAHs Pentachlorophenol* (µg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)	Dioxins* (TEQ)[4] (pg/g)
EPA RSL - Protection of Groundwater SSL						8.8	24	NE	NE	1.3	1400	180,000,000	46,000	14000	48,000	680,000	2	22,000		360,000	10	3.5	35		350	1,100	11	160,000	27,000	120	0.47		120,000	
5B	MIS A	10/13/2006	0-1	79 J	270	81	78	159	--	2.6	0.3	12	32.2	32 J	18.2	73	--	24 U	22 U	28 U	51 J	60 J	82	46 J	59 J	83	34 U	110	26 U	40 U	23 U	58 J	130	10.99
	MIS B	10/13/2006	1-5	30 J	120	4.0 U	4.0 U	ND	--	1.1	0.02 U	5.1	9.4	10	7.5	31	--	24 U	22 U	28 U	62 J	62 J	65	40 U	49 J	72	34 U	98	26 U	40 U	23 U	29 U	100	--
	MIS C	10/13/2006	5-10	26 J	77	4.0 UJ	4.0 UJ	ND	--	2.3	0.02 U	20.3	19.3	13	23.5	58	--	25 U	22 U	28 U	39 J	39 J	35 U	40 U	38 U	49 J	35 U	69	26 U	40 U	23 U	55 J	85	--
6A	MIS A	10/17/2006	0-1	82	380	38	51	89	81 J	2.7	0.2	13.5	52.9	23	16.4	113	--	140 J	22 U	290	870	710	590	290	580	1,000	150	2,000	71	290	23 UJ	990	1,600	5.22
	MIS B	10/17/2006	1-5	100	250	4.0 U	4.0 U	ND	1.4 UJ	2.3	0.02 U	10.1	39.7	19	13.9	173	--	25 UJ	22 U	28 U	25 U	77	71	84	38 U	84	35 U	150	26 U	40 U	23 UJ	120	150	--
	MIS B DUP	10/17/2006	1-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25 UJ	22 U	29 U	25 U	67	35 U	68	38 U	71	35 U	120	26 U	40 U	24 UJ	110	120	--
	MIS C	10/17/2006	5-10	340	340	4.0 U	4.0 U	ND	1.4 UJ	2.2	0.02 U	9.3	18	201	14.9	65	--	25 UJ	22 UJ	29 UJ	25 UJ	24 UJ	35 UJ	40 UJ	38 UJ	27 UJ	35 UJ	95 J	69 J	41 UJ	24 UJ	170 J	92 J	--
6B	MIS A	10/23/2006	0-1	40	150	3.8 U	29 J	29	--	2.9	0.3	15.9	30.5 J	36	17.8	98	--	25 U	64	28 U	190	280	360	300	180	270	77	440	26 U	220	23 U	290	400	3.15
	MIS B	10/23/2006	1-5	24	76	3.8 U	3.8 U	ND	--	2.2	0.02 U	10.4	19.8	9	16.5	64	--	25 U	22 U	28 U	25 U	23 U	35 U	40 U	38 U	27 U	35 U	27 U	26 U	40 U	23 U	29 U	39 U	--
	MIS C	10/23/2006	5-10	9	20	3.8 U	3.8 U	ND	--	2.1	0.02 U	10.4	14.4	3	15.9	48	--	25 U	22 U	29 U	25 U	24 U	35 U	40 U	38 U	27 U	35 U	27 U	26 U	40 U	24 U	29 U	39 U	--
6C	MIS A	10/25/2006	0-1	26 J	210	4.0 UJ	91 J	91	1.5 UJ	3.8	0.2	19	55	89	16	222	--	25 UJ	22 UJ	28 UJ	50 J	67 J	42 J	40 UJ	59 J	70 J	35 UJ	88 J	26 UJ	40 UJ	23 UJ	36 J	80 J	3.67
	MIS B	10/25/2006	1-5	22 J	170	4.0 UJ	23 J	23	1.5 UJ	4.1	0.02 U	26	77.2	13	21.4	330	--	26 UJ	23 UJ	30 UJ	26 UJ	24 UJ	36 UJ	42 UJ	40 UJ	36 J	36 UJ	50 J	27 UJ	42 UJ	24 UJ	40 J	42 J	--
	MIS C	10/25/2006	5-10	69 J	470	4.0 UJ	4.0 UJ	ND	1.5 UJ	4.8	0.02 U	18	86.5	32	17.3	100	--	33 J	23 UJ	43 J	72 J	67 J	50 J	42 UJ	56 J	82 J	36 UJ	210 J	27 UJ	42 UJ	24 UJ	170 J	160 J	--
6D	MIS A	10/23/2006	0-1	50	200	3.8 U	33 J	33	--	2.9 J	0.3	17	60.5 J	32	17	230 J	11 J	24 U	22 U	28 U	160	150	180	130	130	240	34 U	280	26 U	100	23 U	150	280	24.9
	MIS B	10/23/2006	1-5	160	300	3.8 U	3.8 U	ND	--	2.2	0.02 U	11.5	23.2	13	17.4	73	--	25 U	22 U	28 U	25 U	23 U	35 U	40 U	38 U	79	35 U	74	26 U	40 U	23 U	29 U	39 U	2
	MIS C	10/23/2006	5-10	210	430	3.8 U	3.8 U	ND	--	1.9	0.02 U	11.7	15.9	9	17.3	58	--	24 U	22 U	28 U	25 U	23 U	34 U	40 U	38 U	64	34 U	76	26 U	40 U	23 U	29 U	63	--
6D1	MIS A	10/27/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	49.8
6D2	MIS A	10/27/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9.2
6D3	MIS A	10/30/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	29

Notes
1. Results shown only for analytes that were detected in at least one sample.
2. Data Qualifiers are as follows:
   J = analyte was positively identified; result is an estimated concentration.
   U = analyte was not detected. Value shown is the reporting limit.
   UJ = analyte was not detected. Value shown is estmated reporting limit.
   NE = screening level not established.
   ND = analyte not detected at or above laboratory reporting limit.
   -- = not analyzed.
3. Analytes marked with an asterisk are considered carcinogens based on EPA criteria (EPA, 2009, 2010).
4. Total TEQ is 2,3,7,8-TCDD toxicity equivalent summed for all congeners. TEQ for each congener is calculated by multiplying analytical results by the WHO 2,3,7,8-TCDD Toxicity Equivalency Factors for dioxin congeners (Van den Burg et al., 2006). TEQs were conservatively calculated using a value of one-half the detection limit for all nondetected congeners.

Abbreviations
µg/kg = micrograms per kilogram
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
EPA = US Environmental Protection Agency
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
pg/g = picograms (10^{-12} grams) per gram
SSL = soil screening level
TEQ = 2,3,7,8-TCDD toxicity equivalents
TPH = total petroleum hydrocarbons
WHO = World Health Organization

TABLE 2

MULTI-INCREMENT SAMPLING RESULTS - RIVER SHORELINE AREAS [1,2,3]
University of Portland, River Campus Property
Portland, Oregon

Area	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1254* (µg/kg)	PCBs Aroclor 1260* (µg/kg)	PCBs Total PCBs* (µg/kg)	Tributyltin (µg/kg)	Metals Arsenic* (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	PAHs Acenaphthene (µg/kg)	Acenaphthylene (µg/kg)	Anthracene (µg/kg)	Benzo(a)anthracene* (µg/kg)	Benzo(a)pyrene* (µg/kg)	Benzo(b)fluoranthene* (µg/kg)	Benzo(g,h,i)perylene (µg/kg)	Benzo(k)fluoranthene* (µg/kg)	Chrysene* (µg/kg)	Dibenz(a,h)anthracene* (µg/kg)	Fluoranthene (µg/kg)	Fluorene (µg/kg)	Indeno(1,2,3-cd)pyrene* (µg/kg)	Naphthalene* (µg/kg)	Phenanthrene (µg/kg)	Pyrene (µg/kg)	Dioxins* (TEQ)[4] (pg/g)
JSCS Screening Level [5]				NE		300	200	0.39	2.3	7 [6]	1	111 [7]	149	17	49	459	300	200	845	1,050	1,450	NE	300	13,000	1,290	1,300	2,230	300	100	561	1,170	1,520	0.0091
EPA Protection of Groundwater SSL				NE	NE	8.8	24	NE	NE	1.3	1400	180,000,000	46,000	14,000	48,000	680,000	22,000	NE	360,000	10	3.5	35	NE	350	1,100	11	160,000	27,000	120	0.47	NE	120,000	NE
PH Lowest Screening Level[8]				NE	NE	NE	NE	0	3.5E+03	0.4	NE	NE	NE	36	NE	NE	NE	NE	NE	8.1E+02	4.2E+01	6.9E+03	NE	1.5E+05	NE	6.9E+02	NE	NE	6.9E+03	NE	NE	NE	0
PH Highest Screening Level[8]				NE	NE	NE	NE	5.0E+03	8.9E+04	540	NE	NE	NE	3.0E+06	NE	NE	NE	NE	NE	3.7E+07	2.4E+07	6.9E+05	NE	1.1E+09	NE	6.9E+04	NE	NE	6.9E+05	NE	NE	NE	9.1E+02
RS-1	MIS A	10/25/2006	0-1	22	110	4.0 U	28 J	28	4.2 J	3.8 J	0.02 U	14 J	39.7 J	23	15.5	94	25 U	22 U	41 J	40 J	48 J	57 J	40 U	38 U	53 J	35 U	81	26 U	40 U	23 UJ	50 J	76	23.8
	MIS B	10/25/2006	1-5	91	370	35	33 J	68	12 J	3.6	0.02 U	15	71.3	22	16.8	107	42 J	80	74	220	280	230	130	290	290	35 U	620	75	120	62 J	500	530	2.9
	MIS C	10/25/2006	5-10	76	350	39	30 J	69	13 J	3.2	0.02 U	14	36.6	16	24.2	89	63 J	130	170	460	520	520	200	450	540	35 U	1,300	120	210	82 J	950	1,100	5.1
RS-1A	MIS A	10/30/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13.9
RS-1B	MIS A	10/30/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4
RS-1C	MIS A	10/30/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.4
RS-1D	MIS A	10/30/09	0-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	29.6
RS-2	MIS A	10/19/2006	0-1	57 J	260 J	72 J	120 J	192	6.1 J	2.2	0.3	15	33.8	33	17.7	115	25 UJ	22 UJ	29 UJ	33 J	49 J	35 UJ	51 J	48 J	47 J	35 UJ	48 J	26 UJ	41 UJ	24 UJ	29 UJ	59 J	3.04
	MIS B	10/19/2006	1-5	30 J	110 J	4.0 UJ	4.0 UJ	ND	1.5 UJ	2.3	0.02 U	13	28.8	13	16.2	98	25 UJ	22 UJ	28 UJ	25 UJ	23 UJ	35 UJ	40 UJ	38 UJ	27 UJ	35 UJ	27 UJ	26 UJ	40 UJ	23 UJ	29 UJ	39 UJ	--
	MIS C	10/19/2006	5-10	42 J	280 J	4.0 UJ	4.0 UJ	ND	26 J	2.4	0.02 U	14	40.8	10	22.2	63	24 UJ	22 UJ	28 UJ	25 UJ	23 UJ	34 UJ	40 UJ	38 UJ	32 J	34 UJ	33 J	26 UJ	40 UJ	23 UJ	29 UJ	40 J	--
RS-3	MIS A	10/13/2006	0-1	36 J	230	4.0 U	58	58	--	2.4	0.02 U	12.7	35.2	37	16.1	58	24 U	22 U	28 U	44 J	38 J	66	40 U	48 J	75	34 U	120	26 U	40 U	23 U	39 J	100	12.65
	MIS A DUP	10/13/2006	0-1	--	--	3.9 U	57	57	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MIS B	10/13/2006	1-5	35 J	110	4.0 U	4.0 U	ND	--	1.8	0.02 U	9.7	21.2	32	15.2	57	24 U	22 U	28 U	34 J	35 J	36 J	40 U	38 U	48 J	35 U	82	26 U	40 U	23 U	110	82	1.31
	MIS C	10/13/2006	5-10	31 J	120	4.0 U	4.0 U	ND	--	1.9	0.02 U	12.7	24.2	30	16.1	62	24 U	22 U	28 U	52 J	56 J	47 J	52 J	46 J	67	35 U	100	26 U	41 J	23 U	72	100	--

Notes
1. Results shown only for analytes that were detected in at least one sample.
2. Data Qualifiers are as follows:
   J = analyte was positively identified; result is an estimated concentration.
   U = analyte was not detected. Value shown is the reporting limit.
   UJ = analyte was not detected. Value shown is estmated reporting limit.
   NE = screening level not established.
   ND = analyte not detected at or above laboratory reporting limit.
   -- = not analyzed.
3. Analytes marked with an asterisk are considered carcinogens based on EPA criteria (EPA, 2009, 2010).
4. Total TEQ is 2,3,7,8-TCDD toxicity equivalent summed for all congeners. TEQ for each congener is calculated by multiplying analytical results by the WHO 2,3,7,8-TCDD Toxicity Equivalency Factors for dioxin congeners (Van den Burg et al., 2006). TEQs were conservatively calculated using a value of one-half the detection limit for all nondetected congeners.
5. JSCS screening level for the Portland Harbor Superfund Site (US EPA and DEQ, 2007).
6. The screening level for arsenic is the background concentration for arsenic in the Portland Harbor area given by Oregon DEQ in a memorandum dated October 28, 2002.
7. Value shown is for chromium(III).
8. Portland Harbor screening levels are draft early preliminary remediation goals dated March 27, 2009 (EPA, 2009).

Abbreviations
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
DEQ = Oregon Department of Environmental Quality
EPA = US Environmental Protection Agency
JSCS = Joint Source Control Strategy
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
pg/g = picograms (10^{-12} grams) per gram
PH = Portland Harbor
SSL = soil screening level
TEQ = 2,3,7,8-TCDD toxicity equivalents
TPH = total petroleum hydrocarbons
WHO = World Health Organization

TABLE 3

HOT SPOT AREAS IDENTIFIED IN THE 2005 DEQ RECORD OF DECISION[1,2,3]
University of Portland River Campus Property
Portland, Oregon

Hot Spot	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1242* (µg/kg)	PCBs Aroclor 1254* (µg/kg)	PCBs Aroclor 1260* (µg/kg)	PCBs Total PCBs* (µg/kg)	Metals Lead (mg/kg)	Metals Arsenic (mg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)
DEQ Risk-Based Concentration (RBC) Screening Levels: Ingestion , Dermal Contact, and Inhalation			Residential	3,900		NE	NE	NE	220	400	0.39	4,700,000	NE	23,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	3,100,000	150	4,600	NE	1,700,000
			Commercial	23,000		NE	NE	NE	NE	800	1.7	61,000,000	NE	93,000,000	2,700	270	2,700	NE	27,000	270,000	270	8,900,000	12,000,000	2,700	23,000	NE	6,700,000
EPA Regional Screening Level (RSL)[4]			Residential	NE		220	220	220	220	400	0.43	3,400,000	NE	17,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	2,300,000	150	3,600	NE	1,700,000
			Industrial	NE		740	740	740	740	800	1.6	33,000,000	NE	170,000,000	2,100	210	2,100	NE	21,000	210,000	210	22,000,000	22,000,000	2,100	18,000	NE	17,000,000
JSCS Screening Level				NE		NE	300	200	0.39	17	7[5]	300	200	845	1,050	1,450	NE	300	13,000	1,290	1,300	2,230	300	100	561	1,170	1,520
ROD Cleanup Levels for Human Receptors[6]				500	500	NE	NE	1,000	NE	750[7]	6[8]	NE	NE	NE	1,700	170	1,700	NE	NE	NE	170	NE	NE	1,700	NE	NE	NE
PH Lowest Screening Level[9]				NE	NE	NE	NE	NE	0	36	0.4	NE	NE	NE	810	42	6,900	NE	150,000	NE	690	NE	NE	6,900	NE	NE	NE
PH Highest Screening Level[9]				NE	NE	NE	NE	NE	5,000	3,000,000	540	NE	NE	NE	37,000,000	24,000,000	690,000	NE	1,100,000,000	NE	690,000	NE	NE	690,000	NE	NE	NE
A2-1	GP-37	5/26/1999	1.3	26,000	--	--	--	--	--	--	--	--	--	ND	190	ND	ND	ND	ND	ND	ND	ND	5,600	ND	1,600	7,100	320
	GP-37	5/26/1999	5	ND	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.1	ND
	GP-37	5/26/1999	15	ND	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-135	8/8/2000	1	1,800	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-01	11/28/2005	4	ND	97	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-01	11/28/2005	7	ND	680	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A2-01	11/28/2005	2	ND	ND	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A2-02	11/28/2005	4	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-02	11/28/2005	2	ND	750	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-03	11/28/2005	4	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-03	11/28/2005	2	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-04	11/28/2005	4	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-04	11/28/2005	2	ND	ND	--	--	--	--	--	--	ND	ND	ND	80	ND	70	ND	60	150	ND	120	60	ND	200	240	190
	DP-A2-05	11/28/2005	4	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-05	11/28/2005	2	ND	ND	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	60	ND	ND	ND	ND	140	160	50
	WS-2A(9.0-10.0)-16	10/30/2006	9-10	10,000	17,000	--	--	--	--	--	--	630 J	ND	ND	ND	ND	ND	ND	ND	1,600	ND	ND	2,900	ND	ND	ND	470
	RC-4	10/20/2009	1.5-2.5	63	200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	RC-4	10/20/2009	3.5-4.5	5.5 U	11 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A2-3	TP-1	9/5/1996	0.5	--	--	--	--	--	--	4,260	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	TP-1	9/5/1996	4	--	--	--	--	--	--	1,550	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-174	8/7/2000	0.5	--	--	--	--	--	--	550	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-09	11/28/2005	2	--	--	--	--	--	--	3.22	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-09	11/28/2005	6	--	--	--	--	--	--	2.06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-10	11/28/2005	2	--	--	--	--	--	--	10.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-10	11/28/2005	6	--	--	--	--	--	--	2.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-11	11/28/2005	2	--	--	--	--	--	--	8.21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A2-11	11/28/2005	6	--	--	--	--	--	--	2.76	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A5-11	GP-82	6/11/1999	0.5	24	ND	--	--	--	--	--	--	ND	5.9	2.2	2.7	7	9.4	8.7	2.7	4	ND	4.3	ND	6.8	3.1	2.5	4.9
	GP-82	6/11/1999	5	45	81	--	--	--	--	--	--	380	14,000	12,000	36,000	75,000	65,000	38,000	26,000	43,000	6,800	79,000	6,700	30,000	9,400	51,000	120,000
	GP-153	8/10/2000	5	--	--	--	--	--	--	--	--	ND	0.5	ND	0.9	1	1.3	--	1	ND	ND	3.8	ND	ND	ND	1	3.4
	GP-154	8/10/2000	5	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-154	8/10/2000	9	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-155	8/10/2000	5	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-155	8/10/2000	8.7	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-156	8/10/2000	5	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-156	8/10/2000	10	--	--	--	--	--	--	--	--	100	120	100	60	120	69	110	45	64	ND	390	95	100	660	560	340

TABLE 3

HOT SPOT AREAS IDENTIFIED IN THE 2005 DEQ RECORD OF DECISION[1,2,3]
University of Portland River Campus Property
Portland, Oregon

Hot Spot	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1242* (µg/kg)	PCBs Aroclor 1254* (µg/kg)	PCBs Aroclor 1260* (µg/kg)	PCBs Total PCBs* (µg/kg)	Metals Lead (mg/kg)	Metals Arsenic (mg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)
DEQ Risk-Based Concentration (RBC) Screening Levels: Ingestion , Dermal Contact, and Inhalation			Residential	3,900		NE	NE	NE	220	400	0.39	4,700,000	NE	23,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	3,100,000	150	4,600	NE	1,700,000
			Commercial	23,000		NE	NE	NE	NE	800	1.7	61,000,000	NE	93,000,000	2,700	270	2,700	NE	27,000	270,000	270	8,900,000	12,000,000	2,700	23,000	NE	6,700,000
EPA Regional Screening Level (RSL)[4]			Residential	NE		220	220	220	220	400	0.43	3,400,000	NE	17,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	2,300,000	150	3,600	NE	1,700,000
			Industrial	NE		740	740	740	740	800	1.6	33,000,000	NE	170,000,000	2,100	210	2,100	NE	21,000	210,000	210	22,000,000	22,000,000	2,100	18,000	NE	17,000,000
JSCS Screening Level				NE		NE	300	200	0.39	17	7[5]	300	200	845	1,050	1,450	NE	300	13,000	1,290	1,300	2,230	300	100	561	1,170	1,520
ROD Cleanup Levels for Human Receptors[6]				500	500	NE	NE	1,000	NE	750[7]	6[8]	NE	NE	NE	1,700	170	1,700	NE	NE	NE	170	NE	NE	1,700	NE	NE	NE
A5-11 (Continued)	DP-A5-36	11/30/2005	4	--	--	--	--	--	--	--	--	ND	ND	ND	159	204.5	159	113.6	125	170	ND	261	ND	136	ND	ND	329.5
	DP-A5-36	11/30/2005	8	--	--	--	--	--	--	--	--	ND	ND	ND	92	52.6	52.6	52.6	65.79	157.89	ND	130	ND	ND	ND	ND	170
	DP-A5-37	11/30/2005	4	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	65.9
	DP-A5-37	11/30/2005	8	--	--	--	--	--	--	--	--	1,159	61,000	39,630	390,000	610,000	490,000	420,000	280,000	400,000	65,500	920,000	4,597	490,000	40,000	94,000	1,200,000
	DP-A5-37	11/30/2005	11.5	--	--	--	--	--	--	--	--	ND	ND	ND	253	260	140	230	210	428.57	ND	837	ND	164.8	ND	ND	1,110
	DP-A5-38	11/30/2005	4	--	--	--	--	--	--	--	--	ND	ND	ND	103	110	57.47	103	103	126	ND	229	ND	103	ND	ND	275.86
	DP-A5-38	11/30/2005	8	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RC-5	10/20/2009	4.5-5.5	--	--	--	--	--	--	--	--	ND	ND	ND	7.4	13	8.9	19	8.9	11	5.0 U	12	5.0 U	12	6.4	12	17
	RC-5	10/20/2009	7.5-8.5	--	--	--	--	--	--	--	--	ND	310	340	2,200	3,600	1,900	2,800	1,900	2,300	490	5,400	80	2,000	590	1,900	6,800
	RC-5	10/20/2009	11-12	--	--	--	--	--	--	--	--	ND	160	140	1,400	2,300	1,200	1,800	1,200	1,600	260	3,200	29	1,300	290	490	4,300
A5-13	DP-A5-48	12/1/2005	0.5	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-49	12/1/2005	0.5	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-79	6/2/1999	0.5	470	430	300	ND	2,100	2,400	--	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23	ND	ND	ND	17	22
	GP-79	6/2/1999	2	820	460	ND	ND	ND	ND	--	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-79	6/2/1999	4.5	38	76	ND	ND	ND	ND	--	1.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-150	8/9/2000	0.5	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-151	8/9/2000	0.5	--	--	ND	200	ND	200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-152	8/9/2000	0.5	--	--	ND	ND	120	120	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A4-5	GP-73	6/2/1999	0.5	--	--	ND	ND	ND	ND	--	--	ND	ND	270	340	160	100	ND	ND	510	ND	280	ND	ND	100	170	1,200
	GP-73	6/2/1999	5	--	--	720	ND	4,300	5,020	--	--	6.5	22	24	130	120	120	61	ND	160	28	130	11	49	20	91	200
	GP-73	6/2/1999	11.5	--	--	ND	ND	ND	ND	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	ND	ND	ND	ND	14
	GP-146	8/9/2000	5	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-147	8/9/2000	1	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-147	8/9/2000	3.5	--	--	ND	ND	ND	ND	--	--	ND	22	ND	43	30	41	ND	ND	49	ND	53	ND	ND	53	53	77
	GP-149	8/9/2000	0.5	--	--	--	--	--	--	--	--	ND	ND	ND	27	29	40	25	ND	33	ND	65	ND	ND	ND	50	73
	GP-149	8/9/2000	4	--	--	ND	ND	ND	ND	--	--	71	ND	ND	110	56	100	40	42	100	ND	140	27	54	820	60	150
	GP-148	8/9/2000	0.5	--	--	--	--	--	--	--	--	ND	ND	ND	24	ND	32	ND	ND	32	ND	55	ND	ND	ND	26	46
	GP-148	8/9/2000	4	--	--	ND	ND	ND	ND	--	--	ND	ND	ND	80	61	76	41	39	87	ND	110	ND	52	26	63	120
	DP-A4-15	11/29/2005	6	--	--	ND	ND	ND	ND	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50	ND	ND	ND	ND	50
	DP-A4-15	11/29/2005	7	--	--	--	--	--	--	--	--	ND	ND	70	ND	70	130	ND	130	310	ND	470	ND	ND	ND	110	400
	DP-A4-16	11/29/2005	6	--	--	ND	ND	ND	ND	--	--	ND	ND	ND	ND	ND	ND	ND	ND	60	ND	50	ND	ND	ND	ND	50
	DP-A4-16	11/29/2005	7.5	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A4-17	11/29/2005	6	--	--	--	--	--	--	--	--	ND	ND	450	940	710	950	310	1,000	2,000	ND	1,300	ND	380	ND	290	1,200
	DP-A4-17	11/29/2005	8	--	--	--	--	--	--	--	--	ND	ND	ND	200	110	140	ND	170	370	ND	390	ND	50	ND	130	370
A5-12A/B	GP-88	6/2/1999	0.5	79	ND	ND	360	ND	360	--	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-88	6/2/1999	5	25	ND	ND	ND	ND	ND	--	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-88	6/2/1999	12	--	--	ND	ND	ND	ND	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-89	6/3/1999	0.5	6,400	860	ND	440	ND	440	--	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-89	6/3/1999	5	36	ND	ND	ND	ND	ND	--	1.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-89	6/3/1999	15	--	--	ND	ND	ND	ND	--	1.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-160	8/9/2000	0.5	230	660	ND	1,300	ND	1,300	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 3

HOT SPOT AREAS IDENTIFIED IN THE 2005 DEQ RECORD OF DECISION[1,2,3]
University of Portland River Campus Property
Portland, Oregon

Hot Spot	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1242* (µg/kg)	PCBs Aroclor 1254* (µg/kg)	PCBs Aroclor 1260* (µg/kg)	PCBs Total PCBs* (µg/kg)	Metals Lead (mg/kg)	Metals Arsenic (mg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)
DEQ Risk-Based Concentration (RBC) Screening Levels: Ingestion , Dermal Contact, and Inhalation			Residential	3,900		NE	NE	NE	220	400	0.39	4,700,000	NE	23,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	3,100,000	150	4,600	NE	1,700,000
			Commercial	23,000		NE	NE	NE	NE	800	1.7	61,000,000	NE	93,000,000	2,700	270	2,700	NE	27,000	270,000	270	8,900,000	12,000,000	2,700	23,000	NE	6,700,000
EPA Regional Screening Level (RSL)[4]			Residential	NE		220	220	220	220	400	0.43	3,400,000	NE	17,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	2,300,000	150	3,600	NE	1,700,000
			Industrial	NE		740	740	740	740	800	1.6	33,000,000	NE	170,000,000	2,100	210	2,100	NE	21,000	210,000	210	22,000,000	22,000,000	2,100	18,000	NE	17,000,000
JSCS Screening Level				NE		NE	300	200	0.39	17	7[5]	300	200	845	1,050	1,450	NE	300	13,000	1,290	1,300	2,230	300	100	561	1,170	1,520
ROD Cleanup Levels for Human Receptors[6]				500	500	NE	NE	1,000	NE	750[7]	6[8]	NE	NE	NE	1,700	170	1,700	NE	NE	NE	170	NE	NE	1,700	NE	NE	NE
A5-12A/B (Continued)	GP-160	8/9/2000	3.5	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-160	8/9/2000	6	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-162	8/7/2000	0.5	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	GP-161	8/7/2000	0.5	--	--	ND	700	ND	700	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-39	11/30/2005	3	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-40	11/30/2005	3	1,800	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-40	11/30/2005	8	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-41	11/30/2005	1	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-41	11/30/2005	3	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-42	11/30/2005	1	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-42	11/30/2005	3	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-43	11/30/2005	1	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-43	11/30/2005	3	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-44	11/30/2005	1	--	--	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-44	11/30/2005	3	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-45	11/30/2005	12	--	--	--	--	--	--	--	1.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-45	11/30/2005	14	--	--	--	--	--	--	--	2.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-46	11/30/2005	12	--	--	--	--	--	--	--	3.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-46	11/30/2005	15	--	--	--	--	--	--	--	3.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-47	11/30/2005	12	--	--	--	--	--	--	--	1.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A5-47	11/30/2005	14	--	--	--	--	--	--	--	27.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes
1. Results shown only for analytes that were detected in at least one sample.
2. Data Qualifiers are as follows:
   J = analyte was positively identified; result is an estimated concentration.
   U = analyte was not detected. Value shown is the reporting limit.
   UJ = analyte was not detected. Value shown is estmated reporting limit.
   NE = screening level not established.
   ND = analyte not detected at or above laboratory reporting limit.
   -- = not analyzed.
3. Analytes marked with an asterisk are considered carcinogens based on EPA criteria (EPA, 2009, 2010).
4. EPA screening levels are based on tabulated Regional Screening Levels (RSLs) for residential and industrial users (EPA, 2011). Analytes marked with an asterisk are considered carcinogens. For further information see Section 3.3 in the text.
5. The JSCS Screening Level for arsenic is the background concentration for arsenic in the Portland Harbor area given by Oregon DEQ in a memorandum dated October 28, 2002.
6. Cleanup levels are based on Table 5 from the 2005 DEQ ROD.
7. Cleanup level is an EPA prelimiatry remediation goal (PRG) for lead in an industrial setting, and is based on the rish of uptake of lead into the blood stream.
8. The Clark County, Washington, 90th percentile background concentration of 6 mg/kg arsenic (Cology, 1994).
9. Portland Harbor screening levels are draft early preliminary remediation goals dated March 27, 2009 (EPA, 2009).

Abbreviations
EPA = US Environmental Protection Agency
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
TPH = total petroleum hydrocarbons
DEQ = Oregon Department of Environmental Quality
JSCS = Joint Source Control Strategy
RBC = risk-based concentrations
ROD = record of decision
RSL = regional screening levels

TABLE 4

POTENTIAL HOT SPOT AREAS - UPLANDS AREAS[1,2,3,4]
University of Portland, River Campus Property
Portland, Oregon

Potential Hot Spot	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	TPH Gasoline (mg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)	VOCs Ethylbenzene (µg/kg)	VOCs 1,2,4-Trimethylbenzene (µg/kg)
DEQ Risk Based Concentration (RBC) Screening Levels Ingestion , Dermal Contact, and Inhalation			**Residential**	3,900		740	4,700,000	NE	23,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	3,100,000	150	4,600	NE	1,700,000	30,000	110,000
			Commercial	**23,000**		**13,000**	61,000,000	NE	**93,000,000**	2,700	270	2,700	NE	27,000	270,000	270	**8,900,000**	**12,000,000**	2,700	23,000	NE	**6,700,000**	140,000	2,000,000
EPA Regional Screening Level (RSL) [5]			**Residential**	NE		NE	3,400,000	NE	17,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	2,300,000	150	3,600	NE	1,700,000	5,400	62,000
			Industrial	NE		NE	**33,000,000**	NE	170,000,000	**2,100**	**210**	**2,100**	NE	**21,000**	**210,000**	**210**	22,000,000	22,000,000	**2,100**	**18,000**	NE	17,000,000	**27,000**	**260,000**
ROD Cleanup Levels for Human Receptors[6]				500	500	NE	NE	NE	NE	1,700	170	1,700	NE	NE	NE	170	NE	NE	1,700	**NE**	NE	NE	NE	4,800,000
WS-3A-2A	WS-3A(9.6-10)-2A	10/27/2006	9.6-10	4,800	2,200	--	120 NJ	ND	ND	ND	ND	ND	ND	ND	110	ND	ND	370	ND	ND	720	ND	--	--
	GP-139	8/10/2000	10.8	960	1,400	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WS-6A-23	WS-6A-(3-4)-23	10/18/2006	3-4	3,600	220	--	260 N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1,400	ND	ND	2,200	110	--	--
WS-6A-8/9	WS-6A-(8-8.5)-8B	10/19/2006	8-8.5	5,300	1,200	--	790 N	22	270	110	100	65	59 J	75	180	ND	220	2,200	42 J	180 N	3,900	400	--	--
	WS-6A-(8-8.5)-8C	10/19/2006	8-8.5	5,600	**27,000**	--	380 J	88 NJ	280 J	410 J	**1,400 J**	580 NJ	410 J	580 NJ	1,600 J	140 J	810 J	420 J	190 J	ND	1,100 J	2,500 J	--	--
	WS-6A-(8.5-9)-9A	10/19/2006	8.5-9	210	610	--	ND	ND	ND	53 J	83	67	54 J	72	99	ND	170	ND	41 J	ND	46 J	170	--	--
WS-6D-8	WS-6D-(2-2.5)-8	10/24/2006	2-2.5	13,000	**24,000**	--	ND	ND	ND	ND	ND	ND	ND	ND	840 J	ND	190 J	ND	ND	270 J	400 J	230 J	--	--
WS-6D-13/14	WS-6D-(4.5-5)-13A	10/25/2006	4.5-5	5,300	14,000	3,100	670 J	150 NJ	420 J	220 J	**290 NJ**	260 NJ	86 J	320 NJ	380 J	ND	780 J	1,200 J	ND	5,500 J	3,200 J	920 J	18,000	28,000
	WS-6D-(4.5-5)-13B	10/25/2006	4.5-5	790	1,300	5,400	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	WS-6D-(9-10)-14B	10/24/2006	9-10	6,100	2,400	--	1,100 J	280 NJ	780 J	120 J	110 J	71 J	ND	60 J	130 J	ND	370 J	3,000 J	ND	390 NJ	5,800 J	340 J	91 J	4,100 J

Notes
1. Results shown only for analytes that were detected in at least one sample.
2. Data Qualifiers are as follows:
   -- = not analyzed.
   J = analyte was positively identified; result is an estimated concentration.
   N = compounds is tentatively identified.
   ND = analyte not detected at or above laboratory reporting limit.
   NE = screening level not established.
   NJ = compound is tentatively identified. Result shown is the estimated concentration.
3. Analytes marked with an asterisk are considered carcinogens based on EPA criteria (EPA, 2009, 2010).
4. Results are compared against screening criteria shown in **bold** in the upper rows of the table. The screenign criterion is the lower of the EPA industrial RSL (May 2011) and DEQ commercial (occupational) RBCs (DEQ, 2010), as described in Section 3.3 of the text.
   For aid in review, relative magnitude of detected cnocentrations are indicated in the table as follows:
   bold = Concentration is greater than applicable screening criterion, but value is less than 10 times the screening criterion.
5. EPA screening levels are based on tabulated Regional Screening Levels (RSLs) for residential and industrial users (EPA, 2011). Analytes marked with an asterisk are considered carcinogens. For further information see Section 3.3 in the text. The value shown in **bold** indicates the applicable screening criterion.
6. Cleanup levels are based on Table 5 from the 2005 DEQ ROD.

Abbreviations
DEQ = Oregon Department of Environmental Quality
EPA = US Environmental Protection Agency
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
RBC = risk-based concentration
ROD = record of decision
RSL = Regional Screening Level
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

TABLE 5

POTENTIAL HOT SPOT AREAS - RIVERFRONT AND OVERLAPPING RIVERFRONT/UPLANDS AREAS[1,2,3]
University of Portland, River Campus Property
Portland, Oregon

Potential Hot Spot	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1260 (µg/kg)	PCBs Total PCBs (µg/kg)	Metals Arsenic (mg/kg)	Metals Chromium (mg/kg)	Metals Copper (mg/kg)	Metals Lead (mg/kg)	Metals Nickel (mg/kg)	Metals Zinc (mg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene* (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)
DEQ Risk-Based Concentration (RBC) Screening Levels: Ingestion, Dermal Contact, and Inhalation			**Residential**	3,900		NE	220	0.4	38 [4]	3,100	400	12,000	NE	4,700,000	NE	23,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	3,100,000	150	4,600	NE	1,700,000
			Commercial	23,000		NE	NE	1.7	NE	NE	800	NE	NE	61,000,000	NE	93,000,000	2,700	270	2,700	NE	27,000	270,000	270	8,900,000	12,000,000	2,700	23,000	NE	6,700,000
EPA Regional Screening Level (RSL)			**Residential**	NE		220	220	0.4	0.3 [4]	3,100	400	0.38	23,000	3,400,000	NE	17,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	2,300,000	150	3,600	NE	1,700,000
			Industrial	NE		740	740	1.6	1,500,000	41,000	800	47,000	310,000	33,000,000	NE	170,000,000	2,100	210	2,100	NE	21,000	210,000	210	22,000,000	22,000,000	2,100	18,000	NE	17,000,000
JSCS Screening Level				NE		200	0.39	7 [6]	111 [7]	149	17	49	459	300	200	845	1,050	1,450	NE	300	13,000	1,290	1,300	2,230	300	100	561	1,170	1,520
ROD Cleanup Levels for Human Receptors[8]				500	500	1,000	NE	6[9]	NE	NE	750[10]	NE	NE	NE	NE	NE	1,700	170	1,700	NE	NE	NE	170	NE	NE	1,700	NE	NE	NE
PH Lowest Screening Level[11]				NE	NE	NE	0	0.4	NE	NE	36	NE	NE	NE	NE	NE	810	42	6,900	NE	150,000	NE	690	NE	NE	6,900	NE	NE	NE
PH Highest Screening Level[11]				NE	NE	NE	5,000	540	NE	NE	3,000,000	NE	NE	NE	NE	NE	37,000,000	24,000,000	690,000	NE	1,100,000,000	NE	69,000	NE	NE	690,000	NE	NE	NE
WS-RS-1-24	WS-RS-1 (5-6)-24	10/25/2006	5-6	370	890	--	--	--	--	--	--	--	--	ND	77	74	270	280	240	190	320	400	ND	800	100	150	ND	500	600
A4-8	GP-59	5/28/1999	0.5	33	82	ND	ND	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	4.3	ND	5.2	ND	ND	3.9	6.9	8.3
	GP-59	5/28/1999	5	110	240	ND	ND	--	--	--	--	--	--	36	12	19	70	110	91	83	42	71	ND	170	13	67	45	170	230
	GP-59	5/28/1999	14	70	120	--	--	--	--	--	--	--	--	6.7	12	31	220	490	360	270	58	220	ND	180	11	230	50	130	360
	GP-143	8/9/2000	5	--	--	--	--	--	--	--	--	--	--	97	57	72	370	420	380	300	120	420	ND	790	55	350	110	540	880
	GP-143	8/9/2000	12	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	GP-144	8/9/2000	4	--	--	--	--	--	--	--	--	--	--	ND	22	ND	43	40	74	31	ND	52	ND	86	ND	29	22	87	82
	GP-144	8/9/2000	6	--	--	--	--	--	--	--	--	--	--	32	ND	ND	43	47	31	ND	ND	45	ND	88	ND	ND	29	81	110
	GP-145	8/9/2000	4.5	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	19	ND	25	ND	19	23	ND	44	ND	ND	21	50	64
	GP-145	8/9/2000	11	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A4-23	11/29/2005	4	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	70
	DP-A4-23	11/29/2005	12	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A4-23	11/29/2005	14.5	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	270	160	220	140	240	460	ND	510	ND	140	290	510	400
	DP-A4-24	11/29/2005	4	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A4-24	11/29/2005	16	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	50	ND	ND	ND	50	ND	ND	ND	ND	60	110	ND
	DP-A4-25	11/29/2005	16	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A4-26	11/29/2005	10	--	--	--	--	--	--	--	--	--	--	ND	70	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60	ND
	DP-A4-26	11/29/2005	16	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60
	DP-A4-27	11/30/2005	4	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DP-A4-28	11/30/2005	4	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	58	ND	ND	47	47	128	ND	105	ND	ND	ND	46.5	151
	DP-A4-28	11/30/2005	16	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
WS-RS-3-1	WS-RS-3 (5-8)-1	10/13/2006	5-8	83 J	190 J	--	-	27	9.3	51	59	19.3	43	ND	ND	ND	91 J	72 J	140 J	57 J	54 J	250 J	ND	140 J	110 J	ND	330 J	600 J	110 J
A6-14B	GP-126	6/1/1999	0.5	75	310	--	--	9.9	--	--	--	--	--	ND	3.9	5.4	21	16	ND	ND	ND	36	ND	35	ND	ND	ND	7.9	41
	GP-126	6/1/1999	5	180	320	850	*850*	2.1	--	--	--	--	--	18	11	20	24	52	51	ND	29	32	ND	120	15	22	25	93	73
	GP-126	6/1/1999	12	--	--	--	--	--	--	--	--	--	--	ND	5.2	6.7	20	28	22	20	7.1	14	ND	21	ND	16	5.2	22	28
	GP-171	8/8/2000	0.5	--	--	190	*190*	--	--	--	--	--	--	ND	ND	ND	22	ND	ND	ND	ND	22	ND	37	ND	ND	ND	20	33
	GP-171	8/8/2000	5	--	--	150	*150*	--	--	--	--	--	--	42	27	29	77	79	88	64	31	90	ND	150	35	79	160	150	170
	GP-171	8/8/2000	6.7	--	--	--	--	--	--	--	--	--	--	85	64	42	110	140	170	130	45	130	ND	270	50	140	95	210	470
	GP-172	8/8/2000	0.5	--	--	--	--	--	--	--	--	--	--	290	290	670	860	690	730	790	660	1,100	ND	740	570	ND	ND	670	790
	GP-172	8/8/2000	5	--	--	1,300	*1,300*	--	--	--	--	--	--	120	220	180	440	600	500	470	230	530	790	890	120	530	300	460	1,000
	GP-172	8/8/2000	7.3	--	--	150	*150*	--	--	--	--	--	--	ND	33	ND	73	47	84	40	31	140	ND	220	53	ND	40	320	240

TABLE 5

POTENTIAL HOT SPOT AREAS - RIVERFRONT AND OVERLAPPING RIVERFRONT/UPLANDS AREAS[1,2,3]
University of Portland, River Campus Property
Portland, Oregon

Potential Hot Spot	Sample ID/ Location	Date	Depth (feet)	TPH Diesel (mg/kg)	TPH Motor Oil (mg/kg)	PCBs Aroclor 1260 (µg/kg)	PCBs Total PCBs (µg/kg)	Metals Arsenic (mg/kg)	Metals Chromium (mg/kg)	Metals Copper (mg/kg)	Metals Lead (mg/kg)	Metals Nickel (mg/kg)	Metals Zinc (mg/kg)	PAHs Acenaphthene (µg/kg)	PAHs Acenaphthylene (µg/kg)	PAHs Anthracene (µg/kg)	PAHs Benzo(a)anthracene* (µg/kg)	PAHs Benzo(a)pyrene* (µg/kg)	PAHs Benzo(b)fluoranthene* (µg/kg)	PAHs Benzo(g,h,i)perylene* (µg/kg)	PAHs Benzo(k)fluoranthene* (µg/kg)	PAHs Chrysene* (µg/kg)	PAHs Dibenz(a,h)anthracene* (µg/kg)	PAHs Fluoranthene (µg/kg)	PAHs Fluorene (µg/kg)	PAHs Indeno(1,2,3-cd)pyrene* (µg/kg)	PAHs Naphthalene* (µg/kg)	PAHs Phenanthrene (µg/kg)	PAHs Pyrene (µg/kg)
DEQ Risk-Based Concentration (RBC) Screening Levels: Ingestion, Dermal Contact, and Inhalation			**Residential**	3,900		NE	220	0.4	38 [4]	3,100	400	12,000	NE	4,700,000	NE	23,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	3,100,000	150	4,600	NE	1,700,000
			Commercial	23,000		NE	NE	1.7	NE	NE	800	NE	NE	61,000,000	NE	93,000,000	2,700	270	2,700	NE	27,000	270,000	270	8,900,000	12,000,000	2,700	23,000	NE	6,700,000
EPA Regional Screening Level (RSL)			**Residential**	NE		220	220	0.4	0.3 [4]	3,100	400	0.38	23,000	3,400,000	NE	17,000,000	150	15	150	NE	1,500	15,000	15	2,300,000	2,300,000	150	3,600	NE	1,700,000
			Industrial	NE		740	740	1.6	1,500,000	41,000	800	47,000	310,000	33,000,000	NE	170,000,000	2,100	210	2,100	NE	21,000	210,000	210	22,000,000	22,000,000	2,100	18,000	NE	17,000,000
JSCS Screening Level				NE		200	0.39	7 [6]	111 [7]	149	17	49	459	300	200	845	1,050	1,450	NE	300	13,000	1,290	1,300	2,230	300	100	561	1,170	1,520
ROD Cleanup Levels for Human Receptors[8]				500	500	1,000	NE	6[9]	NE	NE	750[10]	NE	NE	NE	NE	NE	1,700	170	1,700	NE	NE	NE	170	NE	NE	1,700	NE	NE	NE
PH Lowest Screening Level[11]				NE	NE	NE	0	0.4	NE	NE	36	NE	NE	NE	NE	NE	810	42	6,900	NE	150,000	NE	690	NE	NE	6,900	NE	NE	NE
PH Highest Screening Level[11]				NE	NE	NE	5,000	540	NE	NE	3,000,000	NE	NE	NE	NE	NE	37,000,000	24,000,000	690,000	NE	1,100,000,000	NE	69,000	NE	NE	690,000	NE	NE	NE
A6-14B (continued)	GP-173	8/8/2000	0.5	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23
	GP-173	8/8/2000	5	--	--	--	--	--	--	--	--	--	--	420	46	120	73	100	87	79	27	91	ND	200	160	85	25	96	230
	GP-173	8/8/2000	7.3	--	--	--	--	--	--	--	--	--	--	*6,200*	880	3,000	3,200	*3,500*	2,800	2,200	940	3,100	230	9,800	*3,600*	*2,600*	610	*16,000*	11,000
	DP-A6-51	12/1/2005	5	--	--	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A6-51	12/1/2005	8	--	--	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A6-52	12/1/2005	5	--	--	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A6-52	12/1/2005	8	--	--	ND	ND	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	56	ND	ND	ND	ND	67.4
	DP-A6-52	12/1/2005	12	--	--	ND	ND	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	58.8	ND	105.9	ND	ND	ND	70.6	105.9
	DP-A6-53	12/1/2005	5	--	--	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	DP-A6-53	12/1/2005	8	--	--	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes
1. Results shown only for analytes that were detected in at least one sample.
2. Data Qualifiers are as follows:
   J = analyte was positively identified; result is an estimated concentration.
   NE = screening level not established.
   ND = analyte not detected at or above laboratory reporting limit.
   -- = not analyzed.
3. Analytes marked with an asterisk are considered carcinogens based on EPA criteria (EPA, 2009, 2010).
4. Value shown is for chromium(VI).
5. EPA screening levels are based on tabulated Regional Screening Levels (RSLs) for residential and industrial users (EPA, 2011). Analytes marked with an asterisk are considered carcinogens. For further information see Section 3.3 in the text. The value shown in **bold** indicates the applicable screening criterion.
6. The JSCS Screening Level for arsenic is the background concentration for arsenic in the Portland Harbor area given by Oregon DEQ in a memorandum dated October 28, 2002.
7. Value shown is for chromium(III).
8. Cleanup levels are based on Table 5 from the 2005 DEQ ROD.
9. The Clark County, Washington, 90th percentile background concentration of 6 mg/kg arsenic (Cology, 1994).
10. Cleanup level is an EPA prelimiatry remediation goal (PRG) for lead in an industrial setting, and is based on the rish of uptake of lead into the blood stream.
11. Portland Harbor screening levels are draft early preliminary remediation goals dated March 27, 2009 (EPA, 2009).

Abbreviations
DEQ = Oregon Department of Environmental Quality
EPA = US Environmental Protection Agency
JSCS = Joint Source Control Strategy
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
RBC = risk-based concentrations
ROD = record of decision
RSL = regional screening levels
TPH = total petroleum hydrocarbons

TABLE 6

RISK ASSESSMENT FOR POTENTIAL HOT SPOT AREAS[1,2,3,4,5,6]
University of Portland River Campus Property
Portland, Oregon

Analyte	EPA Industrial RSL		EPA Residential RSL		WS-3A-2A	WS-3A-2A Residential		WS-3A-2A Occupational		WS-6D-8	WS-6D-8 Residential		WS-6D-8 Occupational	
	ca	nc	ca	nc		Risk	Hazard	Risk	Hazard		Risk	Hazard	Risk	Hazard
Arsenic	1.6	260	0.39	22	--	--	--	--	--	--	--	--	--	--
Cadmium	9,300	800	1,800	70	--	--	--	--	--	--	--	--	--	--
Chromium		1,500,000		120,000	--	--	--	--	--	--	--	--	--	--
Copper		41,000		3,100	--	--	--	--	--	--	--	--	--	--
Lead	--	800	--	400	--	--	--	--	--	--	--	--	--	--
Nickel	--	47,000	--	3,800	--	--	--	--	--	--	--	--	--	--
Zinc	--	310,000	--	23,000	--	--	--	--	--	--	--	--	--	--
Tributyltin	--	180	--	18	--	--	--	--	--	--	--	--	--	--
Aroclor 1016	21	37	6.3	3.9	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	0.74	11	0.22	1.1	--	--	--	--	--	--	--	--	--	--
PCBs	0.74	11	0.22	1.1	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDDeq	0.000018	0.00085	0.0000045	0.000072	--	--	--	--	--	--	--	--	--	--
Acenaphthene	--	33,000	--	3,400	0.12	--	4.E-05	--	4.E-06	*0.099*	--	3.E-05	--	3.E-06
Acenaphthylene	--	--	--	--	*0.022*	--	--	--	--	*0.099*	--	--	--	--
Anthracene	--	170,000	--	17,000	*0.028*	--	2.E-06	--	2.E-07	*0.099*	--	6.E-06	--	6.E-07
Benzo(a)anthracene	2.1	--	0.15	--	*0.025*	2.E-07	--	1.E-08	--	*0.099*	7.E-07	--	5.E-08	--
Benzo(b)flouranthene	2.1	--	0.15	--	*0.034*	2.E-07	--	2.E-08	--	*0.099*	7.E-07	--	5.E-08	--
Benzo(k)fluoranthene	21	--	1.5	--	*0.038*	3.E-08	--	2.E-09	--	*0.099*	7.E-08	--	5.E-09	--
Benzo(g,h,i)perylene	--	--	--	--	*0.04*	--	--	--	--	*0.099*	--	--	--	--
Benzo(a)pyrene	0.21	--	0.015	--	*0.023*	2.E-06	--	1.E-07	--	*0.099*	7.E-06	--	5.E-07	--
Chrysene	210	--	15	--	0.11	7.E-09	--	5.E-10	--	0.84	6.E-08	--	4.E-09	--
Dibenz(a,h)anthracene	0.21	--	0.015	--	*0.034*	2.E-06	--	2.E-07	--	*0.099*	7.E-06	--	5.E-07	--
Fluoranthene	--	22,000	--	2,300	*0.026*	--	1.E-05	--	1.E-06	0.19	--	8.E-05	--	9.E-06
Fluorene	--	22,000	--	2,300	*0.37*	--	2.E-04	--	2.E-05	*0.099*	--	4.E-05	--	5.E-06
Indeno(1,2,3-c,d)pyrene	2.1	--	0.15	--	*0.04*	3.E-07	--	2.E-08	--	*0.099*	7.E-07	--	5.E-08	--
Naphthalene	18	620	3.6	140	*0.023*	6.E-09	2.E-04	1.E-09	4.E-05	0.27	8.E-08	2.E-03	2.E-08	4.E-04
Phenanthrene	--	--	--	--	*0.72*	--	--	--	--	0.4	--	--	--	--
Pyrene	--	17,000	--	1,700	*0.039*	--	2.E-05	--	2.E-06	0.23	--	1.E-04	--	1.E-05
Ethylbenzene	27	21000	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	2.7	1900	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPHg	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPHd	3,700,000	10,000	740,000	780	4,800	6.E-09	6.E+00	1.E-09	5.E-01	5600	8.E-09	7.E+00	2.E-09	6.E-01
TPHmo	--	--	--	--	2,200	--	--	--	--	27000	--	--	--	--
TOTAL	**--**	**--**	**--**	**--**	**--**	**5E-06**	**6.2**	**3E-07**	**0.48**	**--**	**2E-05**	**7.2**	**1E-06**	**0.56**

Notes
1. Table was provided by EPA and then backchecked by AMEC Geomatrix on April 27, 2011.
= exceeds risk threshold for an individual compound of 1E-6 or for total risk of 1E-5.
italics = value is the detection limit.
2. -- = no value is available.
3. Added in the highest values from primary area (i.e., 6D) when sub areas were only sampled for limited contaminants (i.e., 6D1).
4. Non-detect values were entered as detected values at the reporting limit and indicated by italics.
5. All units are miligrams per kilograms.
6. Concentrations represent the maximum detected concentrations for each analyte.

Abbreviations
ca=carcinogen
EPA = US Environmental Protection Agency
nc=non-carcinogen
RSL = Regional Screening Level

TABLE 7

HISTORICAL AND CURRENT GROUNDWATER DATA[1,2,3]
University of Portland River Campus Property
Portland, Oregon

All concentrations are in micrograms per liter (µg/L)

Reference[4]	Area	Sample ID/ Location	Date	Depth (feet bgs)	Monitoring Point Type	PAHs																		
						1-Methylnaphthalene	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Dibenzofuran	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
	JSCS Screening Level					**NE**	**0.2**	**0.2**	**0.2**	**0.2**	**0.018**	**0.018**	**0.018**	**0.2**	**0.018**	**0.018**	**0.018**	**NE**	**0.2**	**0.2**	**0.018**	**0.2**	**0.2**	**0.2**
	EPA Regional Screening Level (RSL)					**2.3**	**150**	**2,200**	**NE**	**11,000**	**0.029**	**0.0029**	**0.029**	**NE**	**0.29**	**2.9**	**0.0029**	**NE**	**1,500**	**1,500**	**0.029**	**0.14**	**NE**	**1,100**
	EPA Maximum Contaminant Level (MCL)					**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**0.2000**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
EMCON, 1993	5B	SB3-W	2/8/1993	15	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5B	SB4-W	2/5/1993	13	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5B	SB5-W	2/5/1993	14	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5B	SB6-W	2/5/1993	15	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	RS1	SB7-W	2/8/1993	13	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6A	SB8-W	2/4/1993	10	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	SB10-W	2/4/1993	16	TB	--	--	--	--	ND	ND	ND	ND	ND	ND	**2.6**	--	--	ND	--	ND	--	ND	ND
	6D	SB11-W	2/5/1993	10	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6B	SB12-W	2/5/1993	17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6B	SB13-W	2/4/1993	10	TB	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	--	--	ND	--	ND	--	**0.3**	ND
	2B	SB15-W	2/8/1993	19	TB	--	--	--	--	**2.1**	**8**	**6**	**3.2**	**2.3**	**2.4**	**6**	--	--	**13**	--	**2**	--	**4.2**	**12**
	3A	SB16-W	2/8/1993	9	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5A	SB1A-W-0923	9/23/1993	20	TB	--	--	--	--	--	**59**	**31**	**47**	**31**	--	**33**	**34**	--	**77**	--	**34**	--	**19**	**86**
	5A	SB2A-W-0924	9/24/1993	20	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	RS2	SB3A-W-0924	9/24/1993	20	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1A	MW-0930-1	9/30/1993	20-30	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1A	MW-1011-2	10/11/1993	20-30	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 7

HISTORICAL AND CURRENT GROUNDWATER DATA[1,2,3]
University of Portland River Campus Property
Portland, Oregon

All concentrations are in micrograms per liter (µg/L)

Reference[4]	Area	Sample ID/ Location	Date	Depth (feet bgs)	Monitoring Point Type	PAHs																		
						1-Methylnaphthalene	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Dibenzofuran	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
	JSCS Screening Level					**NE**	**0.2**	**0.2**	**0.2**	**0.2**	**0.018**	**0.018**	**0.018**	**0.2**	**0.018**	**0.018**	**0.018**	**NE**	**0.2**	**0.2**	**0.018**	**0.2**	**0.2**	**0.2**
	EPA Regional Screening Level (RSL)					**2.3**	**150**	**2,200**	**NE**	**11,000**	**0.029**	**0.0029**	**0.029**	**NE**	**0.29**	**2.9**	**0.0029**	**NE**	**1,500**	**1,500**	**0.029**	**0.14**	**NE**	**1,100**
	EPA Maximum Contaminant Level (MCL)					**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**0.2000**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
MFA, 1996	2	GP-090596-1C-22	9/5/1996	Not Provided	TB	--	--	ND	ND	ND	0.2 U	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	--	ND	ND
MFA, 1996	2	GP-090596-2C-22	9/5/1996	Not Provided	TB	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	--	ND	ND
MFA, 1996	2	GP-090596-3C-22	9/5/1996	Not Provided	TB	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	--	ND	ND
MFA, 1996	2/3	GP-090596-4M-18	9/5/1996	Not Provided	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MFA, 1996	2/3	GP-090596-6M-22	9/5/1996	Not Provided	TB	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND	**2**	ND	--	ND	ND
MFA, 1996	2/3	GP-090596-5M-22	9/5/1996	Not Provided	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MFA, 1996	2/3	GP-090696-7M-26	9/6/1996	Not Provided	TB	--	--	--	--	ND	--	--	--	--	--	ND	--	--	ND	--	--	--	ND	--
MFA, 1996	2/3	GP-090696-9B-22	9/6/1996	Not Provided	TB	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	--	ND	ND
MFA, 1996	2	GP-090696-11D-22	9/6/1996	Not Provided	TB	--	--	--	--	ND	--	--	--	--	--	ND	--	--	ND	--	--	--	ND	--
MFA, 1996	5B	GMW-1-090696	9/6/1996	Not Provided	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MFA, 1996	6D	HMW-1-090696	9/6/1996	Not Provided	MW	--	--	--	--	ND	--	--	--	--	--	ND	--	--	ND	--	--	--	ND	--
MFA, 1996	6D	HMW-2-090696	9/6/1996	Not Provided	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MFA, 1996	6D	HMW-3-090696	9/6/1996	Not Provided	MW	--	--	--	--	ND	--	--	--	--	--	ND	--	--	ND	--	--	--	ND	--
MFA, 1996	1A	KMW-1-090696	9/6/1996	Not Provided	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MFA, 1996	1A	KMW-2-090696	9/6/1996	Not Provided	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MFA, 1996	1B	EMW-1-090696	9/6/1996	Not Provided	MW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AMEC E&E, 2006	4	MW-A4-1	12/2/2005	10-25	MW	--	--	--	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.19 U	--	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U
AMEC E&E, 2006	4	MW-A4-2	12/2/2005	10-30	MW	--	--	--	1.90 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.19 U	--	0.0952 U	1.90 U	0.0952 U	1.90 U	0.199	0.0952 U
AMEC E&E, 2006	2A	MW-A2-3	12/2/2005	10-25	MW	--	--	--	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.19 U	--	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U
AMEC E&E, 2006	3A	MW-A3-4	12/2/2005	10-30	MW	--	--	--	0.0962 U	0.0962 U	0.0962 U	0.0962 U	0.0962 U	0.0962 U	0.0962 U	0.0962 U	0.192 U	--	0.0962 U	0.0962 U	0.0962 U	0.144 U	0.0962 U	0.0962 U
AMEC E&E, 2006	3B	MW-A3-5	12/2/2005	10-30	MW	--	--	--	1.89 U	1.89 U	1.89 U	1.89 U	1.89 U	1.89 U	1.89 U	1.89 U	3.77 U	--	1.89 U	1.89 U	1.89 U	1.89 U	1.89 U	1.89 U
AMEC E&E, 2008	4	GW-4-1	10/12/2006	36-40	TB	--	--	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.04 UJ	0.04 UJ	0.05 UJ	0.06 UJ	0.04 UJ	0.05 UJ	--	0.02 UJ	0.03 UJ	0.05 UJ	0.11 J	0.02 UJ	0.04 UJ
AMEC E&E, 2008	4	GW-4-13	10/12/2006	25-29	TB	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.04 U	0.04 U	0.05 U	0.06 U	0.04 U	0.05 U	--	0.02 U	0.03 U	0.05 U	0.03 U	0.02 U	0.04 U
AMEC E&E, 2008	4	GW-4-5	10/12/2006	28-32	TB	--	--	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.04 UJ	0.04 UJ	0.05 UJ	0.06 UJ	0.04 UJ	0.05 UJ	--	0.02 UJ	0.03 UJ	0.05 UJ	0.03 UJ	0.02 UJ	0.04 UJ
AMEC E&E, 2008	4	GW-4-22	10/12/2006	18-22	TB	--	--	0.02 UJ	0.02 UJ	0.02 UJ	0.02 UJ	0.04 UJ	0.04 UJ	0.05 UJ	0.06 UJ	0.04 UJ	0.05 UJ	--	0.02 UJ	0.03 UJ	0.05 UJ	0.03 UJ	0.02 UJ	0.04 UJ

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	JSCS Screening Level					**NE**	**0.2**	**0.2**	**0.2**	**0.2**	**0.018**	**0.018**	**0.018**	**0.2**	**0.018**	**0.018**	**0.018**	**NE**	**0.2**	**0.2**	**0.018**	**0.2**	**0.2**	**0.2**
	EPA Regional Screening Level (RSL)					**2.3**	**150**	**2,200**	**NE**	**11,000**	**0.029**	**0.0029**	**0.029**	**NE**	**0.29**	**2.9**	**0.0029**	**NE**	**1,500**	**1,500**	**0.029**	**0.14**	**NE**	**1,100**
	EPA Maximum Contaminant Level (MCL)					**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**0.2000**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
AMEC Geomatrix, 2010	2B	GW-2B-01/RC-1	3/3/2010	15-20	TB	0.010 UJ	0.011 J	0.017 J	0.010 UJ	0.02 J	0.012 J	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.017 J	0.010 UJ	0.010 UJ	0.048 J	0.018 J	0.010 UJ	0.02 J	0.11 J	0.045 J
	2B	GW-2B-02/RC-2	3/3/2010	15-20	TB	0.010 UJ	0.010 UJ	0.021 J	0.010 UJ	0.010 UJ	0.011 J	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.012 J	0.010 UJ	0.010 UJ	0.02 J	0.010 UJ	0.010 UJ	0.019 J	0.014 J	0.021 J
	5B	GW-5B-01/RC-3	3/2/2010	14-19	TB	0.010 UJ	0.010 UJ	0.016 J	0.010 UJ	0.010 J	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.022 J	0.010 UJ	0.010 UJ	0.018 J	0.037 J	0.033 J
	6C	GW-6C-01/RC-6	3/2/2010	14-19	TB	0.010 UJ	0.010 UJ	0.028 J	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.010 U	0.02	0.017	0.010 UJ	0.012 J	0.042 J	0.02
	6C	GW-6C-01X/RC-6	3/2/2010	14-19	TB	0.010 UJ	0.010 UJ	0.021 J	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.010 U	0.015	0.01	0.010 UJ	0.010 J	0.031 J	0.016
	6C	GW-6C-02/RC-7	3/2/2010	12-17	TB	0.011 J	0.022 J	0.033 J	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.010 UJ	0.013 J	0.010 UJ	0.010 UJ	0.022 J	0.010 UJ	0.010 UJ	0.057 J	0.025 J	0.025 J
	6C	GW-6C-03/RC-8	3/2/2010	15-20	TB	0.12 J	0.095 J	**3.8 J**	0.038 J	0.10 J	**0.036 J**	**0.039 J**	**0.035 J**	0.035 J	**0.027 J**	**0.06 J**	0.010 UJ	0.37 J	**0.25 J**	**2.0 J**	**0.024 J**	**0.28 J**	**1.7 J**	**0.21 J**
	RS2	GW-RS2-01/RC-9	3/2/2010	9-14	TB	0.010 UJ	0.014 J	0.073 J	0.010 UJ	0.010 UJ	**0.033 J**	**0.028 J**	0.016 J	0.018 J	0.018 J	**0.05 J**	0.010 UJ	0.010 UJ	0.051 J	0.019 J	0.012 J	0.034 J	0.041 J	0.069 J
	6D	GW-6D1-01/RC-10	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-01X/RC-10	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-02/RC-11	3/3/2010	10-15	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-03/RC-12	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D3-01/RC-13	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 7

HISTORICAL AND CURRENT GROUNDWATER DATA[1,2,3]
University of Portland River Campus Property
Portland, Oregon

All concentrations are in micrograms per liter (µg/L)

Reference[4]	Area	Sample ID/ Location	Date	Depth (feet bgs)	Monitoring Point Type	TPH: Gasoline	TPH: Diesel	TPH: Motor Oil Other Oils	Metals: Antimony	Metals: Arsenic	Metals: Beryllium	Metals: Calcium	Metals: Chromium	Metals: Copper	Metals: Lead	Metals: Magnesium	Metals: Nickel	Metals: Zinc	VOCs: 1,1,1-Trichloroethane	VOCs: 1,1-Dichloroethane	VOCs: 1,2-Dichloropropane	VOCs: 2-Butanone (MEK)	VOCs: 4-Isopropyltoluene	VOCs: Benzene	VOCs: Carbon disulfide	VOCs: Chloroethane	VOCs: Chloromethane	VOCs: cis-1,2-Dichloroethene	VOCs: Methylene chloride	VOCs: Naphthalene	VOCs: sec-Butylbenzene	VOCs: tert-Butylbenzene	VOCs: Tetrachloroethene	VOCs: Toluene	VOCs: Vinyl chloride
	JSCS Screening Level					**100[5]**	**90[5]**	**90[5]**	**6**	**0.045**	**NE**	**NE**	**100**	**2.7**	**0.54**	**NE**	**16**	**36**	**11**	**47**	**0.97**	**7,100**	**NE**	**1.2**	**0.92**	**23**	**2.1**	**590**	**8.9**	**0.2**	**NE**	**NE**	**0.12**	**9.8**	**0.015**
	EPA Regional Screening Level (RSL)								**15**	**0.045**	**73**	**NE**	**0.043[6]**	**1,500**	**NE**	**NE**	**NE**	**11,000**	**9,100**	**2.4**	**0.39**	**7,100**	**NE**	**0.41**	**100**	**NE**	**190**	**370**	**4.8**	**0.14**	**NE**	**NE**	**0.11**	**2,300**	**0.02**
	EPA Maximum Contaminant Level (MCL)					**NE**	**NE**	**NE**	**6**	**10**	**4**	**NE**	**100**	**1,300**	**15**	**NE**	**NE**	**NE**	**200**	**5**	**5**	**NE**	**NE**	**5**	**NE**	**NE**	**NE**	**70**	**NE**	**NE**	**NE**	**NE**	**5**	**1,000**	**2**
EMCON, 1993	5B	SB3-W	2/8/1993	15	TB	ND	ND	**1,990**	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	--	ND	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	5B	SB4-W	2/5/1993	13	TB	ND	ND	**630**	--	--	--	--	--	--	--	--	--	--	ND	0.5	ND	--	ND	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	5B	SB5-W	2/5/1993	14	TB	ND	**5,200**	ND	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	--	ND	ND	--	--	ND	ND	--	**2**	--	--	ND	ND	ND
	5B	SB6-W	2/5/1993	15	TB	ND	**806**	ND	--	--	--	--	--	--	--	--	--	--	ND	1.2	ND	--	ND	**1.6**	--	--	ND	ND	--	ND	--	--	ND	0.5	ND
	RS1	SB7-W	2/8/1993	13	TB	53	ND	**1,000**	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	--	ND	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	6A	SB8-W	2/4/1993	10	TB	ND	ND	**3,870**	**56**	**12**	**8**	90,600	--	**489**	**116**	69,800	**238**	**1,080**	ND	ND	**0.8**	--	ND	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	6D	SB10-W	2/4/1993	16	TB	ND	ND	**2,000**	ND	**10**	ND	65,600	--	**10**	**3**	34,700	ND	**42**	ND	ND	ND	--	ND	ND	--	--	2	0.5	--	ND	--	--	ND	ND	ND
	6D	SB11-W	2/5/1993	10	TB	ND	**4,010**	**1,060**	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	--	5	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	6B	SB12-W	2/5/1993	17	TB	**157**	ND	**210**	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	--	ND	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	6B	SB13-W	2/4/1993	10	TB	ND	ND	**830**	**76**	**8**	**16**	152,000	--	**1,450**	**91**	131,000	**313**	**1,660**	ND	ND	ND	--	ND	ND	--	--	ND	1.4	--	ND	--	--	ND	ND	**1.4**
	2B	SB15-W	2/8/1993	19	TB	ND	ND	**9,940**	--	--	--	--	--	--	--	--	--	--	5.1	**4.6**	ND	--	ND	ND	--	--	ND	ND	--	ND	--	--	**1**	ND	ND
	3A	SB16-W	2/8/1993	9	TB	**114**	ND	**8,300**	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	--	ND	ND	--	--	ND	ND	--	ND	--	--	ND	ND	ND
	5A	SB1A-W-0923	9/23/1993	20	TB	ND	**155**	**4,160**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5A	SB2A-W-0924	9/24/1993	20	TB	ND	57	**1,650**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	RS2	SB3A-W-0924	9/24/1993	20	TB	ND	ND	**2,940**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1A	MW-0930-1	9/30/1993	20-30	MW	ND	66	ND	--	ND	ND	60,900	38	**105**	**28**	30,500	**32**	**209**	--	--	--	4	--	--	ND	--	--	--	--	--	--	--	--	--	--
	1A	MW-1011-2	10/11/1993	20-30	MW	ND	**95**	**431**	ND	**190**	ND	469,000	**1,550**	**3,590**	**740**	474,000	**1,340**	**5,590**	--	--	--	ND	--	--	ND	--	--	--	--	--	--	--	--	--	--

TABLE 7

HISTORICAL AND CURRENT GROUNDWATER DATA[1,2,3]
University of Portland River Campus Property
Portland, Oregon

All concentrations are in micrograms per liter (µg/L)

Reference[4]	Area	Sample ID/ Location	Date	Depth (feet bgs)	Monitoring Point Type	TPH: Gasoline	TPH: Diesel	TPH: Motor Oil Other Oils	Metals: Antimony	Metals: Arsenic	Metals: Beryllium	Metals: Calcium	Metals: Chromium	Metals: Copper	Metals: Lead	Metals: Magnesium	Metals: Nickel	Metals: Zinc	VOCs: 1,1,1-Trichloroethane	VOCs: 1,1-Dichloroethane	VOCs: 1,2-Dichloropropane	VOCs: 2-Butanone (MEK)	VOCs: 4-Isopropyltoluene	VOCs: Benzene	VOCs: Carbon disulfide	VOCs: Chloroethane	VOCs: Chloromethane	VOCs: cis-1,2-Dichloroethene	VOCs: Methylene chloride	VOCs: Naphthalene	VOCs: sec-Butylbenzene	VOCs: tert-Butylbenzene	VOCs: Tetrachloroethene	VOCs: Toluene	VOCs: Vinyl chloride
		JSCS Screening Level				**100[5]**	**90[5]**	**90[5]**	**6**	**0.045**	**NE**	**NE**	**100**	**2.7**	**0.54**	**NE**	**16**	**36**	**11**	**47**	**0.97**	**7,100**	**NE**	**1.2**	**0.92**	**23**	**2.1**	**590**	**8.9**	**0.2**	**NE**	**NE**	**0.12**	**9.8**	**0.015**
		EPA Regional Screening Level (RSL)							**15**	**0.045**	**73**	**NE**	**0.043[6]**	**1,500**	**NE**	**NE**	**NE**	**11,000**	**9,100**	**2.4**	**0.39**	**7,100**	**NE**	**0.41**	**100**	**NE**	**190**	**370**	**4.8**	**0.14**	**NE**	**NE**	**0.11**	**2,300**	**0.02**
		EPA Maximum Contaminant Level (MCL)				**NE**	**NE**	**NE**	**6**	**10**	**4**	**NE**	**100**	**1,300**	**15**	**NE**	**NE**	**NE**	**200**	**5**	**5**	**NE**	**NE**	**5**	**NE**	**NE**	**NE**	**70**	**NE**	**NE**	**NE**	**NE**	**5**	**1,000**	**2**
MFA, 1996	2	GP-090596-1C-22	9/5/1996	Not Provided	TB	ND	**17,000**	ND	--	--	--	--	--	--	--	--	--	--	ND	**3**	ND	--	ND	ND	**1**	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2	GP-090596-2C-22	9/5/1996		TB	--	--	--	--	--	--	--	--	--	--	--	--	--	2	0.8	ND	--	ND	ND	0.8	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2	GP-090596-3C-22	9/5/1996		TB	--	--	--	ND	ND	ND	--	ND	ND	ND	--	ND	--	ND	0.5	ND	--	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2/3	GP-090596-4M-18	9/5/1996		TB	--	--	--	ND	**23**	ND	--	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2/3	GP-090596-6M-22	9/5/1996		TB	ND	**17,900**	**5,430**	ND	**19**	ND	--	ND	ND	ND	--	**20**	--	ND	ND	ND	--	ND	ND	ND	--	ND	ND	ND	ND	3	3	ND	ND	ND
	2/3	GP-090596-5M-22	9/5/1996		TB	--	--	--	ND	**8**	ND	--	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2/3	GP-090696-7M-26	9/6/1996		TB	ND	**12,700**	ND	ND	**8**	ND	--	ND	ND	ND	--	ND	--	ND	ND	ND	--	ND	ND	ND	--	ND	ND	ND	ND	5	5	ND	ND	ND
	2/3	GP-090696-9B-22	9/6/1996		TB	ND	**26,000**	**2,730**	ND	ND	ND	--	ND	ND	ND	--	**163**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2	GP-090696-11D-22	9/6/1996		TB	--	--	--	ND	**6**	ND	--	ND	ND	ND	--	ND	--	ND	ND	ND	--	ND	ND	ND	--	ND	ND	1	ND	ND	ND	ND	ND	ND
	5B	GMW-1-090696	9/6/1996		MW	--	--	--	ND	**7**	ND	--	ND	**217**	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	HMW-1-090696	9/6/1996		MW	--	--	--	ND	**6**	ND	--	ND	**226**	ND	--	ND	--	ND	ND	ND	--	ND	ND	ND	--	ND	1	ND	ND	ND	ND	ND	ND	**2**
	6D	HMW-2-090696	9/6/1996		MW	--	--	--	ND	**13**	ND	--	ND	ND	ND	--	ND	--	--	ND	--	--	--	ND	--	0.09	ND	ND	--	--	ND	ND	--	--	--
	6D	HMW-3-090696	9/6/1996		MW	--	--	--	ND	**6**	ND	--	ND	ND	ND	--	ND	--	ND	ND	ND	--	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	**1**
	1A	KMW-1-090696	9/6/1996		MW	--	--	--	ND	ND	ND	--	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1A	KMW-2-090696	9/6/1996		MW	--	--	--	ND	ND	ND	--	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1B	EMW-1-090696	9/6/1996		MW	--	--	--	ND	ND	ND	--	ND	ND	ND	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AMEC E&E, 2006	4	MW-A4-1	12/2/2005	10-25	MW	--	**249**	472 U	--	**6.36**	--	--	--	--	1 U	--	--	--	1 U	1 U	1 U	10 U	2 U	1 U	10 U	--	5 U	1 U	--	2 U	1 U	1 U	1 U	1 U	1 U
	4	MW-A4-2	12/2/2005	10-30	MW	--	**4,030**	472 U	--	**20.9**	--	--	--	--	1 U	--	--	--	1 U	1 U	1 U	10 U	2 U	1 U	10 U	--	5 U	1 U	--	2 U	1.1	1.5	1 U	1 U	1 U
	2A	MW-A2-3	12/2/2005	10-25	MW	--	236 U	472 U	--	1 U	--	--	--	--	1 U	--	--	--	1 U	1 U	1 U	10 U	2 U	1 U	10 U	--	5 U	1 U	--	2 U	1 U	1 U	1 U	1 U	1 U
	3A	MW-A3-4	12/2/2005	10-30	MW	--	**1,260**	472 U	--	**3.97**	--	--	--	--	1 U	--	--	--	1 U	1 U	1 U	10 U	2 U	1 U	10 U	--	5 U	1 U	--	2 U	1 U	1 U	1 U	1 U	1 U
	3B	MW-A3-5	12/2/2005	10-30	MW	--	**4,060**	472 U	--	**4.07**	--	--	--	--	1 U	--	--	--	1 U	1 U	1 U	10 U	2 U	1 U	10 U	--	5 U	1 U	--	2 U	1 U	1.2	1 U	1 U	1 U
AMEC E&E, 2008	4	GW-4-1	10/12/2006	36-40	TB	--	**890**	500 U	0.02 U	**2.7**	--	--	0.2 U	0.1 U	0.4 U	--	**24.4**	**410**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4	GW-4-13	10/12/2006	25-29	TB	--	20 U	501 U	0.02 U	**0.4**	--	--	0.2 U	0.1 U	0.4 U	--	1.2	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4	GW-4-5	10/12/2006	28-32	TB	--	**3,800**	502 U	0.02 U	**11.2**	--	--	0.6 U	0.1 U	0.4 U	--	8.3	7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	4	GW-4-22	10/12/2006	18-22	TB	--	**300**	503 U	0.02 U	**3**	--	--	0.6 U	0.1 U	0.4 U	--	2	9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 7

HISTORICAL AND CURRENT GROUNDWATER DATA[1,2,3]
University of Portland River Campus Property
Portland, Oregon

All concentrations are in micrograms per liter (µg/L)

Reference [4]	Area	Sample ID/ Location	Date	Depth (feet bgs)	Monitoring Point Type	TPH: Gasoline	TPH: Diesel	TPH: Motor Oil Other Oils	Metals: Antimony	Metals: Arsenic	Metals: Beryllium	Metals: Calcium	Metals: Chromium	Metals: Copper	Metals: Lead	Metals: Magnesium	Metals: Nickel	Metals: Zinc	VOCs: 1,1,1-Trichloroethane	VOCs: 1,1-Dichloroethane	VOCs: 1,2-Dichloropropane	VOCs: 2-Butanone (MEK)	VOCs: 4-Isopropyltoluene	VOCs: Benzene	VOCs: Carbon disulfide	VOCs: Chloroethane	VOCs: Chloromethane	VOCs: cis-1,2-Dichloroethene	VOCs: Methylene chloride	VOCs: Naphthalene	VOCs: sec-Butylbenzene	VOCs: tert-Butylbenzene	VOCs: Tetrachloroethene	VOCs: Toluene	VOCs: Vinyl chloride
	JSCS Screening Level					**100 [5]**	**90 [5]**	**90 [5]**	**6**	**0.045**	**NE**	**NE**	**100**	**2.7**	**0.54**	**NE**	**16**	**36**	**11**	**47**	**0.97**	**7,100**	**NE**	**1.2**	**0.92**	**23**	**2.1**	**590**	**8.9**	**0.2**	**NE**	**NE**	**0.12**	**9.8**	**0.015**
	EPA Regional Screening Level (RSL)								**15**	**0.045**	**73**	**NE**	**0.043 [6]**	**1,500**	**NE**	**NE**	**NE**	**11,000**	**9,100**	**2.4**	**0.39**	**7,100**	**NE**	**0.41**	**100**	**NE**	**190**	**370**	**4.8**	**0.14**	**NE**	**NE**	**0.11**	**2,300**	**0.02**
	EPA Maximum Contaminant Level (MCL)					**NE**	**NE**	**NE**	**6**	**10**	**4**	**NE**	**100**	**1,300**	**15**	**NE**	**NE**	**NE**	**200**	**5**	**5**	**NE**	**NE**	**5**	**NE**	**NE**	**NE**	**70**	**NE**	**NE**	**NE**	**NE**	**5**	**1,000**	**2**
AMEC Geomatrix, 2010	2B	GW-2B-01/RC-1	3/3/2010	15-20	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2B	GW-2B-02/RC-2	3/3/2010	15-20	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	5B	GW-5B-01/RC-3	3/2/2010	14-19	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6C	GW-6C-01/RC-6	3/2/2010	14-19	TB	--	0.25 UJ	0.50 UJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6C	GW-6C-01X/RC-6	3/2/2010	14-19	TB	--	0.25 UJ	0.50 UJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6C	GW-6C-02/RC-7	3/2/2010	12-17	TB	--	0.25 UJ	0.50 UJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6C	GW-6C-03/RC-8	3/2/2010	15-20	TB	--	0.25 UJ	0.55 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	RS2	GW-RS2-01/RC-9	3/2/2010	9-14	TB	--	0.25 UJ	0.50 UJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-01/RC-10	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-01X/RC-10	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-02/RC-11	3/3/2010	10-15	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D1-03/RC-12	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6D	GW-6D3-01/RC-13	3/3/2010	12-17	TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes

1. Results shown only for analytes detected in at least one sample.
2. Data qualifers are as follows:
   -- = not analyzed.
   J = Value is an estimate.
   U = Analyte was not detected at the laboratory reporting limit listed.
   UJ = Analyte was not detected at the estimated reporting limit listed.
   ND = analyte not detected (laboratory reporting limit not available).
   NE = screening level not established.
   NA = not applicable.
3. Results are compared against the JSCS screening level (US EPA and DEQ, 2007), and screening levels based on EPA Regional Screening Levels (RSLs) supportive of tapwater (EPA, 2010). EPA maximum levels (MCLs).
   Bold type indicates results for detected analytes exceed either of the screening levels.
4. References:
   AMEC E&E (AMEC Earth & Environmental), 2006, Phase II Environmental Site Assessment, 35-Acre Triangle Park Property, 5828 N. Van Houten Place, Portland, Oregon, January.
   AMEC E&E, 2008, Final Removal Action Investigation Report, Triangle Park Property, Portland, Oregon, May.
   AMEC Geomatrix, 2010, Final Data Gaps Investigation Report, University of Portland River Campus Property, Portland, Oregon, July.
   EMCON (EMCON Northwest, Inc.), 1993, Focused Phase II Environmental Site Assessment, Riedel International's North Portland Yard, 5828 N. Van Houten Place, Portland, Oregon, December 15.
   MFA (Maul Foster & Alongi, Inc.), 1996 report unavailable; investigation data summarized in: MFA, 1999, Remedial Investigation Work Plan for Soil, Triangle Park, LLC (North Portland Yard), 5828 North Van Houten Place, Portland, Oregon, April 12.
5. Screening levels for TPH fractions are the lowest applicable Oregon risk-based concentration screening levels (US EPA and DEQ, 2009). Neither JSCS screening levels nor RSLs are available for TPH fractions.
6. Screening level provided for chromium is chromium(VI) fraction (EPA, 2010).

Abbreviations

bgs = below ground surface
EPA = US Environmental Protection Agency
JSCS = Joint Source Control Strategy
µg/L = micrograms per liter
MCL = maximum contaminant level
MEK = methyl ethyl ketone
MW = monitoring well
PAHs = polycyclic aromatic hydrocarbons
RSL = Regional Screening Level
TB = temporary boring
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

TABLE 8

STREAMLINED RISK ASSESSMENT [1,2,3,4,5]
University of Portland River Campus Property
Portland, Oregon

	EPA		EPA		1A					1B					1C					2A					2A1				
	Industrial RSL		Residential RSL			Residential		Occupational			Residential		Occupational			Residential		Occupational			Residential		Occupational			Residential		Occupational	
Chemical Depth	ca	nc	ca	nc	Max	Risk	Hazard	Risk	Hazard	Max	Risk	Hazard	Risk	Hazard	Max	Risk	Hazard	Risk	Hazard	Max	Risk	Hazard	Risk	Hazard	Max	Risk	Hazard	Risk	Hazard
Arsenic	1.6	260	0.39	22	1.7	4.E-06	8.E-02	1.E-06	7.E-03	1.9	5.E-06	9.E-02	1.E-06	7.E-03	1.5	4E-06	7E-02	9E-07	6E-03	3	8.E-06	1.E-01	2.E-06	1.E-02	3	8.E-06	1.E-01	2.E-06	1.E-02
Cadmium	9,300	800	1,800	70	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.2	1E-10	3E-03	2E-11	3E-04	0.6	3.E-10	9.E-03	6.E-11	8.E-04	0.3	2.E-10	4.E-03	3.E-11	4.E-04
Chromium		1,500,000		120,000	10		8.E-05		7.E-06	10		8.E-05		7.E-06	13		1E-04		9E-06	13		1.E-04		9.E-06	14.1		1.E-04		9.E-06
Copper		41,000		3,100	20.7		7.E-03		5.E-04	19.4		6.E-03		5.E-04	26.8		9E-03		7E-04	40.6		1.E-02		1.E-03	44.7		1.E-02		1.E-03
Lead		800		400	15					19					14					84					89				
Nickel		47,000		3,800	15.6		4.E-03		3.E-04	14.5		4.E-03		3.E-04	32.5		9E-03		7E-04	17.1		5.E-03		4.E-04	23.4		6.E-03		5.E-04
Zinc		310,000		23,000	54		2.E-03		2.E-04	68		3.E-03		2.E-04	66		3E-03		2E-04	133		6.E-03		4.E-04	129		6.E-03		4.E-04
Tributyltin		180		18																									
Aroclor 1016	21	37	6.3	3.9	0.0038	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6E-10	1E-03	2E-10	1E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.0039	6.E-10	1.E-03	2.E-10	1.E-04
PCBs	0.74	11	0.22	1.1	0.0038	2.E-08	3.E-03	5.E-09	3.E-04	0.004	2.E-08	4.E-03	5.E-09	4.E-04	0.081	4E-07	7E-02	1E-07	7E-03	0.058	3.E-07	5.E-02	8.E-08	5.E-03	0.031	1.E-07	3.E-02	4.E-08	3.E-03
2,3,7,8-TCDDeq	0.000018	0.00085	4.5E-06	0.000072																									
Acenaphthene		33,000		3,400	0.024		7.E-06		7.E-07	1		3.E-04		3.E-05	0.025		7E-06		8E-07	0.26		8.E-05		8.E-06	0.046		1.E-05		1.E-06
Acenaphthylene					0.022					0.04					0.023					0.022					0.0074				
Anthracene		170,000		17,000	0.028		2.E-06		2.E-07	2.4		1.E-04		1.E-05	0.029		2E-06		2E-07	0.42		2.E-05		2.E-06	0.083		5.E-06		5.E-07
Benzo(a)anthracene	2.1		0.15		0.025	2.E-07		1.E-08		2.1	1.E-05		1.E-06		0.084	6E-07		4E-08		0.51	3.E-06		2.E-07		0.06	4.E-07		3.E-08	
Benzo(b)flouranthene	2.1		0.15		0.035	2.E-07		2.E-08		1.6	1.E-05		8.E-07		0.092	6E-07		4E-08		0.37	2.E-06		2.E-07		0.046	3.E-07		2.E-08	
Benzo(k)fluoranthene	21		1.5		0.038	3.E-08		2.E-09		1.1	7.E-07		5.E-08		0.088	6E-08		4E-09		0.38	3.E-07		2.E-08		0.049	3.E-08		2.E-09	
Benzo(g,h,i)perylene					0.04					0.64					0.088					0.24					0.066				
Benzo(a)pyrene	0.21		0.015		0.023	2.E-06		1.E-07		2.1	1.E-04		1.E-05		0.12	8E-06		6E-07		0.56	4.E-05		3.E-06		0.056	4.E-06		3.E-07	
Chrysene	210		15		0.027	2.E-09		1.E-10		2.2	1.E-07		1.E-08		0.11	7E-09		5E-10		0.61	4.E-08		3.E-09		0.1	7.E-09		5.E-10	
Dibenz(a,h)anthracene	0.21		0.015		0.035	2.E-06		2.E-07		0.076	5.E-06		4.E-07		0.036	2E-06		2E-07		0.035	2.E-06		2.E-07		0.012	8.E-07		6.E-08	
Fluoranthene		22,000		2,300	0.027		1.E-05		1.E-06	5.9		3.E-03		3.E-04	0.2		9E-05		9E-06	1.3		6.E-04		6.E-05	0.088		4.E-05		4.E-06
Fluorene		22,000		2,300	0.026		1.E-05		1.E-06	1.4		6.E-04		6.E-05	0.027		1E-05		1E-06	0.31		1.E-04		1.E-05	0.045		2.E-05		2.E-06
Indeno(1,2,3-c,d)pyrene	2.1		0.15		0.04	3.E-07		2.E-08		0.64	4.E-06		3.E-07		0.079	5E-07		4E-08		0.23	2.E-06		1.E-07		0.058	4.E-07		3.E-08	
Naphthalene	18	620	3.6	140	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.81	2.E-07	6.E-03	5.E-08	1.E-03	0.024	7E-09	2E-04	1E-09	4E-05	0.2	6.E-08	1.E-03	1.E-08	3.E-04	0.016	4.E-09	1.E-04	9.E-10	3.E-05
Phenanthrene					0.029					11					0.12					1.9					0.074				
Pyrene		17,000		1,700	0.039		2.E-05		2.E-06	5.8		3.E-03		3.E-04	0.19		1E-04		1E-05	1.2		7.E-04		7.E-05	0.12		7.E-05		7.E-06
TPHg																													
TPHd	3,700,000	10,000	740,000	780	57	8.E-11	7.E-02	2.E-11	6.E-03	53	7.E-11	7.E-02	1.E-11	5.E-03	12	2E-11	2E-02	3E-12	1E-03	67	9.E-11	9.E-02	2.E-11	7.E-03					
TPHmo					170					130					60					310									
					Total=	9E-06	0.2	1E-06	0.01	**Total=**	2E-04	0.2	1E-05	0.02	**Total=**	2E-05	0.2	2E-06	0.02	**Total=**	6E-05	0.3	5E-06	0.03	**Total=**	1E-05	0.2	2E-06	0.02
					Lead>RSL?		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No

TABLE 8

STREAMLINED RISK ASSESSMENT [1,2,3,4,5]
University of Portland River Campus Property
Portland, Oregon

Chemical Depth	EPA Industrial RSL ca	EPA Industrial RSL nc	EPA Residential RSL ca	EPA Residential RSL nc	2B Max	2B Residential Risk	2B Residential Hazard	2B Occupational Risk	2B Occupational Hazard	3A Max	3A Residential Risk	3A Residential Hazard	3A Occupational Risk	3A Occupational Hazard	3B Max	3B Residential Risk	3B Residential Hazard	3B Occupational Risk	3B Occupational Hazard	3B1 Max	3B1 Residential Risk	3B1 Residential Hazard	3B1 Occupational Risk	3B1 Occupational Hazard	3B2 Max	3B2 Residential Risk	3B2 Residential Hazard	3B2 Occupational Risk	3B2 Occupational Hazard
Arsenic	1.6	260	0.39	22	7.8	2.E-05	4.E-01	5.E-06	3.E-02	1.3	3.E-06	6.E-02	8.E-07	5.E-03	1.4	4.E-06	6.E-02	9.E-07	5.E-03	1.4	4.E-06	6.E-02	9.E-07	5.E-03	1.4	4.E-06	6.E-02	9.E-07	5.E-03
Cadmium	9,300	800	1,800	70	0.04	2.E-11	6.E-04	4.E-12	5.E-05	0.3	2.E-10	4.E-03	3.E-11	4.E-04	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05
Chromium		1,500,000		120,000	13		1.E-04		9.E-06	12		1.E-04		8.E-06	11		9.E-05		7.E-06	9.3		8.E-05		6.E-06	9.3		8.E-05		6.E-06
Copper		41,000		3,100	46.5		2.E-02		1.E-03	25.9		8.E-03		6.E-04	26.3		8.E-03		6.E-04	26.3		8.E-03		6.E-04	26.3		8.E-03		6.E-04
Lead		800		400	60					17					16					15					15				
Nickel		47,000		3,800	16.1		4.E-03		3.E-04	19.4		5.E-03		4.E-04	17		4.E-03		4.E-04	14		4.E-03		3.E-04	14		4.E-03		3.E-04
Zinc		310,000		23,000	149		6.E-03		5.E-04	67		3.E-03		2.E-04	59		3.E-03		2.E-04	57		2.E-03		2.E-04	57		2.E-03		2.E-04
Tributyltin		180		18																									
Aroclor 1016	21	37	6.3	3.9	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.02	3.E-09	5.E-03	1.E-09	5.E-04	0.046	7.E-09	1.E-02	2.E-09	1.E-03
PCBs	0.74	11	0.22	1.1	0.09	4.E-07	8.E-02	1.E-07	8.E-03	0.166	8.E-07	2.E-01	2.E-07	2.E-02	0.644	3.E-06	6.E-01	9.E-07	6.E-02	0.029	1.E-07	3.E-02	4.E-08	3.E-03	0.29	1.E-06	3.E-01	4.E-07	3.E-02
2,3,7,8-TCDDeq	0.000018	0.00085	4.5E-06	0.000072																									
Acenaphthene		33,000		3,400	0.025		7.E-06		8.E-07	0.025		7.E-06		8.E-07	0.025		7.E-06		8.E-07	0.024		7.E-06		7.E-07	0.024		7.E-06		7.E-07
Acenaphthylene					0.022					0.022					0.022					0.022					0.022				
Anthracene		170,000		17,000	0.029		2.E-06		2.E-07	0.029		2.E-06		2.E-07	0.028		2.E-06		2.E-07	0.028		2.E-06		2.E-07	0.028		2.E-06		2.E-07
Benzo(a)anthracene	2.1		0.15		0.049	3.E-07		2.E-08		0.026	2.E-07		1.E-08		0.043	3.E-07		2.E-08		0.025	2.E-07		1.E-08		0.025	2.E-07		1.E-08	
Benzo(b)flouranthene	2.1		0.15		0.035	2.E-07		2.E-08		0.035	2.E-07		2.E-08		0.035	2.E-07		2.E-08		0.034	2.E-07		2.E-08		0.034	2.E-07		2.E-08	
Benzo(k)fluoranthene	21		1.5		0.038	3.E-08		2.E-09		0.039	3.E-08		2.E-09		0.038	3.E-08		2.E-09		0.038	3.E-08		2.E-09		0.038	3.E-08		2.E-09	
Benzo(g,h,i)perylene					0.041					0.041					0.04					0.04					0.04				
Benzo(a)pyrene	0.21		0.015		0.034	2.E-06		2.E-07		0.024	2.E-06		1.E-07		0.04	3.E-06		2.E-07		0.023	2.E-06		1.E-07		0.023	2.E-06		1.E-07	
Chrysene	210		15		0.061	4.E-09		3.E-10		0.027	2.E-09		1.E-10		0.057	4.E-09		3.E-10		0.027	2.E-09		1.E-10		0.027	2.E-09		1.E-10	
Dibenz(a,h)anthracene	0.21		0.015		0.035	2.E-06		2.E-07		0.035	2.E-06		2.E-07		0.035	2.E-06		2.E-07		0.034	2.E-06		2.E-07		0.034	2.E-06		2.E-07	
Fluoranthene		22,000		2,300	0.1		4.E-05		5.E-06	0.027		1.E-05		1.E-06	0.093		4.E-05		4.E-06	0.036		2.E-05		2.E-06	0.036		2.E-05		2.E-06
Fluorene		22,000		2,300	0.026		1.E-05		1.E-06	0.027		1.E-05		1.E-06	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06
Indeno(1,2,3-c,d)pyrene	2.1		0.15		0.041	3.E-07		2.E-08		0.041	3.E-07		2.E-08		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08	
Naphthalene	18	620	3.6	140	0.024	7.E-09	2.E-04	1.E-09	4.E-05	0.024	7.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05
Phenanthrene					0.08					0.029					0.075					0.029					0.029				
Pyrene		17,000		1,700	0.1		6.E-05		6.E-06	0.04		2.E-05		2.E-06	0.089		5.E-05		5.E-06	0.039		2.E-05		2.E-06	0.039		2.E-05		2.E-06
TPHg																													
TPHd	3,700,000	10,000	740,000	780	37	5.E-11	5.E-02	1.E-11	4.E-03	25	3.E-11	3.E-02	7.E-12	3.E-03	42	6.E-11	5.E-02	1.E-11	4.E-03	42	6.E-11	5.E-02	1.E-11	4.E-03	42	6.E-11	5.E-02	1.E-11	4.E-03
TPHmo					150					110					170														
					Total=	3E-05	0.5	5E-06	0.04	**Total=**	9E-06	0.3	1E-06	0.02	**Total=**	1E-05	0.7	2E-06	0.07	**Total=**	8E-06	0.16	1E-06	0.014	**Total=**	9E-06	0.4	2E-06	0.04
					Lead>RSL?		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No

TABLE 8

STREAMLINED RISK ASSESSMENT [1,2,3,4,5]
University of Portland River Campus Property
Portland, Oregon

Chemical Depth	EPA Industrial RSL ca	EPA Industrial RSL nc	EPA Residential RSL ca	EPA Residential RSL nc	3B3 Max	3B3 Residential Risk	3B3 Residential Hazard	3B3 Occupational Risk	3B3 Occupational Hazard	3B4 Max	3B4 Residential Risk	3B4 Residential Hazard	3B4 Occupational Risk	3B4 Occupational Hazard
Arsenic	1.6	260	0.39	22	1.4	4.E-06	6.E-02	9.E-07	5.E-03	1.4	4.E-06	6.E-02	9.E-07	5.E-03
Cadmium	9,300	800	1,800	70	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05
Chromium		1,500,000		120,000	9.3		8.E-05		6.E-06	9.3		8.E-05		6.E-06
Copper		41,000		3,100	26.3		8.E-03		6.E-04	26.3		8.E-03		6.E-04
Lead		800		400	15					15				
Nickel		47,000		3,800	14		4.E-03		3.E-04	14		4.E-03		3.E-04
Zinc		310,000		23,000	57		2.E-03		2.E-04	57		2.E-03		2.E-04
Tributyltin		180		18										
Aroclor 1016	21	37	6.3	3.9	0.019	3.E-09	5.E-03	9.E-10	5.E-04	0.0039	6.E-10	1.E-03	2.E-10	1.E-04
PCBs	0.74	11	0.22	1.1	0.36	2.E-06	3.E-01	5.E-07	3.E-02	0.0039	2.E-08	4.E-03	5.E-09	4.E-04
2,3,7,8-TCDDeq	0.000018	0.00085	4.5E-06	0.000072										
Acenaphthene		33,000		3,400	0.024		7.E-06		7.E-07	0.024		7.E-06		7.E-07
Acenaphthylene					0.022					0.022				
Anthracene		170,000		17,000	0.028		2.E-06		2.E-07	0.028		2.E-06		2.E-07
Benzo(a)anthracene	2.1		0.15		0.025	2.E-07		1.E-08		0.025	2.E-07		1.E-08	
Benzo(b)flouranthene	2.1		0.15		0.034	2.E-07		2.E-08		0.034	2.E-07		2.E-08	
Benzo(k)fluoranthene	21		1.5		0.038	3.E-08		2.E-09		0.038	3.E-08		2.E-09	
Benzo(g,h,i)perylene					0.04					0.04				
Benzo(a)pyrene	0.21		0.015		0.023	2.E-06		1.E-07		0.023	2.E-06		1.E-07	
Chrysene	210		15		0.027	2.E-09		1.E-10		0.027	2.E-09		1.E-10	
Dibenz(a,h)anthracene	0.21		0.015		0.034	2.E-06		2.E-07		0.034	2.E-06		2.E-07	
Fluoranthene		22,000		2,300	0.036		2.E-05		2.E-06	0.036		2.E-05		2.E-06
Fluorene		22,000		2,300	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06
Indeno(1,2,3-c,d)pyrene	2.1		0.15		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08	
Naphthalene	18	620	3.6	140	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05
Phenanthrene					0.029					0.029				
Pyrene		17,000		1,700	0.039		2.E-05		2.E-06	0.039		2.E-05		2.E-06
TPHg														
TPHd	3,700,000	10,000	740,000	780	42	6.E-11	5.E-02	1.E-11	4.E-03	42	6.E-11	5.E-02	1.E-11	4.E-03
TPHmo														
					Total=	1E-05	0.5	2E-06	0.04	**Total=**	8E-06	0.137	1E-06	0.0112
					Lead>RSL?		No		No	**Lead>RSL?**		No		No

Chemical Depth	4 Max	4 Residential Risk	4 Residential Hazard	4 Occupational Risk	4 Occupational Hazard	5A Max	5A Residential Risk	5A Residential Hazard	5A Occupational Risk	5A Occupational Hazard	5B Max	5B Residential Risk	5B Residential Hazard	5B Occupational Risk	5B Occupational Hazard
Arsenic	3	8.E-06	1.E-01	2.E-06	1.E-02	2.4	6.E-06	1.E-01	2.E-06	9.E-03	2.6	6.67E-06	1.18E-01	1.63E-06	1.00E-02
Cadmium	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.2	1.E-10	3.E-03	2.E-11	3.E-04	0.3	1.67E-10	4.29E-03	3.23E-11	3.75E-04
Chromium	18.1		2.E-04		1.E-05	17		1.E-04		1.E-05	20.3		1.69E-04		1.35E-05
Copper	45.3		1.E-02		1.E-03	38.8		1.E-02		9.E-04	32.2		1.04E-02		7.85E-04
Lead	36					52					32				
Nickel	19		5.E-03		4.E-04	18.4		5.E-03		4.E-04	23.5		6.18E-03		5.00E-04
Zinc	125		5.E-03		4.E-04	90		4.E-03		3.E-04	73		3.17E-03		2.35E-04
Tributyltin						0.0015		8.E-05		8.E-06					
Aroclor 1016	0.0038	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.35E-10	1.03E-03	1.90E-10	1.08E-04
PCBs	0.0038	2.E-08	3.E-03	5.E-09	3.E-04	0.004	2.E-08	4.E-03	5.E-09	4.E-04	0.159	7.23E-07	1.45E-01	2.15E-07	1.45E-02
2,3,7,8-TCDDeq	4E-06	9.E-07	6.E-02	2.E-07	5.E-03	6.8E-06	2.E-06	9.E-02	4.E-07	8.E-03	1.1E-05	2.44E-06	1.53E-01	6.11E-07	1.29E-02
Acenaphthene	0.025		7.E-06		8.E-07	0.025		7.E-06		8.E-07	0.025		7.35E-06		7.58E-07
Acenaphthylene	0.022					0.022					0.022				
Anthracene	0.029		2.E-06		2.E-07	0.028		2.E-06		2.E-07	0.028		1.65E-06		1.65E-07
Benzo(a)anthracene	0.025	2.E-07		1.E-08		0.025	2.E-07		1.E-08		0.062	4.13E-07		2.95E-08	
Benzo(b)flouranthene	0.035	2.E-07		2.E-08		0.035	2.E-07		2.E-08		0.082	5.47E-07		3.90E-08	
Benzo(k)fluoranthene	0.038	3.E-08		2.E-09		0.038	3.E-08		2.E-09		0.059	3.93E-08		2.81E-09	
Benzo(g,h,i)perylene	0.063					0.04					0.046				
Benzo(a)pyrene	0.024	2.E-06		1.E-07		0.023	2.E-06		1.E-07		0.062	4.13E-06		2.95E-07	
Chrysene	0.027	2.E-09		1.E-10		0.027	2.E-09		1.E-10		0.083	5.53E-09		3.95E-10	
Dibenz(a,h)anthracene	0.035	2.E-06		2.E-07		0.035	2.E-06		2.E-07		0.035	2.33E-06		1.67E-07	
Fluoranthene	0.027		1.E-05		1.E-06	0.064		3.E-05		3.E-06	0.11		4.78E-05		5.00E-06
Fluorene	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06	0.026		1.13E-05		1.18E-06
Indeno(1,2,3-c,d)pyrene	0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08		0.04	2.67E-07		1.90E-08	
Naphthalene	0.024	7.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.39E-09	1.64E-04	1.28E-09	3.71E-05
Phenanthrene	0.029					0.029					0.058				
Pyrene	0.039		2.E-05		2.E-06	0.039		2.E-05		2.E-06	0.13		7.65E-05		7.65E-06
TPHg															
TPHd	29	4.E-11	4.E-02	8.E-12	3.E-03	110	1.E-10	1.E-01	3.E-11	1.E-02	79	1.07E-10	1.01E-01	2.14E-11	7.90E-03
TPHmo	400					390					270				
	Total=	1E-05	0.3	2E-06	0.02	**Total=**	1E-05	0.4	2E-06	0.03	**Total=**	2E-05	0.5	3E-06	0.05
	Lead>RSL?		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No

TABLE 8

STREAMLINED RISK ASSESSMENT [1,2,3,4,5]
University of Portland River Campus Property
Portland, Oregon

Chemical Depth	EPA Industrial RSL ca	EPA Industrial RSL nc	EPA Residential RSL ca	EPA Residential RSL nc	6A Max	6A Residential Risk	6A Residential Hazard	6A Occupational Risk	6A Occupational Hazard	6B Max	6B Residential Risk	6B Residential Hazard	6B Occupational Risk	6B Occupational Hazard	6C Max	6C Residential Risk	6C Residential Hazard	6C Occupational Risk	6C Occupational Hazard	6D Max	6D Residential Risk	6D Residential Hazard	6D Occupational Risk	6D Occupational Hazard	6D1 Max	6D1 Residential Risk	6D1 Residential Hazard	6D1 Occupational Risk	6D1 Occupational Hazard
Arsenic	1.6	260	0.39	22	2.7	7.E-06	1.E-01	2.E-06	1.E-02	2.9	7.E-06	1.E-01	2.E-06	1.E-02	4.8	1.E-05	2.E-01	3.E-06	2.E-02	2.9	7.E-06	1.E-01	2.E-06	1.E-02	2.9	7.E-06	1.E-01	2.E-06	1.E-02
Cadmium	9,300	800	1,800	70	0.2	1.E-10	3.E-03	2.E-11	3.E-04	0.3	2.E-10	4.E-03	3.E-11	4.E-04	0.2	1.E-10	3.E-03	2.E-11	3.E-04	0.3	2.E-10	4.E-03	3.E-11	4.E-04	0.3	2.E-10	4.E-03	3.E-11	4.E-04
Chromium		1,500,000		120,000	13.5		1.E-04		9.E-06	15.9		1.E-04		1.E-05	26		2.E-04		2.E-05	17		1.E-04		1.E-05	17		1.E-04		1.E-05
Copper		41,000		3,100	52.9		2.E-02		1.E-03	30.5		1.E-02		7.E-04	86.5		3.E-02		2.E-03	60.5		2.E-02		1.E-03	60.5		2.E-02		1.E-03
Lead		800		400	201					36					89					32					32				
Nickel		47,000		3,800	16.4		4.E-03		3.E-04	17.8		5.E-03		4.E-04	21.4		6.E-03		5.E-04	17.4		5.E-03		4.E-04	17		4.E-03		4.E-04
Zinc		310,000		23,000	173		8.E-03		6.E-04	98		4.E-03		3.E-04	330		1.E-02		1.E-03	230		1.E-02		7.E-04	230		1.E-02		7.E-04
Tributyltin		180		18	0.081		5.E-03		5.E-04						0.0015		8.E-05		8.E-06										
Aroclor 1016	21	37	6.3	3.9	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.0038	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.0038	6.E-10	1.E-03	2.E-10	1.E-04	0.0038	6.E-10	1.E-03	2.E-10	1.E-04
PCBs	0.74	11	0.22	1.1	0.089	4.E-07	8.E-02	1.E-07	8.E-03	0.029	1.E-07	3.E-02	4.E-08	3.E-03	0.091	4.E-07	8.E-02	1.E-07	8.E-03	0.033					0.033	2.E-07	3.E-02	4.E-08	3.E-03
2,3,7,8-TCDDeq	0.000018	0.00085	4.5E-06	0.000072	5.2E-05	1.E-05	7.E-01	3.E-06	6.E-02	3.2E-06	7.E-07	4.E-02	2.E-07	4.E-03	3.67E-06	8.E-07	5.E-02	2.E-07	4.E-03	2.49E-05	6.E-06	3.E-01	1.E-06	3.E-02	0.0000498	1.E-05	7.E-01	3.E-06	6.E-02
Acenaphthene		33,000		3,400	0.14		4.E-05		4.E-06	0.025		7.E-06		8.E-07	0.033		1.E-05		1.E-06	0.025		7.E-06		8.E-07	0.024		7.E-06		7.E-07
Acenaphthylene					0.022					0.064					0.023					0.022					0.022				
Anthracene		170,000		17,000	0.29		2.E-05		2.E-06	0.029		2.E-06		2.E-07	0.043		3.E-06		3.E-07	0.028		2.E-06		2.E-07	0.028		2.E-06		2.E-07
Benzo(a)anthracene	2.1		0.15		0.87	6.E-06		4.E-07		0.19	1.E-06		9.E-08		0.072	5.E-07		3.E-08		0.16	1.E-06		8.E-08		0.16	1.E-06		8.E-08	
Benzo(b)flouranthene	2.1		0.15		0.59	4.E-06		3.E-07		0.36	2.E-06		2.E-07		0.05	3.E-07		2.E-08		0.18	1.E-06		9.E-08		0.18	1.E-06		9.E-08	
Benzo(k)fluoranthene	21		1.5		0.58	4.E-07		3.E-08		0.18	1.E-07		9.E-09		0.059	4.E-08		3.E-09		0.13	9.E-08		6.E-09		0.13	9.E-08		6.E-09	
Benzo(g,h,i)perylene					0.29					0.3					0.042					0.13					0.13				
Benzo(a)pyrene	0.21		0.015		0.71	5.E-05		3.E-06		0.28	2.E-05		1.E-06		0.067	4.E-06		3.E-07		0.15	1.E-05		7.E-07		0.15	1.E-05		7.E-07	
Chrysene	210		15		1	7.E-08		5.E-09		0.27	2.E-08		1.E-09		0.082	5.E-09		4.E-10		0.24	2.E-08		1.E-09		0.24	2.E-08		1.E-09	
Dibenz(a,h)anthracene	0.21		0.015		0.15	1.E-05		7.E-07		0.077	5.E-06		4.E-07		0.036	2.E-06		2.E-07		0.035	2.E-06		2.E-07		0.034	2.E-06		2.E-07	
Fluoranthene		22,000		2,300	2		9.E-04		9.E-05	0.44		2.E-04		2.E-05	0.21		9.E-05		1.E-05	0.28		1.E-04		1.E-05	0.28		1.E-04		1.E-05
Fluorene		22,000		2,300	0.071		3.E-05		3.E-06	0.026		1.E-05		1.E-06	0.027		1.E-05		1.E-06	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06
Indeno(1,2,3-c,d)pyrene	2.1		0.15		0.29	2.E-06		1.E-07		0.22	1.E-06		1.E-07		0.042	3.E-07		2.E-08		0.1	7.E-07		5.E-08		0.1	7.E-07		5.E-08	
Naphthalene	18	620	3.6	140	0.024	7.E-09	2.E-04	1.E-09	4.E-05	0.024	7.E-09	2.E-04	1.E-09	4.E-05	0.024	7.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05
Phenanthrene					0.99					0.29					0.17					0.15					0.15				
Pyrene		17,000		1,700	1.6		9.E-04		9.E-05	0.4		2.E-04		2.E-05	0.16		9.E-05		9.E-06	0.28		2.E-04		2.E-05	0.28		2.E-04		2.E-05
TPHg																													
TPHd	3,700,000	10,000	740,000	780	340	5.E-10	4.E-01	9.E-11	3.E-02	40	5.E-11	5.E-02	1.E-11	4.E-03	69	9.E-11	9.E-02	2.E-11	7.E-03	210	3.E-10	3.E-01	6.E-11	2.E-02	50	7.E-11	6.E-02	1.E-11	5.E-03
TPHmo					380					150					470					430					200				
					Total=	9E-05	1.4	1E-05	0.12	**Total=**	4E-05	0.3	4E-06	0.02	**Total=**	2E-05	0.5	4E-06	0.042	**Total=**	3E-05	0.8	4E-06	0.06	**Total=**	3E-05	1	6E-06	0.1
					Lead>RSL?		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No

TABLE 8

STREAMLINED RISK ASSESSMENT [1,2,3,4,5]
University of Portland River Campus Property
Portland, Oregon

Chemical Depth	EPA Industrial RSL ca	EPA Industrial RSL nc	EPA Residential RSL ca	EPA Residential RSL nc	6D2 Max	6D2 Residential Risk	6D2 Residential Hazard	6D2 Occupational Risk	6D2 Occupational Hazard	6D3 Max	6D3 Residential Risk	6D3 Residential Hazard	6D3 Occupational Risk	6D3 Occupational Hazard
Arsenic	1.6	260	0.39	22	2.9	7.E-06	1.E-01	2.E-06	1.E-02	2.9	7.E-06	1.E-01	2.E-06	1.E-02
Cadmium	9,300	800	1,800	70	0.3	2.E-10	4.E-03	3.E-11	4.E-04	0.3	2.E-10	4.E-03	3.E-11	4.E-04
Chromium		1,500,000		120,000	17		1.E-04		1.E-05	17		1.E-04		1.E-05
Copper		41,000		3,100	60.5		2.E-02		1.E-03	60.5		2.E-02		1.E-03
Lead		800		400	32					32				
Nickel		47,000		3,800	17		4.E-03		4.E-04	17		4.E-03		4.E-04
Zinc		310,000		23,000	230		1.E-02		7.E-04	230		1.E-02		7.E-04
Tributyltin		180		18										
Aroclor 1016	21	37	6.3	3.9	0.0038	6.E-10	1.E-03	2.E-10	1.E-04	0.0038	6.E-10	1.E-03	2.E-10	1.E-04
PCBs	0.74	11	0.22	1.1	0.033	2.E-07	3.E-02	4.E-08	3.E-03	0.033	2.E-07	3.E-02	4.E-08	3.E-03
2,3,7,8-TCDDeq	0.000018	0.00085	4.5E-06	0.000072	0.0000092	2.E-06	1.E-01	5.E-07	1.E-02	2.9E-05	6.E-06	4.E-01	2.E-06	3.E-02
Acenaphthene		33,000		3,400	0.024		7.E-06		7.E-07	0.024		7.E-06		7.E-07
Acenaphthylene					0.022					0.022				
Anthracene		170,000		17,000	0.028		2.E-06		2.E-07	0.028		2.E-06		2.E-07
Benzo(a)anthracene	2.1		0.15		0.16	1.E-06		8.E-08		0.16	1.E-06		8.E-08	
Benzo(b)flouranthene	2.1		0.15		0.18	1.E-06		9.E-08		0.18	1.E-06		9.E-08	
Benzo(k)fluoranthene	21		1.5		0.13	9.E-08		6.E-09		0.13	9.E-08		6.E-09	
Benzo(g,h,i)perylene					0.13					0.13				
Benzo(a)pyrene	0.21		0.015		0.15	1.E-05		7.E-07		0.15	1.E-05		7.E-07	
Chrysene	210		15		0.24	2.E-08		1.E-09		0.24	2.E-08		1.E-09	
Dibenz(a,h)anthracene	0.21		0.015		0.034	2.E-06		2.E-07		0.034	2.E-06		2.E-07	
Fluoranthene		22,000		2,300	0.28		1.E-04		1.E-05	0.28		1.E-04		1.E-05
Fluorene		22,000		2,300	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06
Indeno(1,2,3-c,d)pyrene	2.1		0.15		0.1	7.E-07		5.E-08		0.1	7.E-07		5.E-08	
Naphthalene	18	620	3.6	140	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05
Phenanthrene					0.15					0.15				
Pyrene		17,000		1,700	0.28		2.E-04		2.E-05	0.28		2.E-04		2.E-05
TPHg														
TPHd	3,700,000	10,000	740,000	780	50	7.E-11	6.E-02	1.E-11	5.E-03	50	7.E-11	6.E-02	1.E-11	5.E-03
TPHmo					200					200				
					Total=	3E-05	0.4	4E-06	0.04	**Total=**	3E-05	0.7	5E-06	0.06
					Lead>RSL?		No		No	**Lead>RSL?**		No		No

Chemical Depth	RS-1 Max	RS-1 Residential Risk	RS-1 Residential Hazard	RS-1 Occupational Risk	RS-1 Occupational Hazard	RS-1A Max	RS-1A Residential Risk	RS-1A Residential Hazard	RS-1A Occupational Risk	RS-1A Occupational Hazard	RS-1B Max	RS-1B Residential Risk	RS-1B Residential Hazard	RS-1B Occupational Risk	RS-1B Occupational Hazard
Arsenic	3.8	1.E-05	2.E-01	2.E-06	1.E-02	3.8	1.E-05	2.E-01	2.E-06	1.E-02	3.8	1.E-05	2.E-01	2.E-06	1.E-02
Cadmium	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05
Chromium	15		1.E-04		1.E-05	14		1.E-04		9.E-06	14		1.E-04		9.E-06
Copper	71.3		2.E-02		2.E-03	39.7		1.E-02		1.E-03	39.7		1.E-02		1.E-03
Lead	23					23					23				
Nickel	24.2		6.E-03		5.E-04	15.5		4.E-03		3.E-04	15.5		4.E-03		3.E-04
Zinc	107		5.E-03		3.E-04	94		4.E-03		3.E-04	94		4.E-03		3.E-04
Tributyltin	0.013		7.E-04		7.E-05	0.0042		2.E-04		2.E-05	0.0042		2.E-04		2.E-05
Aroclor 1016	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04
PCBs	0.069	3.E-07	6.E-02	9.E-08	6.E-03	0.028	1.E-07	3.E-02	4.E-08	3.E-03	0.028	1.E-07	3.E-02	4.E-08	3.E-03
2,3,7,8-TCDDeq	2.38E-05	5.E-06	3.E-01	1.E-06	3.E-02	1.39E-05	3.E-06	2.E-01	8.E-07	2.E-02	7.4E-06	2.E-06	1.E-01	4.E-07	9.E-03
Acenaphthene	0.063		2.E-05		2.E-06	0.025		7.E-06		8.E-07	0.025		7.E-06		8.E-07
Acenaphthylene	0.13					0.022					0.022				
Anthracene	0.17		1.E-05		1.E-06	0.041		2.E-06		2.E-07	0.041		2.E-06		2.E-07
Benzo(a)anthracene	0.46	3.E-06		2.E-07		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08	
Benzo(b)flouranthene	0.52	3.E-06		2.E-07		0.057	4.E-07		3.E-08		0.057	4.E-07		3.E-08	
Benzo(k)fluoranthene	0.45	3.E-07		2.E-08		0.038	3.E-08		2.E-09		0.038	3.E-08		2.E-09	
Benzo(g,h,i)perylene	0.2					0.04					0.04				
Benzo(a)pyrene	0.52	3.E-05		2.E-06		0.048	3.E-06		2.E-07		0.048	3.E-06		2.E-07	
Chrysene	0.54	4.E-08		3.E-09		0.53	4.E-08		3.E-09		0.53	4.E-08		3.E-09	
Dibenz(a,h)anthracene	0.035	2.E-06		2.E-07		0.035	2.E-06		2.E-07		0.035	2.E-06		2.E-07	
Fluoranthene	1.3		6.E-04		6.E-05	0.081		4.E-05		4.E-06	0.081		4.E-05		4.E-06
Fluorene	0.12		5.E-05		5.E-06	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06
Indeno(1,2,3-c,d)pyrene	0.21	1.E-06		1.E-07		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08	
Naphthalene	0.082	2.E-08	6.E-04	5.E-09	1.E-04	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05
Phenanthrene	0.95					0.05					0.05				
Pyrene	1.1		6.E-04		6.E-05	0.076		4.E-05		4.E-06	0.076		4.E-05		4.E-06
TPHg															
TPHd	91	1.E-10	1.E-01	2.E-11	9.E-03	22	3.E-11	3.E-02	6.E-12	2.E-03	22	3.E-11	3.E-02	6.E-12	2.E-03
TPHmo	370					110					110				
	Total=	6E-05	0.7	7E-06	0.06	**Total=**	2E-05	0.5	4E-06	0.04	**Total=**	2E-05	0.4	3E-06	0.032
	Lead>RSL?		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No

TABLE 8

STREAMLINED RISK ASSESSMENT [1,2,3,4,5]
University of Portland River Campus Property
Portland, Oregon

	EPA		EPA		RS-1C					RS-1D					RS-2					RS-3				
	Industrial RSL		Residential RSL			Residential		Occupational			Residential		Occupational			Residential		Occupational			Residential		Occupational	
Chemical Depth	**ca**	**nc**	**ca**	**nc**	**Max**	**Risk**	**Hazard**	**Risk**	**Hazard**	**Max**	**Risk**	**Hazard**	**Risk**	**Hazard**	**Max**	**Risk**	**Hazard**	**Risk**	**Hazard**	**Max**	**Risk**	**Hazard**	**Risk**	**Hazard**
Arsenic	1.6	260	0.39	22	3.8	1.E-05	2.E-01	2.E-06	1.E-02	3.8	1.E-05	2.E-01	2.E-06	1.E-02	2.4	6E-06	1E-01	2E-06	9E-03	2.4	6.E-06	1.E-01	2.E-06	9.E-03
Cadmium	9,300	800	1,800	70	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.02	1.E-11	3.E-04	2.E-12	3.E-05	0.3	2E-10	4E-03	3E-11	4E-04	0.02	1.E-11	3.E-04	2.E-12	3.E-05
Chromium		1,500,000		120,000	14		1.E-04		9.E-06	14		1.E-04		9.E-06	15		1E-04		1E-05	12.7		1.E-04		8.E-06
Copper		41,000		3,100	39.7		1.E-02		1.E-03	39.7		1.E-02		1.E-03	40.8		1E-02		1E-03	35.2		1.E-02		9.E-04
Lead		800		400	23					23					33					35				
Nickel		47,000		3,800	15.5		4.E-03		3.E-04	15.5		4.E-03		3.E-04	22.2		6E-03		5E-04	16.1		4.E-03		3.E-04
Zinc		310,000		23,000	94		4.E-03		3.E-04	94		4.E-03		3.E-04	115		5E-03		4E-04	62		3.E-03		2.E-04
Tributyltin		180		18	0.0042		2.E-04		2.E-05	0.0042		2.E-04		2.E-05	0.026		1E-03		1E-04					
Aroclor 1016	21	37	6.3	3.9	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04	0.004	6E-10	1E-03	2E-10	1E-04	0.004	6.E-10	1.E-03	2.E-10	1.E-04
PCBs	0.74	11	0.22	1.1	0.028	1.E-07	3.E-02	4.E-08	3.E-03	0.028	1.E-07	3.E-02	4.E-08	3.E-03	0.192	9E-07	2E-01	3E-07	2E-02	0.058	3.E-07	5.E-02	8.E-08	5.E-03
2,3,7,8-TCDDeq	0.000018	0.00085	4.5E-06	0.000072	4.4E-06	1.E-06	6.E-02	2.E-07	5.E-03	3E-05	7.E-06	4.E-01	2.E-06	3.E-02	3E-06	7E-07	4E-02	2E-07	4E-03	1.3E-05	3.E-06	2.E-01	7.E-07	1.E-02
Acenaphthene		33,000		3,400	0.025		7.E-06		8.E-07	0.025		7.E-06		8.E-07	0.025		7E-06		8E-07	0.024		7.E-06		7.E-07
Acenaphthylene					0.022					0.022					0.022					0.022				
Anthracene		170,000		17,000	0.041		2.E-06		2.E-07	0.041		2.E-06		2.E-07	0.029		2E-06		2E-07	0.028		2.E-06		2.E-07
Benzo(a)anthracene	2.1		0.15		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08		0.033	2E-07		2E-08		0.052	3.E-07		2.E-08	
Benzo(b)flouranthene	2.1		0.15		0.057	4.E-07		3.E-08		0.057	4.E-07		3.E-08		0.035	2E-07		2E-08		0.066	4.E-07		3.E-08	
Benzo(k)fluoranthene	21		1.5		0.038	3.E-08		2.E-09		0.038	3.E-08		2.E-09		0.048	3E-08		2E-09		0.048	3.E-08		2.E-09	
Benzo(g,h,i)perylene					0.04					0.04					0.051					0.052				
Benzo(a)pyrene	0.21		0.015		0.048	3.E-06		2.E-07		0.048	3.E-06		2.E-07		0.049	3E-06		2E-07		0.056	4.E-06		3.E-07	
Chrysene	210		15		0.53	4.E-08		3.E-09		0.53	4.E-08		3.E-09		0.047	3E-09		2E-10		0.075	5.E-09		4.E-10	
Dibenz(a,h)anthracene	0.21		0.015		0.035	2.E-06		2.E-07		0.035	2.E-06		2.E-07		0.035	2E-06		2E-07		0.035	2.E-06		2.E-07	
Fluoranthene		22,000		2,300	0.081		4.E-05		4.E-06	0.081		4.E-05		4.E-06	0.048		2E-05		2E-06	0.12		5.E-05		5.E-06
Fluorene		22,000		2,300	0.026		1.E-05		1.E-06	0.026		1.E-05		1.E-06	0.026		1E-05		1E-06	0.026		1.E-05		1.E-06
Indeno(1,2,3-c,d)pyrene	2.1		0.15		0.04	3.E-07		2.E-08		0.04	3.E-07		2.E-08		0.041	3E-07		2E-08		0.041	3.E-07		2.E-08	
Naphthalene	18	620	3.6	140	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05	0.024	7E-09	2E-04	1E-09	4E-05	0.023	6.E-09	2.E-04	1.E-09	4.E-05
Phenanthrene					0.05					0.05					0.029					0.11				
Pyrene		17,000		1,700	0.076		4.E-05		4.E-06	0.076		4.E-05		4.E-06	0.059		3E-05		3E-06	0.1		6.E-05		6.E-06
TPHg																								
TPHd	3,700,000	10,000	740,000	780	22	3.E-11	3.E-02	6.E-12	2.E-03	22	3.E-11	3.E-02	6.E-12	2.E-03	57	8E-11	7E-02	2E-11	6E-03	36	5.E-11	5.E-02	1.E-11	4.E-03
TPHmo					110					110					280					230				
					Total=	2E-05	0.34	3E-06	0.029	**Total=**	2E-05	0.7	5E-06	0.06	**Total=**	1E-05	0.5	3E-06	0.05	**Total=**	2E-05	0.5	3E-06	0.04
					Lead>RSL?		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No	**Lead>RSL?**		No		No

Notes
1. Table was provided by EPA and then backchecked by AMEC Geomatrix on April 27, 2011.
= exceeds risk threshold for an individual compounds of 1E-6 or for total risk of 1E-5.
2. Blank cells indicate no value is available.
3. Added in the highest values from primary area (i.e., 6D) when sub areas were only sampled for limited contaminants (i.e., 6D1).
4. Non-detect values were entered as detected values at the reporting limit.
5. All units are miligrams per kilograms.
6. Concentrations for 0-1 ft represent the maximum detected concentrations for each analyte.

Abbreviations
ca=carcinogen
EPA = US Environmental Protection Agency
nc=non-carcinogen
RSL = Regional Screening Level

TABLE 9

SUMMARY OF COC RISKS AND HAZARDS
University of Portland River Campus Property
Portland, Oregon

MIS Area	Depth Interval (feet)	Individual Residential COC Risk >1E-6	Individual Occupational COC Risk >1E-6	Total Risk (based on maximum concentration)			
				Residential		Occupational	
				Risk	Hazard	Risk	Hazard
1A	0-10	yes [1,2]	yes [2]	8.94E-06	1.68E-01	1.39E-06	1.38E-02
1B	0-10	*yes*	**yes**	*1.80E-04*	1.85E-01	1.37E-05	1.61E-02
1C	0-10	*yes*	no	*1.64E-05*	1.82E-01	1.92E-06	1.63E-02
2A	0-10	*yes*	**yes**	*5.54E-05*	3.11E-01	5.35E-06	2.66E-02
2A1	0-10	*yes*	yes [2]	*1.35E-05*	1.96E-01	2.32E-06	1.69E-02
2B	0-10	*yes*	yes [2]	*2.59E-05*	5.12E-01	5.39E-06	4.41E-02
3A	0-10	yes [1,2]	no	8.74E-06	2.64E-01	1.37E-06	2.44E-02
3B	0-10	*yes*	no	*1.23E-05*	7.20E-01	2.16E-06	6.95E-02
3B1	0-10	yes [1,2]	no	8.22E-06	1.64E-01	1.24E-06	1.40E-02
3B2	0-10	*yes*	no	9.41E-06	4.08E-01	1.59E-06	3.84E-02
3B3	0-10	*yes*	no	9.72E-06	4.65E-01	1.68E-06	4.40E-02
3B4	0-10	yes [1,2]	no	8.10E-06	1.37E-01	1.20E-06	1.12E-02
4 [3]	0-10	yes [1,2]	yes [2]	*1.33E-05*	2.63E-01	2.45E-06	2.19E-02
5A	0-10	*yes*	yes [2]	*1.22E-05*	3.74E-01	2.21E-06	3.06E-02
5B	0-10	*yes*	yes [2]	*1.76E-05*	5.42E-01	3.00E-06	4.74E-02
6A	0-10	*yes*	**yes**	*8.84E-05*	1.40E+00	9.67E-06	1.17E-01
6B	0-10	*yes*	**yes**	*3.73E-05*	2.78E-01	4.10E-06	2.35E-02
6C	0-10	*yes*	yes [2]	*2.15E-05*	4.93E-01	3.90E-06	4.20E-02
6D	0-10	*yes*	**yes**	*2.83E-05*	7.87E-01	4.30E-06	6.46E-02
6D1	0-10	*yes*	**yes**	*3.41E-05*	9.87E-01	5.77E-06	8.39E-02
6D2	0-10	*yes*	yes [2]	*2.51E-05*	4.24E-01	3.51E-06	3.61E-02
6D3	0-10	*yes*	**yes**	*2.95E-05*	6.99E-01	4.61E-06	5.94E-02
RS-1	0-10	*yes*	**yes**	*6.06E-05*	7.21E-01	7.03E-06	6.11E-02
RS-1A	0-10	*yes*	yes [2]	*1.96E-05*	4.68E-01	3.69E-06	4.01E-02
RS-1B	0-10	*yes*	yes [2]	*1.82E-05*	3.78E-01	3.33E-06	3.24E-02
RS-1C	0-10	*yes*	yes [2]	*1.75E-05*	3.36E-01	3.16E-06	2.89E-02
RS-1D	0-10	*yes*	**yes**	*2.31E-05*	6.86E-01	4.56E-06	5.85E-02
RS-2	0-10	*yes*	yes [2]	*1.46E-05*	5.39E-01	2.55E-06	4.94E-02
RS-3	0-10	*yes*	yes [2]	*1.67E-05*	4.56E-01	2.87E-06	3.99E-02

Notes
1. Risk due to individual contaminant exceeds 1E-6 due to an elevated detection limit.
2. Risk due to arsenic is greater than 1E-6 but arsenic concentration is lower than or equal to the background value of 7 mg/kg.
3. No detected constituent exceeds the residential RSL except arsenic, with a concentration less than the background value of 7 mg/kg.

Abbreviations
-- = Not calculated
COC = constituent of concern
EPA = US Environmental Protection Agency
mg/kg = milligrams per kilogram
MIS = multi-incremental sampling
RSLs = risk-based screening levels
bold = Exceeds calculated occupational risk threshold based on Occupational EPA RSLs and Oregon Regulations for at least one depth interval.
italics = Exceeds calculated residential risk threshold based on Residential EPA RSLs and Oregon Regulations for at least one depth interval.

TABLE 10

DETAILED LISTING OF SCREENING LEVELS - UPLAND SOILS
University of Portland River Campus Property
Portland, Oregon

		Units	EPA Regional Screening Level (RSL) [1]		DEQ Risk-Based Concentration (RBC) Screening Levels Ingestion, Dermal Contact, and Inhalation		EPA Protection of Groundwater Soil Screening Level (SSL)
			Residential	Industrial	Residential	Commercial	
	Investigation Units/Areas Applied		Uplands MIS Areas (Risk Calculation), Hot Spots [2]		Hot Spots [2]		Uplands Areas
TPH	Diesel	mg/kg	NE	NE	3,900	23,000	NE
TPH	Motor Oil	mg/kg	NE	NE	3,900	23,000	NE
TPH	Gasoline	mg/kg	NE	NE	740	13,000	NE
PCBs	Aroclor 1016	µg/kg	3,900	21,000	NE	NE	NE
PCBs	Aroclor 1221*	µg/kg	140	540	NE	NE	0.12
PCBs	Aroclor 1232*	µg/kg	140	540	NE	NE	0.12
PCBs	Aroclor 1242*	µg/kg	220	740	NE	NE	5.3
PCBs	Aroclor 1248*	µg/kg	220	740	NE	NE	5.2
PCBs	Aroclor 1254*	µg/kg	220	740	NE	NE	8.8
PCBs	Aroclor 1260*	µg/kg	220	740	NE	NE	24
PCBs	Total PCBs*	µg/kg	220	740	NE	NE	NE
	Tributyltin	µg/kg	18,000	180,000	NE	NE	NE
Metals	Antimony	mg/kg	310	410	NE	NE	NE
Metals	Arsenic*	mg/kg	0.39	1.6	0.39	1.7	1.3
Metals	Beryllium	mg/kg	NA	NA	NA	NA	NA
Metals	Cadmium	mg/kg	70	800	NE	NE	1400
Metals	Calcium	mg/kg	NA	NA	NA	NA	NA
Metals	Chromium	mg/kg	120,000 [3]	1,500,000 [3]	NE	NE	180,000,000
Metals	Copper	mg/kg	3,100	41,000	NE	NE	46,000
Metals	Lead	mg/kg	400	800	400	800	14000
Metals	Magnesium	mg/kg	NA	NA	NA	NA	NA
Metals	Nickel	mg/kg	3,800	47,000	NE	NE	48,000
Metals	Selenium	mg/kg	NA	NA	NA	NA	NA
Metals	Silver	mg/kg	NA	NA	NA	NA	NA
Metals	Zinc	mg/kg	23,000	310,000	NE	NE	680,000
PAHs	Pentachlorophenol*	µg/kg	890	2,700	NE	NE	2
PAHs	Acenaphthene	µg/kg	3,400,000	33,000,000	4,700,000	61,000,000	22,000
PAHs	Acenaphthylene	µg/kg	NE	NE	NE	NE	NE
PAHs	Anthracene	µg/kg	17,000,000	170,000,000	23,000,000	93,000,000	360,000
PAHs	Benzo(a)anthracene*	µg/kg	150	2,100	150	2,700	10
PAHs	Benzo(a)pyrene*	µg/kg	15	210	15	270	3.5
PAHs	Benzo(b)fluoranthene*	µg/kg	150	2,100	150	2,700	35
PAHs	Benzo(g,h,i)perylene	µg/kg	NE	NE	NE	NE	NE
PAHs	Benzo(k)fluoranthene*	µg/kg	1,500	21,000	1,500	27,000	350
PAHs	Benzo(k)fluoranthene*	µg/kg	15,000	210,000	15,000	270,000	1,100
PAHs	Dibenz(a,h)anthracene*	µg/kg	15	210	15	270	11
PAHs	Fluoranthene	µg/kg	2,300,000	22,000,000	2,300,000	8,900,000	160,000
PAHs	Fluorene	µg/kg	2,300,000	22,000,000	3,100,000	12,000,000	27,000
PAHs	Indeno(1,2,3-cd)pyrene*	µg/kg	150	2,100	150	2,700	120
PAHs	Naphthalene*	µg/kg	3,600	18,000	4,600	23,000	0.47
PAHs	Phenanthrene	µg/kg	NE	NE	NE	NE	
PAHs	Pyrene	µg/kg	1,700,000	17,000,000	1,700,000	6,700,000	120,000
	Dioxins* (TEQ)	pg/g	4.5	18	NE	NE	NE

TABLE 10

DETAILED LISTING OF SCREENING LEVELS - UPLAND SOILS
University of Portland River Campus Property
Portland, Oregon

		Units	EPA Regional Screening Level (RSL) [1]		DEQ Risk-Based Concentration (RBC) Screening Levels Ingestion, Dermal Contact, and Inhalation		EPA Protection of Groundwater Soil Screening Level (SSL)
			Residential	Industrial	Residential	Commercial	
	Investigation Units/Areas Applied		Uplands MIS Areas (Risk Calculation), Hot Spots [2]		Hot Spots [2]		Uplands Areas
VOCs	1,1,1-Trichloroethane	µg/kg	NA	NA	NA	NA	NA
	1,1-Dichloroethane		NA	NA	NA	NA	NA
	1,2-Dichloropropane		NA	NA	NA	NA	NA
	1,2,4-Trimethylbenzene		62,000	260,000	110,000	2,000,000	NE
	2-Butanone (MEK)		NA	NA	NA	NA	NA
	4-Isopropyltoluene		NA	NA	NA	NA	NA
	Benzene		NA	NA	NA	NA	NA
	Carbon Disulfide		NA	NA	NA	NA	NA
	Chloroethane		NA	NA	NA	NA	NA
	Chloromethane		NA	NA	NA	NA	NA
	cis-1,2-dichloroethylene		NA	NA	NA	NA	NA
	Ethylbenzene		5,400	27,000	30,000	140,000	NE
	Methylene Chloride		NA	NA	NA	NA	NA
	Naphthalene		NA	NA	NA	NA	NA
	sec-Butylbenzene		NA	NA	NA	NA	NA
	tert-Butylbenzene		NA	NA	NA	NA	NA
	Tetrachloroethene		NA	NA	NA	NA	NA
	Toluene		NA	NA	NA	NA	NA
	Vinyl Chloride		NA	NA	NA	NA	NA
	All Other VOCs		NA	NA	NA	NA	NA

Notes
1. EPA screening levels are based on tabulated Regional Screening Levels (RSLs) for residential and industrial users (EPA, 2009). For carcinogens, the screening level is the tabulated EPA RSL (EPA, 2009). For noncarcinogens, the screening level is given by the EPA RSL (EPA, 2009) divided by 10 to reflect a cancer risk of 10-6 and a hazard quotient of 0.1. Analytes marked with an asterisk are considered carcinogens in specifying screening levels based on EPA criteria (EPA, 2009, 2010). For further information see Section 3.3 in the text.
2. The lowest of the RSL, RBC, and JSCS screening levels were used for comparison in hot spots. JSCS screening levels were used only for RS areas.
3. Screening level provided is for chromium(III); no value for total chromium is available (EPA, 2011).

Abbreviations
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
DEQ = Oregon Department of Environmental Quality
EPA = US Environmental Protection Agency
µg/kg = micrograms per kilogram
MEK = methyl ethyl ketone
mg/kg = milligrams per kilogram
MIS = mult-incremental sampling
NA = not applicable
NE = not established
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
pg/g = picograms (10^{-12} grams) per gram
RBC = risk-based concentration
RSL = Regional Screening Level
SSL = soil screening level
TEQ = 2,3,7,8-TCDD toxicity equivalents
TPH = total petroleum hydrocarbons

TABLE 11

DETAILED LISTING OF SCREENING LEVELS - RIVER SHORELINE (RS)
University of Portland River Campus Property
Portland, Oregon

		Units	EPA Regional Screening Level (RSL) [1]		DEQ Risk-Based Concentration (RBC) Screening Levels Ingestion, Dermal Contact, and Inhalation		EPA Protection of Groundwater Soil Screening Level (SSL)	JSCS Screening Level	Portland Harbor Screening Level	
			Residential	Industrial	Residential	Commercial			Lowest	Highest
	Investigation Units/Areas Applied		**Uplands MIS Areas (Risk Calculation), Hot Spots [2]**		**Hot Spots [2]**		**Uplands Areas**	**RS Areas, Hot Spots within RS Areas [2]**	**RS Areas**	
TPH	Diesel	mg/kg	NE	NE	3,900	23,000	NE	NE	NE	NE
	Motor Oil								NE	NE
	Gasoline		NE	NE	740	13,000	NE	NE	NE	NE
PCBs	Aroclor 1016	µg/kg	3,900	21,000	NE	NE	NE	530	NE	NE
	Aroclor 1221*		140	540	NE	NE	0.12	NE	NE	NE
	Aroclor 1232*		140	540	NE	NE	0.12	NE	NE	NE
	Aroclor 1242*		220	740	NE	NE	5.3	NE	NE	NE
	Aroclor 1248*		220	740	NE	NE	5.2	1,500	NE	NE
	Aroclor 1254*		220	740	NE	NE	8.8	300	NE	NE
	Aroclor 1260*		220	740	NE	NE	24	200	NE	NE
	Total PCBs*		220	740	NE	NE	NE	0.39	0	5,000
Tributyltin			18,000	180,000	NE	NE	NE	2.3	3,490	89,200
Metals	Antimony	mg/kg	310	410	NE	NE	NE	64	NE	NE
	Arsenic*		0.39	1.6	0.39	1.7	1.3	7 [3]	0.43	540
	Beryllium		NA	NA	NA	NA	NA	NA	NE	NE
	Cadmium		70	800	NE	NE	1400	1	NE	NE
	Calcium		NA	NA	NA	NA	NA	NA	NE	NE
	Chromium		120,000 [4]	1,500,000 [4]	NE	NE	180,000,000	111	NE	NE
	Copper		3,100	41,000	NE	NE	46,000	149	NE	NE
	Lead		400	800	400	800	14000	17	36.3	3,040,000
	Magnesium		NA	NA	NA	NA	NA	NA	NE	NE
	Nickel		3,800	47,000	NE	NE	48,000	49	NE	NE
	Selenium		NA	NA	NA	NA	NA	NA	NE	NE
	Silver		NA	NA	NA	NA	NA	NA	NE	NE
	Zinc		23,000	310,000	NE	NE	680,000	459	NE	NE
PAHs	Pentachlorophenol*	µg/kg	890	2,700	NE	NE	2	250	NE	NE
	Acenaphthene		3,400,000	33,000,000	4,700,000	61,000,000	22,000	300	NE	NE
	Acenaphthylene		NE	NE	NE	NE	NE	200	NE	NE
	Anthracene		17,000,000	170,000,000	23,000,000	93,000,000	360,000	845	NE	NE
	Benzo(a)anthracene*		150	2,100	150	2,700	10	1,050	810	37,000,000
	Benzo(a)pyrene*		15	210	15	270	3.5	1,450	42	24,000,000
	Benzo(b)fluoranthene*		150	2,100	150	2,700	35	NE	6,900	690,000
	Benzo(g,h,i)perylene		NE	NE	NE	NE	NE	300	NE	NE
	Benzo(k)fluoranthene*		1,500	21,000	1,500	27,000	350	13,000	150,000	1,100,000,000
	Chrysene*		15,000	210,000	15,000	270,000	1,100	1,290	NE	NE
	Dibenz(a,h)anthracene*		15	210	15	270	11	1,300	690	69,000
	Fluoranthene		2,300,000	22,000,000	2,300,000	8,900,000	160,000	2,230	NE	NE
	Fluorene		2,300,000	22,000,000	3,100,000	12,000,000	27,000	300	NE	NE
	Indeno(1,2,3-cd)pyrene*		150	2,100	150	2,700	120	100	6,900	690,000
	Naphthalene*		3,600	18,000	4,600	23,000	0.47	561	NE	NE
	Phenanthrene		NE	NE	NE	NE		1,170	NE	NE
	Pyrene		1,700,000	17,000,000	1,700,000	6,700,000	120,000	1,520	NE	NE

TABLE 11

DETAILED LISTING OF SCREENING LEVELS - RIVER SHORELINE (RS)
University of Portland River Campus Property
Portland, Oregon

		Units	EPA Regional Screening Level (RSL) [1]		DEQ Risk-Based Concentration (RBC) Screening Levels Ingestion, Dermal Contact, and Inhalation		EPA Protection of Groundwater Soil Screening Level (SSL)	JSCS Screening Level	Portland Harbor Screening Level	
			Residential	Industrial	Residential	Commercial			Lowest	Highest
	Investigation Units/Areas Applied		Uplands MIS Areas (Risk Calculation), Hot Spots [2]		Hot Spots [2]		Uplands Areas	RS Areas, Hot Spots within RS Areas [2]	RS Areas	
Dioxins* (TEQ)		pg/g	4.5	18	NE	NE	NE	0.0091	0	910
VOCs	1,1,1-Trichloroethane	µg/kg	NA	NA	NA	NA	NA	NA	NE	NE
	1,1-Dichloroethane		NA	NA	NA	NA	NA	NA	NE	NE
	1,2-Dichloropropane		NA	NA	NA	NA	NA	NA	NE	NE
	1,2,4-Trimethylbenzene		62,000	260,000	110,000	2,000,000	NE	NE	NE	NE
	2-Butanone (MEK)		NA	NA	NA	NA	NA	NA	NE	NE
	4-Isopropyltoluene		NA	NA	NA	NA	NA	NA	NE	NE
	Benzene		NA	NA	NA	NA	NA	NA	NE	NE
	Carbon Disulfide		NA	NA	NA	NA	NA	NA	NE	NE
	Chloroethane		NA	NA	NA	NA	NA	NA	NE	NE
	Chloromethane		NA	NA	NA	NA	NA	NA	NE	NE
	cis-1,2-dichloroethylene		NA	NA	NA	NA	NA	NA	NE	NE
	Ethylbenzene		5,400	27,000	30,000	140,000	NE	NE	NE	NE
	Methylene Chloride		NA	NA	NA	NA	NA	NA	NE	NE
	Naphthalene		NA	NA	NA	NA	NA	NA	NE	NE
	sec-Butylbenzene		NA	NA	NA	NA	NA	NA	NE	NE
	tert-Butylbenzene		NA	NA	NA	NA	NA	NA	NE	NE
	Tetrachloroethene		NA	NA	NA	NA	NA	NA	NE	NE
	Toluene		NA	NA	NA	NA	NA	NA	NE	NE
	Vinyl Chloride		NA	NA	NA	NA	NA	NA	NE	NE
	All Other VOCs		NA	NA	NA	NA	NA	NA	NE	NE

Notes
1. EPA screening levels are based on tabulated Regional Screening Levels (RSLs) for residential and industrial users (EPA, 2009). For carcinogens, the screening level is the tabulated EPA RSL (EPA, 2009). For noncarcinogens, the screening level is given by the EPA RSL (EPA, 2009) divided by 10 to reflect a cancer risk of 10-6 and a hazard quotient of 0.1. Analytes marked with an asterisk are considered carcinogens in specifying screening levels based on EPA criteria (EPA, 2009, 2010). For further information see Section 3.3 in the text.
2. The lowest of the RSL, RBC, and JSCS screening levels were used for comparison in hot spots. JSCS screening levels were used only for RS areas.
3. The JSCS screening level for arsenic is the background concentration for arsenic in the Portland Harbor area given by Oregon DEQ in a memorandum dated October 28, 2002.
4. Screening level provided is for chromium(III); no value for total chromium is available (EPA, 2011).

Abbreviations
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
DEQ = Oregon Department of Environmental Quality
EPA = US Environmental Protection Agency
JSCS = Joint Source Control Strategy
µg/kg = micrograms per kilogram
MEK = methyl ethyl ketone
mg/kg = milligrams per kilogram
MIS = multi-incemental sampling
NA = not applicable
NE = not established
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
pg/g = picograms (10^{-12} grams) per gram
RS = river shoreline
RBC = risk-based concentration
RSL = Regional Screening Level
SSL = soil screening level
TEQ = 2,3,7,8-TCDD toxicity equivalents
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

TABLE 12

DETAILED LISTING OF SCREENING LEVELS - GROUNDWATER
University of Portland River Campus Property
Portland, Oregon

		Groundwater			
		Units	JSCS Screening Level	EPA Regional Screening Level (RSL)	EPA Maximum Contaminant Level (MCL)
	Investigation Units/Areas Applied	**All Areas**			
TPH	Diesel	mg/L	90 [1]		NE
	Motor Oil	mg/L	90 [1]		NE
	Gasoline	mg/L	100 [1]		NE
PCBs	Aroclor 1016	µg/L	NA	NA	NA
	Aroclor 1221*	µg/L	NA	NA	NA
	Aroclor 1232*	µg/L	NA	NA	NA
	Aroclor 1242*	µg/L	NA	NA	NA
	Aroclor 1248*	µg/L	NA	NA	NA
	Aroclor 1254*	µg/L	NA	NA	NA
	Aroclor 1260*	µg/L	NA	NA	NA
	Total PCBs*	µg/L	NA	NA	NA
Tributyltin		µg/L	0.072	11	NE
Metals	Antimony	mg/L	6	15	6
	Arsenic*	mg/L	0.045	0.045	10
	Beryllium	mg/L	NE	73	4
	Cadmium	mg/L	0.094	18	5
	Calcium	mg/L	NE	NE	NE
	Chromium	mg/L	100	0.043 [2]	100
	Copper	mg/L	2.7	1,500	1,300
	Lead	mg/L	0.54	NE	15
	Magnesium	mg/L	NE	NE	NE
	Nickel	mg/L	16	NE	NE
	Selenium	mg/L	5	180	50
	Silver	mg/L	0.12	180	NE
	Zinc	mg/L	36	11,000	NE
PAHs	Pentachlorophenol*	µg/L	0.2	0.14	NE
	Acenaphthene	µg/L	0.2	2,200	NE
	Acenaphthylene	µg/L	0.2	NE	NE
	Anthracene	µg/L	0.2	11,000	NE
	Benzo(a)anthracene*	µg/L	0.018	0.029	NE
	Benzo(a)pyrene*	µg/L	0.018	0.0029	0.2000
	Benzo(b)fluoranthene*	µg/L	0.018	0.029	NE
	Benzo(g,h,i)perylene	µg/L	0.2	NE	NE
	Benzo(k)fluoranthene*	µg/L	0.018	0.29	NE
	Chrysene*	µg/L	0.018	2.9	NE
	Dibenz(a,h)anthracene*	µg/L	0.018	0.0029	NE
	Fluoranthene	µg/L	0.2	1,500	NE
	Fluorene	µg/L	0.2	1,500	NE
	Indeno(1,2,3-cd)pyrene*	µg/L	0.018	0.029	NE
	Naphthalene*	µg/L	0.56	0.56	1.00
	Phenanthrene	µg/L	0.2	NE	NE
	Pyrene	µg/L	0.2	1,100	NE

TABLE 12

DETAILED LISTING OF SCREENING LEVELS - GROUNDWATER
University of Portland River Campus Property
Portland, Oregon

		Groundwater			
		Units	JSCS Screening Level	EPA Regional Screening Level (RSL)	EPA Maximum Contaminant Level (MCL)
	Investigation Units/Areas Applied	All Areas			
VOCs	1,1,1-Trichloroethane	µg/L	11	9,100	200
	1,1-Dichloroethane		47	2.4	5
	1,2-Dichloropropane		0.97	0.39	5
	1,2,4-Trimethylbenzene		NA	NA	NA
	2-Butanone (MEK)		7,100	7,100	NE
	4-Isopropyltoluene		NE	NE	NE
	Benzene		1.2	0.41	5
	Carbon Disulfide		0.92	100	NE
	Chloroethane		23	NE	NE
	Chloromethane		2.1	190	NE
	cis-1,2-dichloroethylene		590	370	70
	Ethylbenzene		NA	NA	NA
	Methylene Chloride		8.9	4.8	NE
	Naphthalene		0.2	0.14	NE
	sec-Butylbenzene		NE	NE	NE
	tert-Butylbenzene		NE	NE	NE
	Tetrachloroethene		0.12	0.11	5
	Toluene		9.8	2,300	1,000
	Vinyl Chloride		0.015	0.016	2
	All Other VOCs		NA	NA	NA

Notes
1. Screening levels for TPH fractions are the lowest applicable Oregon RBCs screening levels (DEQ, 2009). Neither JSCS screening level nor RSL is available for TPH fractions.
2. Screening level provided for chromium is chromium(VI) fraction (EPA, 2010).

Abbreviations
2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
EPA = US Environmental Protection Agency
JSCS = Joint Source Control Strategy
µg/L = micrograms per liter
MCL = maximum contaminant level
MEK = methyl ethyl ketone
mg/L = milligrams per liter
NA = not applicable
NE = not established
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
pg/g = picograms (10^{-12} grams) per gram
RSL = Regional Screening Level
TEQ = 2,3,7,8-TCDD toxicity equivalents
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

TABLE 13

COST ANALYSIS - UPLAND AREAS AND POTENTIAL HOT SPOTS[1,2,3,4]

University of Portland River Campus Property

Portland, Oregon

	Area	Option 3: Capping (2 feet thick) with Off-site Soil	Option 4: Excavation and Disposal	
			Backfill from Off Site	Excavation Depth (feet)
Uplands	1A	No Action		
	1B	*$431,000*	*$6,905,000*	*0-10*
	1C[3]	$653,000	$60,000	1-5
	2A	*$97,000*	*$165,000*	*0-1*
			$1,172,000	0-10
	2A1	$43,000	$408,000	0-10
	2B	$490,000	$10,064,000	0-10
	3A	No Action		
	3B	$172,000	$1,673,000	0-5
	4	No Action		
	5A	$252,000	$2,549,000	0-5
	5B	$472,000	$9,594,000	0-10
	6A	*$370,000*	*$839,000*	*0-1*
			$7,497,000	0-10
	6B	*$229,000*	*$520,000*	*0-1*
			$4,523,000	0-10
	6C	$332,000	$6,641,000	0-10
	6D	$610,000	$6,346,000	0-5
	6D1	*$211,000*	*$349,000*	*0-1*
	6D2	No Action		
	6D3	*$207,000*	*$345,000*	*0-1*
SUBTOTAL	**Occupational**	**$1,545,000**	**$9,123,000**	
	Residential	**$4,151,000**	**$57,432,000**	
	Active Response Areas	**$431,000**	**$6,905,000**	
ROD "Hot Spots"	A2-1	--	$211,000	0-11
	A2-3	--	$37,000	0-5
	A5-11	--	$71,000	5-12
	A5-12A/B	--	$189,000	0-3
	A5-13	--	$13,000	0-0.5
	A4-5	--	$47,000	0-6
SUBTOTAL			**$568,000**	
Other Potential "Hot Spots"	WS-3A-2A	$5,000	$16,000	9-10
	WS-6A-23	No Action		
	WS-6A-8/9	No Action		
	A6-14B	No Action		
	WS-6D-8	No Action		
	WS-6D-13/14	No Action		
	WS-RS-1-24	No Action		
	A4-8	No Action		
	WS-RS-3-1	$5,000	$24,000	5-8
	Stained Soil Under Slab	$7,000	$41,000	0-4
	Former Smokestack Area	No Action		
SUBTOTAL		**$17,000**	**$81,000**	

TABLE 13

COST ANALYSIS - UPLAND AREAS AND POTENTIAL HOT SPOTS [1,2,3,4]
University of Portland River Campus Property
Portland, Oregon

	Area	Option 3: Capping (2 feet thick) with Off-site Soil	Option 4: Excavation and Disposal	
			Backfill from Off Site	Excavation Depth (feet)
Asphalt Capping Areas (3/4 Fill at 3" Depth and 2" Asphalt) [5]	All Asphalt Areas	$190,000	No Action	
SUBTOTAL		**$190,000**		

Notes
1. *Italic* type indicates depth interval exceeds actionable levels based on calculated risk for occupational use, and costs for capping and/or excavation will apply under an occupational-only scenario.
2. The cost estimate for Options 3 and 4 is based on the an assumption that imported fill is used for capping and backfill.
3. "Hot Spots" costs do not include additonal full mob./demob. Costs or reporting/oversight costs since they are assumed to coincide with other work costed for the project. However, costs do include an additional 20% contingency to cover mark-up and unaccounted additional associated costs.
4. Cost assumes a 1 foot cap as the top 1 foot of this area does not require cleanup.
5. The asphalt cap: 61,000 square feet; 2 inches thick, with 3 inches of crushed rock base.

TABLE 14

COST ANALYSIS - RIVER SHORELINE AREAS[1]
University of Portland River Campus Property
Portland, Oregon

	Area	Full Excavation Options - to 10 feet		Excavate at 5:1 Slope Options - to 15 feet (near waterline) at deepest point		Excavate at 1.5:1 Slope Options - to 15 feet (near waterline) at deepest point	
		Option 5: Full Excavation and Reuse	Option 4: Full Excavation and Disposal	Option 5: Excavation at a 5:1 slope and Reuse	Option 4: Excavation at a 5:1 slope and Dispose,	Option 5: Excavation at a 1.5:1 slope and Reuse	Option 4: Excavation at a 1.5:1 slope and Dispose
		Backfill 5:1 slope from Off-site Source	Backfill 5:1 slope from Off-site Source	Plus 2 ft cap using Off-site Source	Plus 2 ft cap using Off-site Source	Plus 2 ft cap using Off-site Source	Plus 2 ft cap using Off-site Source
Riverfront	RS-1	$ 833,000	$ 3,413,000	$ 440,000	$ 2,734,000	$ 365,000	$ 1,607,000
	RS-2	$ 762,000	$ 3,080,000	$ 406,000	$ 2,496,000	$ 337,000	$ 1,469,000
	RS-3	$ 1,316,000	$ 5,435,000	$ 585,000	$ 3,453,000	$ 497,000	$ 2,138,000
	TOTAL	**$ 2,911,000**	**$ 11,928,000**	**$ 1,431,000**	**$ 8,683,000**	**$ 1,199,000**	**$ 5,214,000**

Notes
1. The cost estimate for Options 4 and 5 is based on the an assumption that imported fill is used for capping and backfill.

TABLE 15

RECOMMENDED REMOVAL ACTION ALTERNATIVE FOR POTENTIAL HOT SPOT EXCAVATION AREAS
University of Portland River Campus Property
Portland, Oregon

Suspected Hot Spot	In Area Bordering River?	COCs present above residential screening levels only	COCs present above recreational/ commercial screening levels	COCs present above JSCS	Recommended Action
Recommended for Excavation in the ROD					
A2-1	No	motor oil	diesel	NA	**Excavate** 2,400 square feet area to an average of 7 feet. Southern end of hot spot (near GP-37) is shallow and will be excavated to 4 feet; northern end of hot spot is deeper and will be excavated to 11 feet.
A2-3	No	none	lead	NA	**Excavate** 700 square feet area to approximately 5 feet to remove soil with elevated levels of lead from the area of TP-1 and GP-174.
A5-11	No	none	PAHs	NA	**Excavate** 1,100 square feet in area and approximately 5-12 feet deep.
A5-12A/B	Yes[1]	diesel	NA	PCBs, arsenic	Near-river portion of area (within RS-2) to be **excavated**. The area of elevated PCB and TPH concentrations is estimated to be approximately 6,500 square feet and 1 to 2 feet deep. Depth of removal is established based on the PCB and TPH concentrations.
A5-13	Yes	none	NA	PCBs	**Excavate** approximately 500 square feet to remove elevated concentrations of PCBs at 0.5 feet bgs.
A4-5	Yes	none	NA	PCBs, PAHs	**Excavate** approximately 800 square feet. Elevated concentrations of PAHs and PCBs are at 4-6 feet bgs.
Not Recommended for Excavation in the ROD					
WS-3A-2A	No	diesel	none	NA	**Institutional controls.** Elevated concentrations are at 9-10 feet bgs.
WS-6A-23	No	none	none	NA	**None**, results are not above actionable levels.
WS-6A-8/9	No	diesel, PAHs	motor oil, PAHs [b(a)p only]	NA	Evaluated with Area 6A for removal action. **Institutional controls** will apply. Elevated concentrations are at 8-9 feet bgs.
A6-14B	Yes[1]	none	none	none	**None required**. Recent data (2005) did not confirm earlier results that showed elevated concentrations of COCs. Construction of a ramp to the Willamette River appears to have resulted in the removal of most, if not all, of the contaminated soil in the area of the ramp. Even so, the near-river portion (within Areas RS-1c and RS-1d) will be excavated as part of removal action for Area RS-1.
WS-6D-8	No	motor oil	diesel [2]	NA	Evaluated with Area 6D2 for removal action.[2] **Institutional controls** will apply. Elevated concentrations are at 2-2.5 feet bgs.
WS-6D-13/14	No	diesel/motor oil/gasoline, VOCs	PAHs [b(a)p only]	NA	Evaluated with Area 6D1 for removal action. **Institutional controls** will apply. Elevated concentrations are at 4.5-10 feet bgs.
WS-RS-1-24	Yes	none	NA	PAHs	Planned for **excavation** as part of addressing area-wide impact to Area RS-1. Elevated concentrations are at 5-6 feet bgs.
A4-8	Yes	none	NA	PAHs	Planned for **excavation** as part of addressing area-wide impact to Area RS-3. Elevated concentrations only slightly exceeded the screening level and are at depth (5-15 feet bgs). Remnant concentrations will be confirmed following excavation.
WS-RS-3-1	Yes	none	NA	arsenic, lead	Planned for **excavation** as part of addressing area-wide impact to Area RS-3. Elevated concentrations are at 5-8 feet bgs.
Stained Soil Under Slab	No	unknown	unknown	NA	Conservatively planned for **excavation** due to uncertainty regarding COC concentrations.
Former Smokestack Area	No	none	none	NA	**None,** results are not above actionable levels.
Areas Identified for Capping in the 2005 DEQ ROD.					**Capping** in line with ROD. 3-inch stone fill topped by 2 inches of coarse binder asphalt.

Notes
1. Areas A5-12A/B and A6-14B span both riverfront and upland areas.
2. Although diesel exceeds industrial screening levels, WS-6D-8 does not exceed calculated industrial risk and is evaluated for removal action with Area 6D2.

Abbreviations
b(a)p = benzo(a)pyrene
bgs = below ground surface
COCs = contaminants of concern
JSCS = Joint Source Control Strategy
NA = not applicable
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
ROD = Record of Decision (DEQ, 2005)
VOCs = volatile organic compounds

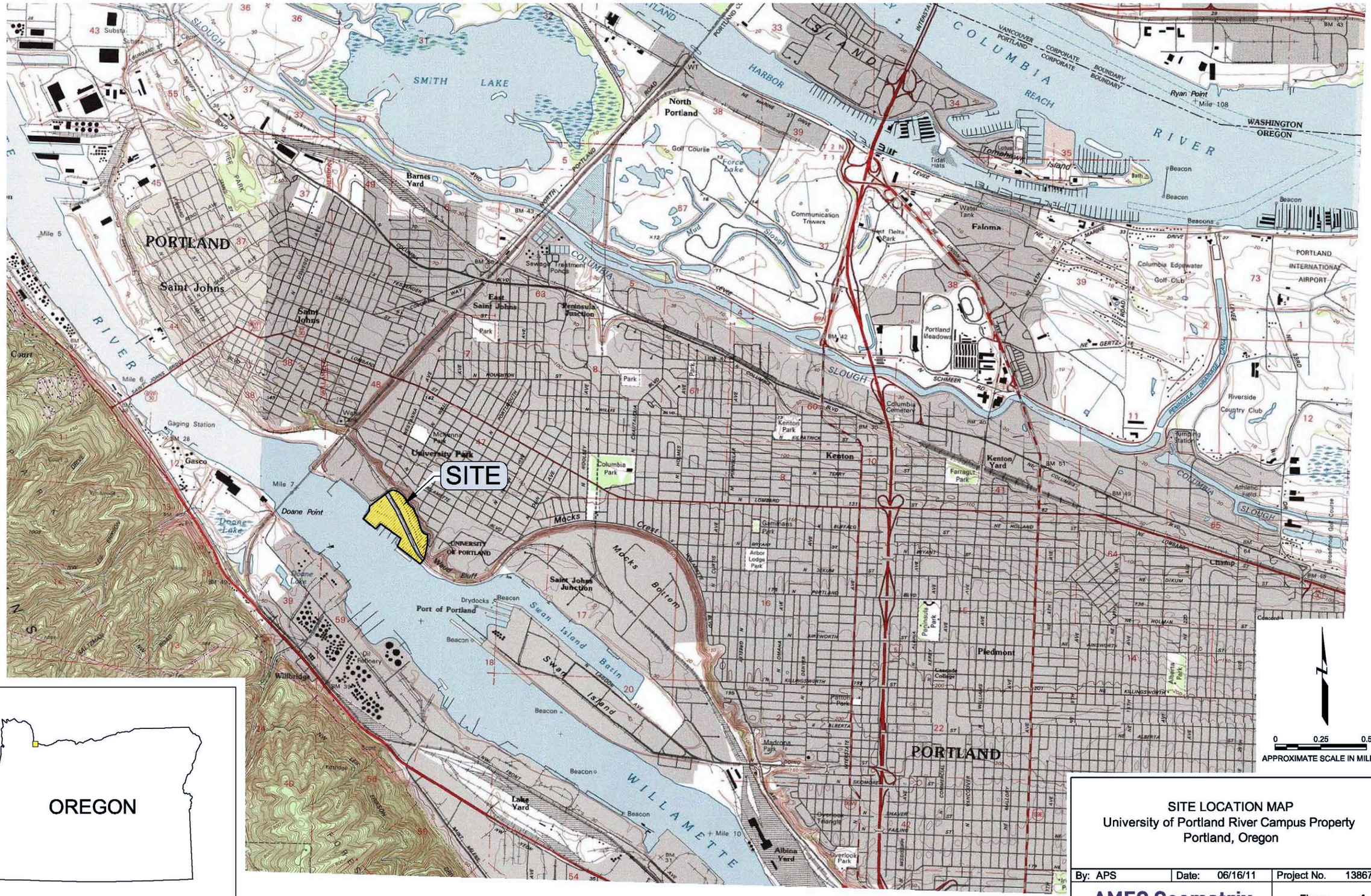
TABLE 16

RECOMMENDED REMOVAL ACTION - COST SUMMARY
University of Portland River Campus Property
Portland, Oregon

	Area	Option 2: Institutional Controls Only	Option 4: Capping (2 feet thick) with Off-Site Soil	Option 6: Excavation and Disposal		Option 4: Excavation at a 5:1 slope and Reuse
				Backfill from Off Site	Excavation depth (feet)	Plus 2 ft cap using Offsite Source
Uplands	1A	No action				
	1B		$431,000			
	1C	X				
	2A	X	$97,000			
	2A1	X				
	2B	X				
	3A	No action				
	3B	X				
	4	No action				
	5A	X				
	5B	X				
	6A	X	$370,000			
	6B	X	$229,000			
	6C	X				
	6D1	X	$211,000			
	6D2	X				
	6D3	X	$207,000			
ROD "Hot Spots"	A2-1			$211,000	0-11	
	A2-3			$37,000	0-5	
	A5-11			$71,000	5-12	
	A5-12A/B			$189,000	0-3	
	A5-13			$12,000	0-0.5	
	A4-5			$47,000	0-6	
Other Potential "Hot Spots"	WS-3A-2A	No action				
	WS-6A-23	No action				
	WS-6A-8/9	No action				
	A6-14B	No action				
	WS-6D-8	No action				
	WS-6D-13/14	No action				
	WS-RS-1-24	No action				
	A4-8	No action				
	WS-RS-3-1	No action				
	Stained Soil Under Slab			$41,000	0-4	
	Former Smokestack Area	No action				
Near River	RS-1					$440,000
	RS-2					$406,000
	RS-3					$585,000
Asphalt Cap Areas [3]	All Areas		$190,000	No Action		
Cost of recommended action (shaded gray)						**$2,660,000**

Notes
1. Recommended removal action from each area is shaded gray and described in Section 7.0 in the text. The cost estimate for Options 4 and 6 is based on the an assumption that imported fill is used for capping and backfill.
2. "Hot Spots" costs do not include additonal mob./demob. Costs or reporting/oversight costs since they are assumed to coincide with other work costed for the project. However, costs do include an additional 20% contingency to cover mark-up and unaccounted additional associated costs.
3. The asphalt cap: 61,000 square feet; 2 inches thick, with 3 inches of crushed rock base.

FIGURES

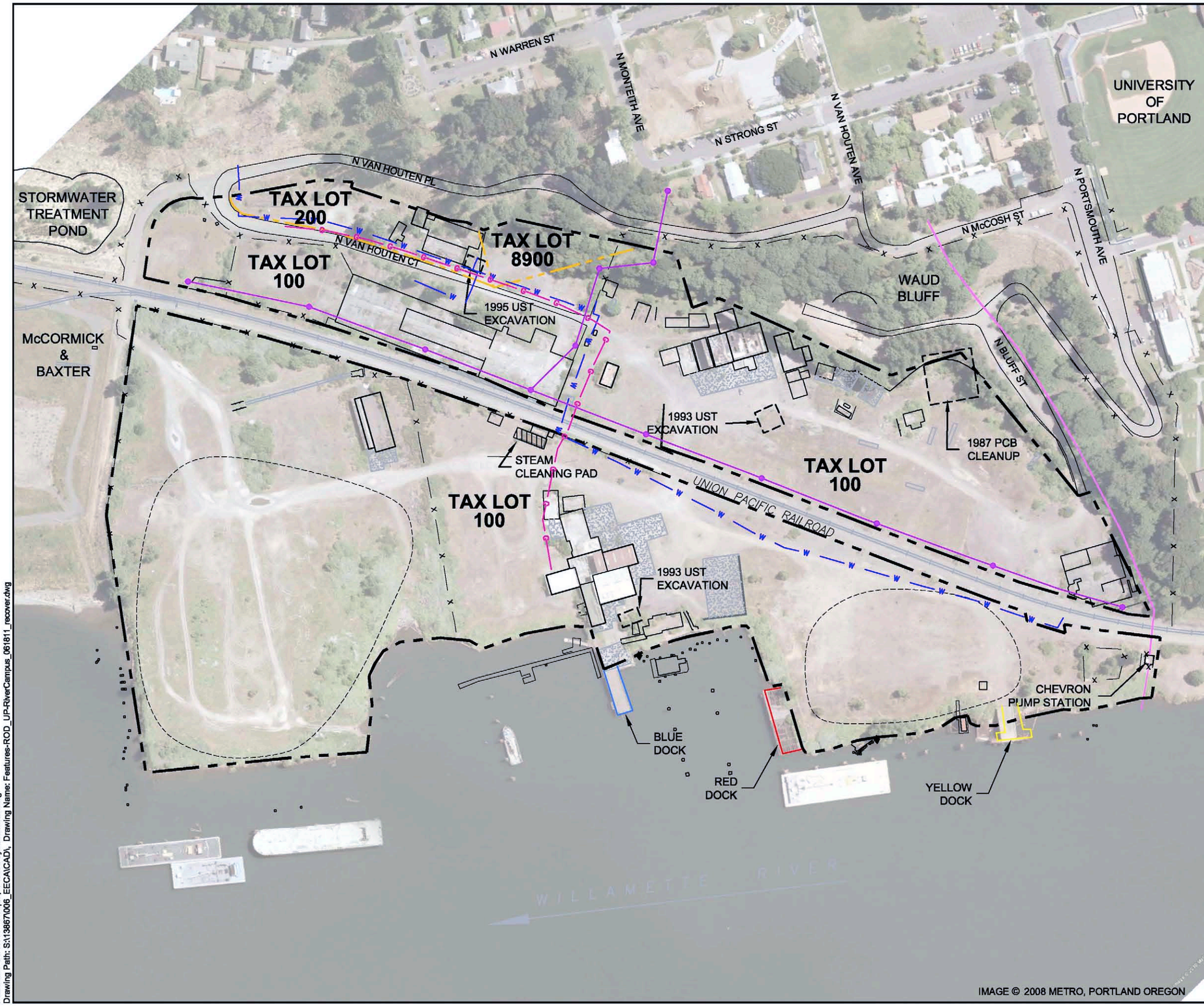


U.S.G.S. TOPO MAP 7.5 MINUTE QUADRANGLE 1990

SITE LOCATION MAP
University of Portland River Campus Property
Portland, Oregon

By: APS	Date: 06/16/11	Project No. 13867
AMEC Geomatrix		Figure 1

Plot Date: 06/16/11 - 7:00pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: Features-ROD_UP-RiverCampus_061811.dwg



EXPLANATION

- WATER LINE
- NATURAL GAS LINE
- CHEVRON PETROLEUM PIPELINE
- SECURITY FLOODLIGHT LINE
- PROPERTY LINE
- PARCEL LINE
- FENCE
- FORMER BUILDING
- FORMER SAND BLASTING AREA

0 100 200
APPROXIMATE SCALE IN FEET

SITE MAP AND HISTORICAL FEATURES
University of Portland River Campus Property
Portland, Oregon

By: APS	Date: 06/17/11	Project No. 13867
AMEC Geomatrix		Figure 2

Plot Date: 06/17/11 - 3:52pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: Features-ROD_UP-RiverCampus_061811_recover.dwg

GROUNDWATER SAMPLING LOCATIONS

- 2A — 2006 MIS SAMPLING AREAS
- 2A1 — 2009/2010 MIS SAMPLING AREAS
- 2010 DIRECT-PUSH GROUNDWATER SAMPLING LOCATION
- EXISTING MONITORING WELL LOCATION
- HISTORIC BORING GROUNDWATER SAMPLING LOCATION
- HISTORIC TEST PIT LOCATION

OTHER SITE FEATURES

- PROPERTY LINE
- PARCEL LINE
- FENCE
- GATE
- CHEVRON PETROLEUM PIPELINE
- APPROXIMATE BOUNDARY OF 100-YEAR FLOOD PLAIN (32.9' NAVD88)
- 1-FT TOPOGRAPHIC CONTOUR INTERVAL
- 5-FT TOPOGRAPHIC CONTOUR INTERVAL

NOTE:
MIS SAMPLE GRID (SPECIFIC SAMPLE LOCATIONS) NOT SHOWN.

0 100 200
APPROXIMATE SCALE IN FEET

TOPOGRAPHIC CONTOURS AND HISTORICAL SAMPLING LOCATIONS
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/05/12	Project No. 13867
AMEC Geomatrix		Figure 3

Plot Date: 03/05/12 - 1:03pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: SiteMap-Topo_UP-RiverCampus_030511.dwg

EXPLANATION

ANTICIPATED RIVER CAMPUS REDEVELOPMENT

ANTICIPATED PAVED AREA OR FUTURE BUILDING

ANTICIPATED RIVER CAMPUS UTILITIES

FIRE HYDRANT

POWER POLE

LIGHT POLE

SAMPLING LOCATION

2B — MIS SAMPLING AREA

0 100 200

APPROXIMATE SCALE IN FEET

PRELIMINARY PLAN OF ANTICIPATED USE
University of Portland River Campus Property
Portland, Oregon

By: APS	Date: 06/20/11	Project No. 13867
AMEC Geomatrix		Figure 4

Plot Date: 06/20/11 - 12:33pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: PreliminaryPlan_UP-RiverCampus_061611.dwg

EXPLANATION

- POTENTIAL HOT SPOT NOT IDENTIFIED FOR EXCAVATION IN ROD
- HOT SPOT FROM 2005 DEQ ROD
- ASPHALT CAP (DEQ ROD AREAS)
- WS-3A-2a Diesel — POTENTIAL HOT SPOT ID AND DETECTED CONTAMINANTS OF POTENTIAL CONCERN
- 2A — MIS SAMPLING AREAS
- PROPERTY LINE
- PARCEL LINE
- FENCE
- GATE
- APPROXIMATE BOUNDARY OF 100-YEAR FLOOD PLAIN

NOTE:

CONTAMINANTS OF POTENTIAL CONCERN ARE LISTED FOR EACH POTENTIAL HOT SPOT AREA BASED ON THE FINDINGS OF THE 2010 DATA GAPS INVESTIGATION REPORT (AMEC, 2010b), AND REPRESENT CONTAMINANTS EXCEEDING PRELIMINARY SCREENING LEVELS IDENTIFIED IN THAT REPORT.

0 100 200
APPROXIMATE SCALE IN FEET

POTENTIAL HOT SPOTS
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/15/12	Project No. 13867
AMEC Geomatrix		Figure 5

Plot Date: 03/15/12 - 2:18pm Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\ Drawing Name: Sampling-ExcavAreas_UP-RiverCampus_031512.dwg

EXPLANATION

- (2A) MIS SAMPLING AREAS
- TPH, PCBs, PAHs/cPAHs — DETECTED ANALYTE GROUPS
- PROPERTY LINE
- FENCE
- GATE
- APPROXIMATE BOUNDARY OF 100-YEAR FLOOD PLAIN

NOTE:

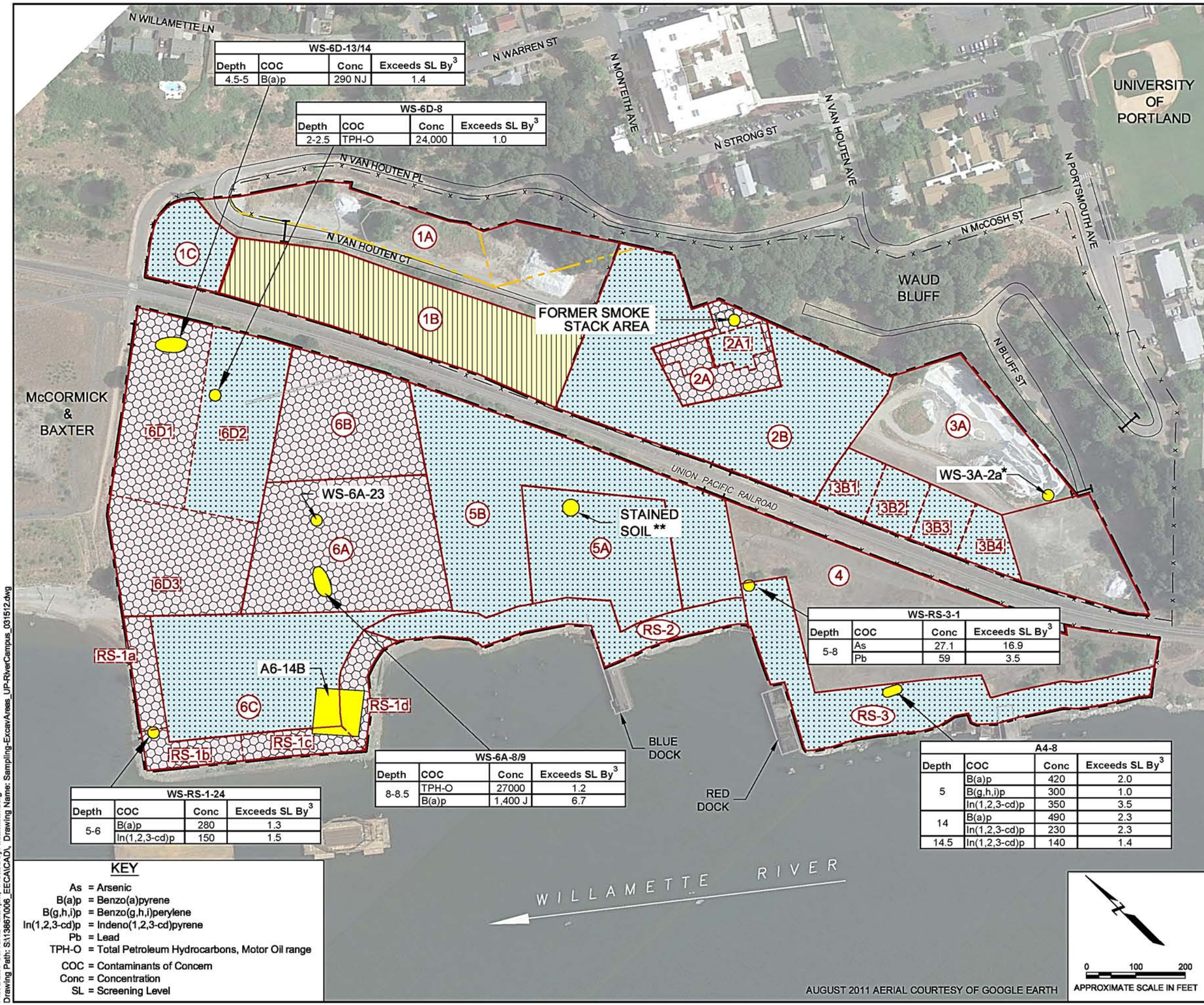
IN ADDITION TO INDICATED ANALYTE GROUPS, METALS HAVE BEEN DETECTED IN SOILS FROM ALL AREAS.

0 100 200
APPROXIMATE SCALE IN FEET

DETECTED ANALYTES IN
MIS SAMPLING AREAS
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 06/20/11	Project No. 13867
AMEC Geomatrix		Figure 6

Plot Date: 06/20/11 - 3:09pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EEC\ACAD\, Drawing Name: Sampling-ExcavAreas_UP-RiverCampus_061711.dwg



WS-6D-13/14			
Depth	COC	Conc	Exceeds SL By[3]
4.5-5	B(a)p	290 NJ	1.4

WS-6D-8			
Depth	COC	Conc	Exceeds SL By[3]
2-2.5	TPH-O	24,000	1.0

WS-RS-3-1			
Depth	COC	Conc	Exceeds SL By[3]
5-8	As	27.1	16.9
	Pb	59	3.5

WS-6A-8/9			
Depth	COC	Conc	Exceeds SL By[3]
8-8.5	TPH-O	27000	1.2
	B(a)p	1,400 J	6.7

WS-RS-1-24			
Depth	COC	Conc	Exceeds SL By[3]
5-6	B(a)p	280	1.3
	In(1,2,3-cd)p	150	1.5

A4-8			
Depth	COC	Conc	Exceeds SL By[3]
5	B(a)p	420	2.0
	B(g,h,i)p	300	1.0
	In(1,2,3-cd)p	350	3.5
14	B(a)p	490	2.3
	In(1,2,3-cd)p	230	2.3
14.5	In(1,2,3-cd)p	140	1.4

KEY

As = Arsenic
B(a)p = Benzo(a)pyrene
B(g,h,i)p = Benzo(g,h,i)perylene
In(1,2,3-cd)p = Indeno(1,2,3-cd)pyrene
Pb = Lead
TPH-O = Total Petroleum Hydrocarbons, Motor Oil range
COC = Contaminants of Concern
Conc = Concentration
SL = Screening Level

EXPLANATION

MIS SAMPLING AREAS

2A — 2006 MIS SAMPLING AREAS
2A1 — 2009/2010 MIS SAMPLING AREAS

OTHER SITE FEATURES

PROPERTY LINE
PARCEL LINE
FENCE
GATE
MIS AREA EXCEEDS OCCUPATIONAL RISK
MIS AREA EXCEEDS RESIDENTIAL RISK
EXCEEDS CARCINOGENIC RISK OF IE-04 OR NONCANCER RISK OF HAZARD INDEX OF 1
POTENTIAL HOT SPOT

NOTES:

1. VALUES SHOWN ONLY FOR POTENTIAL HOT SPOT AREAS NOT PREVIOUSLY IDENTIFIED IN THE 2005 ROD AND ONLY FOR RESULTS THAT EXCEED APPLICABLE SCREENING LEVEL, AS DEFINED IN THE TEXT. SEE TABLES 4 AND 5 FOR FULL RESULTS.
2. AREAS WERE FOUND NOT TO MEET OREGON STATE DEFINITION OF "HOT SPOT" AND WILL BE ADDRESSED ALONG WITH REMOVAL ACTION OPTIONS FOR THE MIS AREA WHERE THEY OCCUR, EXCEPT AS NOTED BELOW:

   * EXCEEDS CALCULATED RESIDENTIAL RISK.

   ** AREA WAS IDENTIFIED AS A HOT SPOT FOR REMOVAL ACTION BASED ON THE UNCERTAINTY OF ACTUAL COC CONCENTRATIONS AND THE PREFERRED OPTION IS EXCAVATION.
3. COC CONCENTRATION DIVIDED BY THE LOWEST APPLICABLE SCREENING LEVEL (EPA INDUSTRIAL/ OCCUPATIONAL RSLs OR DEQ RBCs FOR UPLAND AREAS; EPA INDUSTRIAL OCCUPATIONAL RSLs, DEQ RBCs, OR JSCS SCREENING LEVELS FOR RIVERFRONT AREAS). CONCENTRATIONS >10 TIMES THE CLEANUP LEVEL ARE CONSIDERED A "HOT SPOT" UNDER OREGON STATE DEFINITION.
4. CONCENTRATIONS IN µg/kg EXCEPT MOTOR OIL, ARSENIC AND LEAD, SHOWN IN mg/kg.

ANALYTICAL RESULTS FOR POTENTIAL HOT SPOTS
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/15/12	Project No. 13867
AMEC Geomatrix		Figure 7

Plot Date: 03/15/12 - 2:21pm, Plotted by: adam.stenberg
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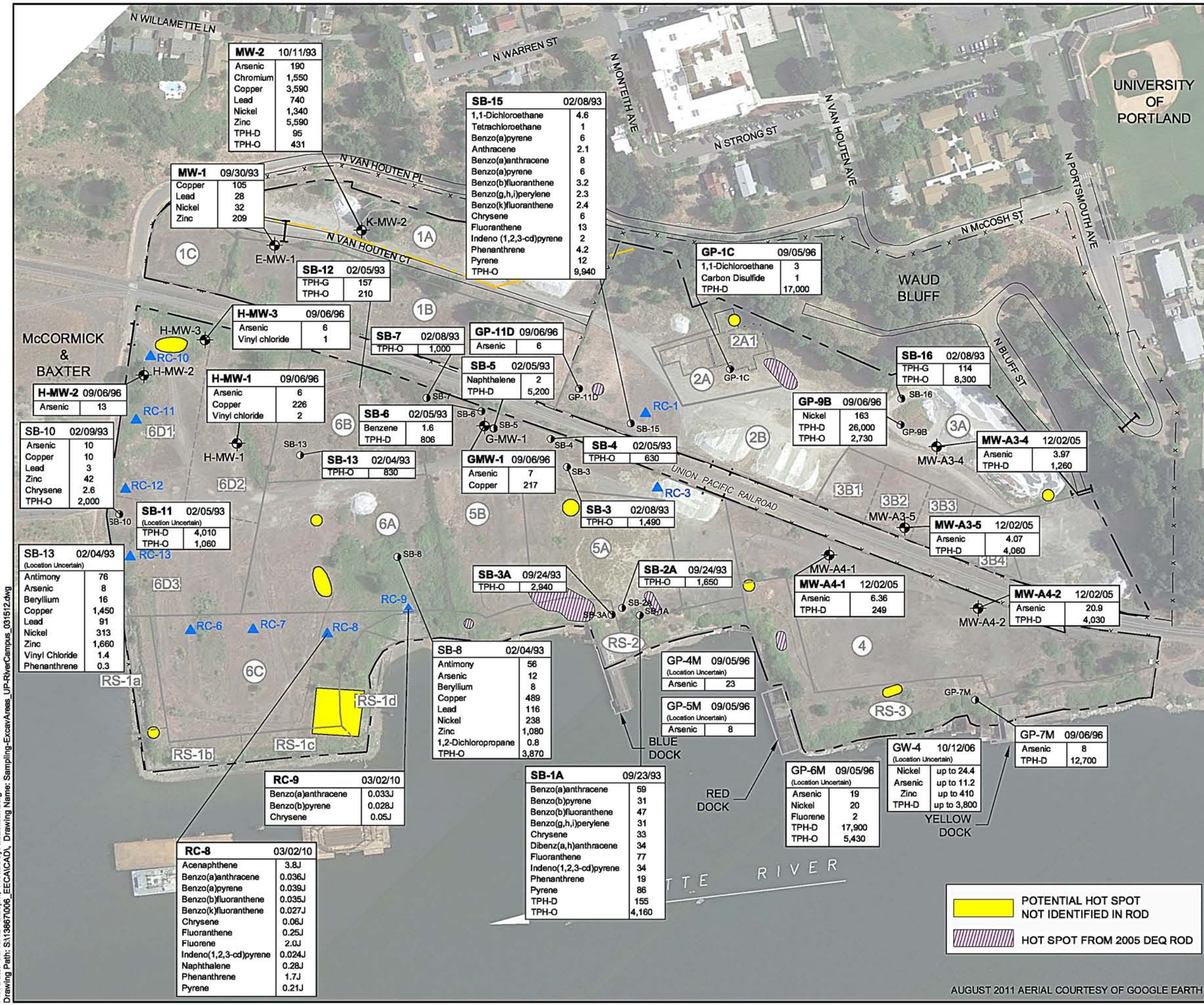


EXPLANATION

GROUNDWATER SAMPLING LOCATIONS

- 2010 DIRECT-PUSH GROUNDWATER SAMPLING LOCATION
- MONITORING WELL LOCATION
- HISTORIC BORING GROUNDWATER SAMPLING LOCATION

CHEMISTRY BOX EXPLANATION

MW-A3-5	12/02/05
Arsenic	4.07

- MW-A3-5 12/02/05 — SAMPLING LOCATION ID AND DATE SAMPLED
- 4.07 — CONCENTRATION IN µg/L
- Arsenic — CONTAMINANTS EXCEEDING SCREENING LEVELS

J = VALUE SHOWN IS ESTIMATED CONCENTRATION
TPH-G = TOTAL PETROLEUM HYDROCARBONS IN GASOLINE
TPH-D = TOTAL PETROLEUM HYDROCARBONS IN DIESEL
TPH-O = TOTAL PETROLEUM HYDROCARBONS IN MOTOR OIL

NOTE:
VALUES SHOWN ONLY FOR RESULTS THAT EXCEED APPLICABLE SCREENING CRITERIA.

OTHER SITE FEATURES

- PROPERTY LINE
- PARCEL LINE
- FENCE
- GATE

MIS SAMPLING AREAS

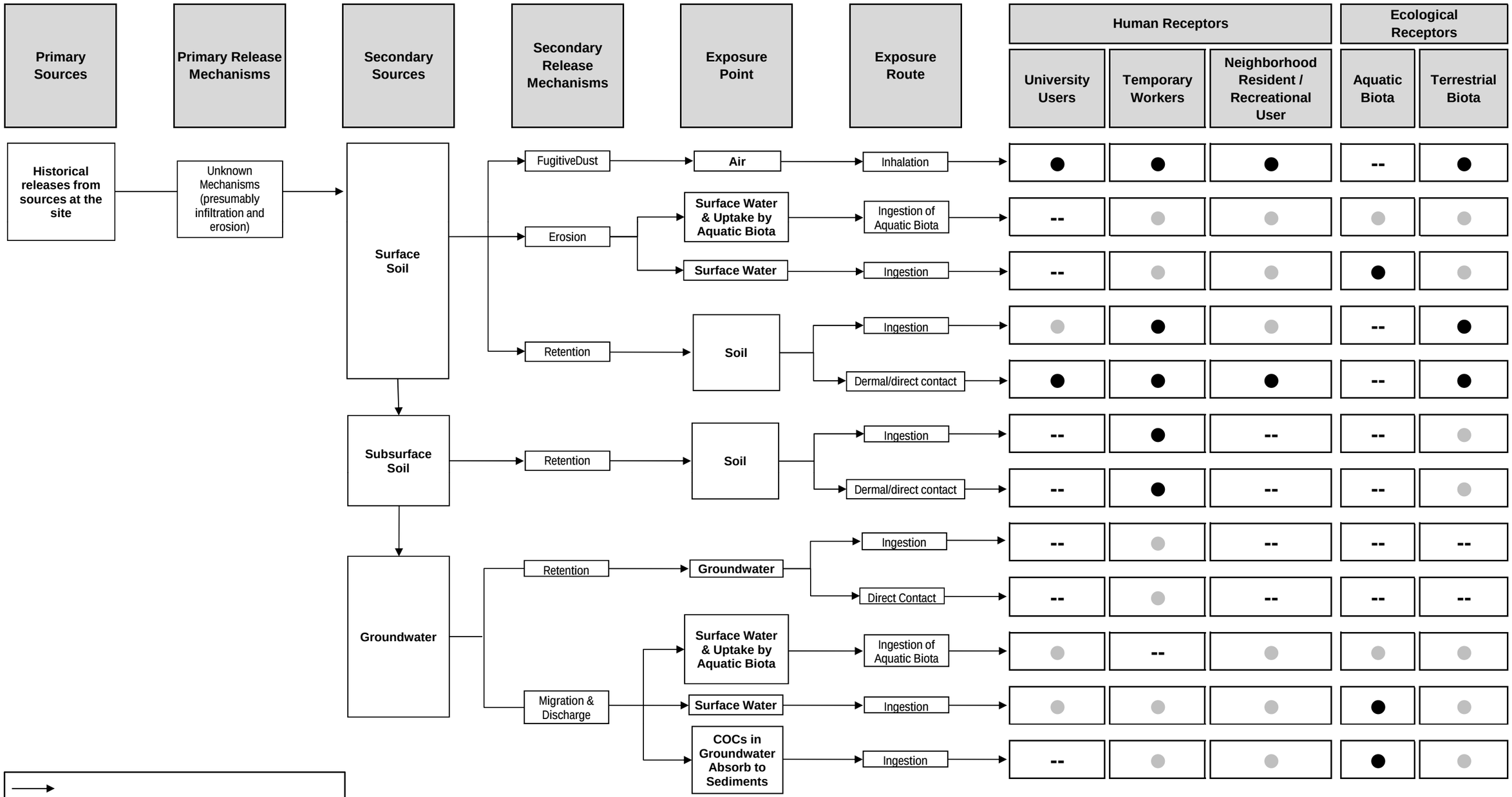
- 2A — 2006 MIS SAMPLING AREAS
- 2A1 — 2009/2010 MIS SAMPLING AREAS

0 100 200
APPROXIMATE SCALE IN FEET

GROUNDWATER ANALYTICAL RESULTS
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/15/12	Project No. 13867
AMEC Geomatrix		Figure 8

Plot Date: 03/15/12 - 2:23pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: Sampling-Excav\Areas_UP-RiverCampus_031512.dwg



CONCEPTUAL SITE MODEL
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/01/2012	Project No. 13867
AMEC Geomatrix		Figure 9

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AUGUST 2011 AERIAL COURTESY OF GOOGLE EARTH

EXPLANATION

RISK ASSESSMENT RESULTS

- 2A — MIS SAMPLING AREAS
- EXCEEDS OCCUPATIONAL RISK
- EXCEEDS RESIDENTIAL RISK
- EXCEEDS CARCINOGENIC RISK OF IE-04 OR NONCANCER RISK OF HAZARD INDEX OF 1

OTHER SITE FEATURES

- EXISTING MONITORING WELL LOCATION
- PROPERTY LINE
- PARCEL LINE
- FENCE
- GATE

NOTES:

1. AREA IS CONSIDERED TO EXCEED OCCUPATIONAL RISK IF CALCULATED RISK BASED ON EPA OCCUPATIONAL RISK-BASED SCREENING LEVELS IS GREATER THAN A TOTAL RISK OF IE-5, A HAZARD QUOTIENT OF 1, OR A RISK FROM INDIVIDUAL COC OF IE-6 FOR AT LEAST ONE DEPTH INTERVAL.
2. AREA IS CONSIDERED TO EXCEED RESIDENTIAL RISK IF CALCULATED RISK BASED ON EPA RESIDENTIAL RISK-BASED SCREENING LEVELS IS GREATER THAN A TOTAL RISK OF IE-5, A HAZARD QUOTIENT OF 1, OR A RISK FROM INDIVIDUAL COC OF IE-6 FOR AT LEAST ONE DEPTH INTERVAL.
3. ALL 'RS' AREAS EXCEED PORTLAND HARBOR PRELIMINARY REMEDIATION GOALS.

0 100 200
APPROXIMATE SCALE IN FEET

SUMMARY OF STREAMLINED RISK ASSESSMENT RESULTS
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/01/12	Project No. 13867
AMEC Geomatrix		Figure 10

Plot Date: 03/01/12 - 4:20pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: Sampling-ExcavAreas_UP-RiverCampus_022812.dwg

Area 6D Risk		
COC	Occ	Res
Tot	--	2.8E-05
TCDDs	1.4E-06	5.5E-06
B(a)a	--	1.1E-06
B(b)fl	--	1.2E-06
B(a)p	--	1.0E-05

Area 6B Risk		
COC	Occ	Res
Tot	--	3.7E-05
B(a)a	--	1.3E-06
B(b)fl	--	2.4E-06
B(a)p	1.3E-06	1.9E-05
Di(a,h)a	--	5.1E-06
In(1,2,3-c,d)p	--	1.5E-06

Area 1B Risk		
COC	Occ	Res
Tot	1.4E-05	1.8E-04
B(a)a	1.0E-06	1.4E-05
B(b)fl	--	1.1E-05
B(a)p	1.0E-05	1.4E-04
Di(a,h)a	--	5.1E-06
In(1,2,3-c,d)p	--	4.3E-06

Area 2A Risk		
COC	Occ	Res
Tot	--	5.4E-05
B(a)a	--	3.4E-06
B(b)fl	--	2.5E-06
B(a)p	2.7E-06	3.7E-05
In(1,2,3-c,d)p	--	1.5E-06

Area 1C Risk		
COC	Occ	Res
Tot	--	1.5E-05
B(a)p	--	8.0E-06

Area 6D2 Risk		
COC	Occ	Res
Tot	--	2.5E-05
TCDDs	--	2.0E-06
B(a)a	--	1.1E-06
B(b)fl	--	1.2E-06
B(a)p	--	1.0E-05

Area 2A1 Risk		
COC	Occ	Res
Tot	--	1.3E-05
B(a)p	--	3.7E-06

Area 3B Risk		
COC	Occ	Res
Tot	--	1.1E-05
PCBs	--	2.9E-06

Area 3B2 Risk		
COC	Occ	Res
PCBs	--	1.3E-06

Area 6D1 Risk		
COC	Occ	Res
Tot	--	3.4E-05
TCDDs	2.8E-06	1.1E-05
B(a)a	--	1.1E-06
B(b)fl	--	1.2E-06
B(a)p	--	1.0E-05

Area 2B Risk		
COC	Occ	Res
Tot	--	2.5E-05
B(a)p	--	2.3E-06

Area 3B3 Risk		
COC	Occ	Res
PCBs	--	1.6E-06

Area 6D3 Risk		
COC	Occ	Res
Tot	--	2.9E-05
TCDDs	1.6E-06	6.4E-06
B(a)a	--	1.1E-06
B(b)fl	--	1.2E-06
B(a)p	--	1.0E-05

Area 5A Risk		
COC	Occ	Res
Tot	--	1.1E-05
2,3,7,8-TCDDe	--	1.5E-06

Area 6C Risk		
COC	Occ	Res
Tot	--	2.0E-05
B(a)p	--	4.5E-06

Area 5B Risk		
COC	Occ	Res
Tot	--	1.7E-05
TCDDs	--	2.4E-06
B(a)p	--	4.1E-06

Area RS-2 Risk		
COC	Occ	Res
Tot	--	1.4E-05
B(a)p	--	3.3E-06

Area 6A Risk		
COC	Occ	Res
Tot	--	9E-05
TCDDs	2.9E-06	1.2E-05
B(a)a	--	5.8E-06
B(b)fl	--	3.9E-06
B(a)p	3.4E-06	4.7E-05
Di(a,h)a	--	1.0E-05
In(1,2,3-c,d)p	--	1.9E-06

Area RS-1A Risk		
COC	Occ	Res
Tot	--	2.0E-05
TCDDs	--	3.1E-06
B(a)p	--	3.2E-06

Area RS-3 Risk		
COC	Occ	Res
Tot	--	1.5E-05
TCDDs	--	2.8E-06
B(a)p	--	3.7E-06

Area RS-1B Risk		
COC	Occ	Res
Tot	--	1.8E-05
TCDDs	--	1.6E-06
B(a)p	--	3.2E-06

Area RS-1 Risk		
COC	Occ	Res
Tot	--	5.5E-05
TCDDs	1.3E-06	5.3E-06
B(a)a	--	3.1E-06
B(b)fl	--	3.5E-06
B(a)p	2.5E-06	3.5E-05
In(1,2,3-c,d)p	--	1.4E-06

Area RS-1D Risk		
COC	Occ	Res
Tot	--	2.3E-05
TCDDs	1.6E-06	6.6E-06
B(a)p	--	3.2E-06

Area RS-1C Risk		
COC	Occ	Res
Tot	--	1.7E-05
B(a)p	--	3.2E-06

EXPLANATION

MIS SAMPLING AREAS

2A — 2006 MIS SAMPLING AREAS

2A1 — 2009/2010 MIS SAMPLING AREAS

OTHER SITE FEATURES

PROPERTY LINE

PARCEL LINE

FENCE

GATE

KEY

B(a)a = Benzo(a)anthracene
B(a)fl = Benzo(b)fluoranthene
B(a)p = Benzo(a)pyrene
B(g,h,i)p = Benzo(g,h,i)perylene
Di(a,h)a = Dibenz(a,h)anthracene
In(1,2,3-cd)p = Indeno(1,2,3-cd)pyrene
PCBs = Total Polychlorinated Biphenyls
TCDDs = Dioxins expressed as 2,3,7,8-TCDD equivalent (see text)
COC = Contaminants of Concern
Occ = Occupational
Res = Residential
Tot = Total

NOTES:

1. AREA IS CONSIDERED TO EXCEED OCCUPATIONAL RISK IF CALCULATED RISK BASED ON EPA OCCUPATIONAL RISK-BASED SCREENING LEVELS IS GREATER THAN A TOTAL RISK OF IE-5, A HAZARD QUOTIENT OF 1, OR A RISK FROM INDIVIDUAL COC OF IE-6 FOR AT LEAST ONE DEPTH INTERVAL.

2. AREA IS CONSIDERED TO EXCEED RESIDENTIAL RISK IF CALCULATED RISK BASED ON EPA RESIDENTIAL RISK-BASED SCREENING LEVELS IS GREATER THAN A TOTAL RISK OF IE-5, A HAZARD QUOTIENT OF 1, OR A RISK FROM INDIVIDUAL COC OF IE-6 FOR AT LEAST ONE DEPTH INTERVAL.

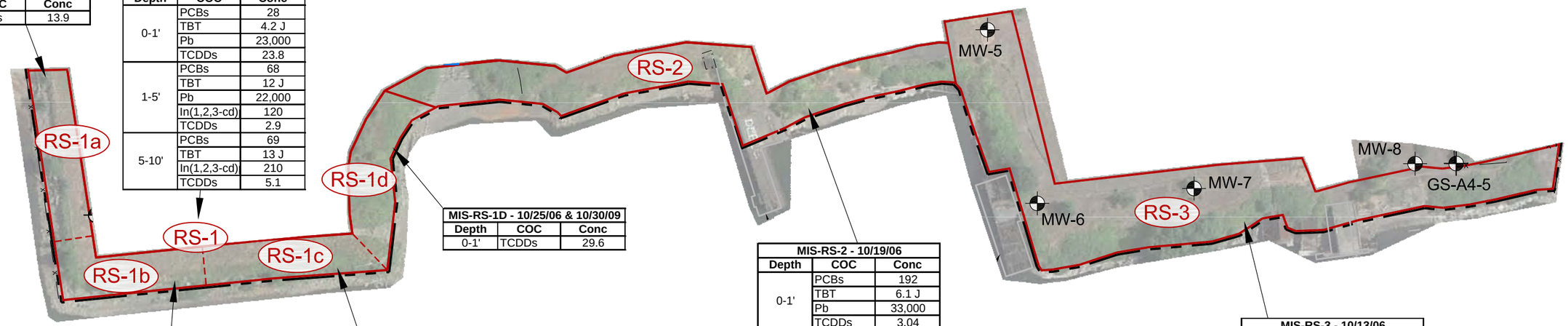
3. AREAS 1A, 3A, AND 4 EXCEED RESIDENTIAL RISK ONLY DUE TO ONE OR MORE CONTAMINANTS HAVING LABORATORY DETECTION LIMITS EXCEEDING EPA RESIDENTIAL RISK-BASED SCREENING LEVELS. DUE TO THE UNCERTAINTY OF ACTUAL CONCENTRATIONS OF THESE CONTAMINANTS, THESE AREAS ARE CONSIDERED TO REQUIRE INSTITUTIONAL CONTROLS UNLESS FURTHER INVESTIGATIONS ARE CONDUCTED TO LOWER DETECTION LIMITS.

0 100 200
APPROXIMATE SCALE IN FEET

RISK GREATER THAN THRESHOLD
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/15/12	Project No. 13867
AMEC Geomatrix		Figure 11

Plot Date: 03/15/12 - 2:26pm Plotted by: adam.stenberg
Drawing Path: S:\13867\06_EECA\CAD\ Drawing Name: Sampling-ExcavAreas_UP-RiverCampus_031512.dwg



MIS-RS-1A - 10/30/09		
Depth	COC	Conc
0-1'	TCDDs	13.9

MIS-RS-1 - 10/25/06		
Depth	COC	Conc
0-1'	PCBs	28
	TBT	4.2 J
	Pb	23,000
	TCDDs	23.8
1-5'	PCBs	68
	TBT	12 J
	Pb	22,000
	In(1,2,3-cd)	120
	TCDDs	2.9
5-10'	PCBs	69
	TBT	13 J
	In(1,2,3-cd)	210
	TCDDs	5.1

MIS-RS-1D - 10/25/06 & 10/30/09		
Depth	COC	Conc
0-1'	TCDDs	29.6

MIS-RS-2 - 10/19/06		
Depth	COC	Conc
0-1'	PCBs	192
	TBT	6.1 J
	Pb	33,000
	TCDDs	3.04
1-5'	None	
5-10'	TBT	26 J

MIS-RS-3 - 10/13/06		
Depth	COC	Conc
0-1'	PCBs	58
	Pb	37,000
	TCDDs	12.65
1-5'	Pb	32,000
	TCDDs	1.31
5-10'	Pb	30,000

MIS-RS-1B - 10/25/06 & 10/30/09		
Depth	COC	Conc
0-1'	TCDDs	7.4

MIS-RS-1C - 10/25/06 & 10/30/09		
Depth	COC	Conc
0-1'	TCDDs	4.4

SUMMARY OF RESULTS

MIS-RS-3 - 10/13/06		
Depth	COC	Conc
0-1'	PCBs	58
	Pb	37,000
	TCDDs	12.65
1-5'	Pb	32,000
	TCDDs	1.31
5-10'	Pb	30,000

SAMPLE ID AND DATE

SAMPLING DEPTH INTERVAL

CONTAMINANTS AND CONCENTRATIONS THAT EXCEED JSCS CLEANUP LEVEL

JSCS SCREENING LEVELS

COC	JSCS Screening Level Value
PCBs	0.39
TBT	2.3
Pb	17,000
In(1,2,3-cd)p	100
TCDDs	0.0091

KEY

PCBs = Total Polychlorinated Biphenyls
TBT = Tributyltin
Pb = Lead
In(1,2,3-cd)p = Indeno(1,2,3-cd)pyrene
TCDDs = Dioxins expressed as 2,3,7,8-TCDD equivalent (see text)
COC = Contaminants of Concern
Conc = Concentration

LEGEND

RS-2 SAMPLING AREAS

EXISTING MONITORING WELL LOCATION

PROPERTY LINE

x FENCE

NOTES:
CONCENTRATIONS IN µg/kg, EXCEPT DIOXINS, SHOWN IN pg/g.
J = REPORTED RESULT IS THE ESTIMATED CONCENTRATION.

0 100 200
APPROXIMATE SCALE IN FEET

AUGUST 2011 AERIAL COURTESY OF GOOGLE EARTH

RIVER SHORELINE AREA
University of Portland, River Campus Property
Portland, Oregon

By: APS | Date: 03/15/12 | Project No. 13867

AMEC Geomatrix

Figure 12

Plot Date: 03/15/12 - 2:28pm Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\ Drawing Name: Sampling-ExcavAreas_UP-RiverCampus_031512.dwg

EXPLANATION

- CAPPING
- EXCAVATION AND BACKFILL
- ASPHALT CAP (DEQ ROD AREAS)
- EXCAVATION (5:1 SLOPE) WITH CAPPING
- INSTITUTIONAL CONTROLS REQUIRED
- ANTICIPATED FUTURE DEVELOPMENT AREA
- (2A) MIS SAMPLING AREAS
- PROPERTY LINE
- FENCE
- APPROXIMATE BOUNDARY OF 100-YEAR FLOOD PLAIN (32.9' NAVD88)

NOTE:

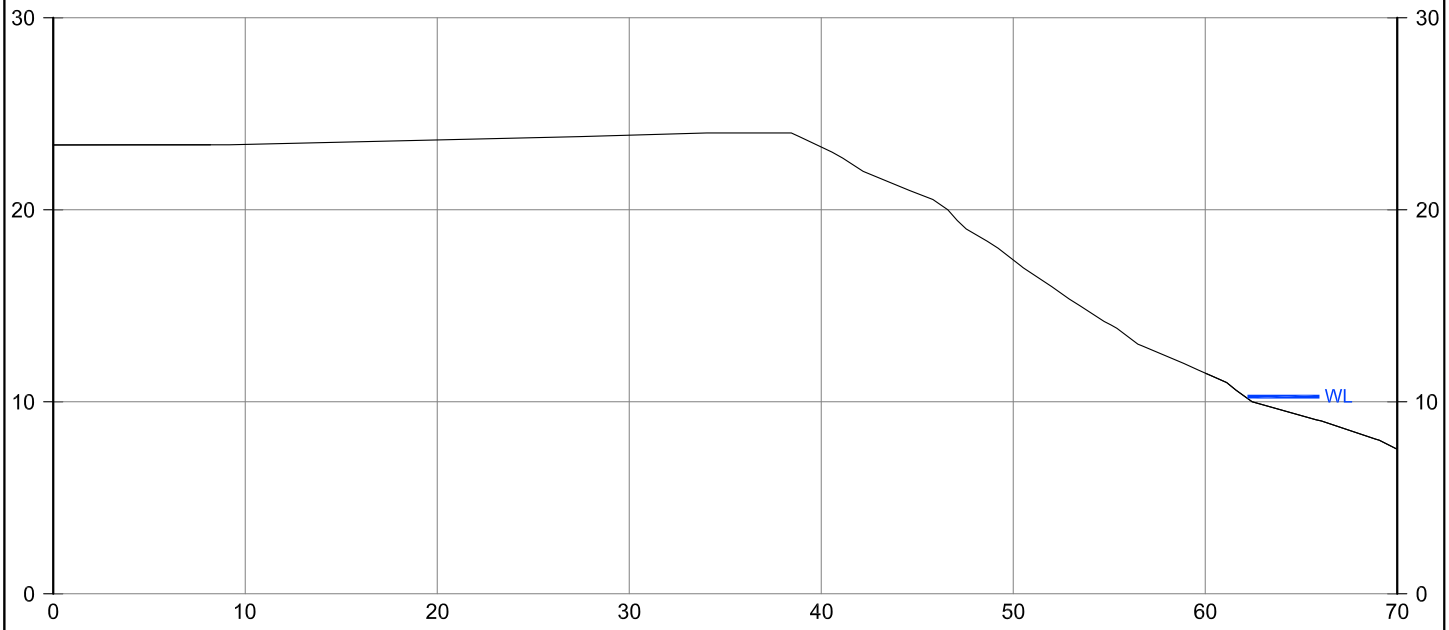
1. ENTIRE SITE WILL HAVE INSTITUTIONAL CONTROLS.
2. DEQ ROD CAP AREAS THAT ARE WITHIN THE RS AREAS WILL BE EXCAVATED. THE CAP AREA UNDER THE BALL FIELD WILL BE CAPPED WITH CLEAN SOIL.

0 100 200
APPROXIMATE SCALE IN FEET

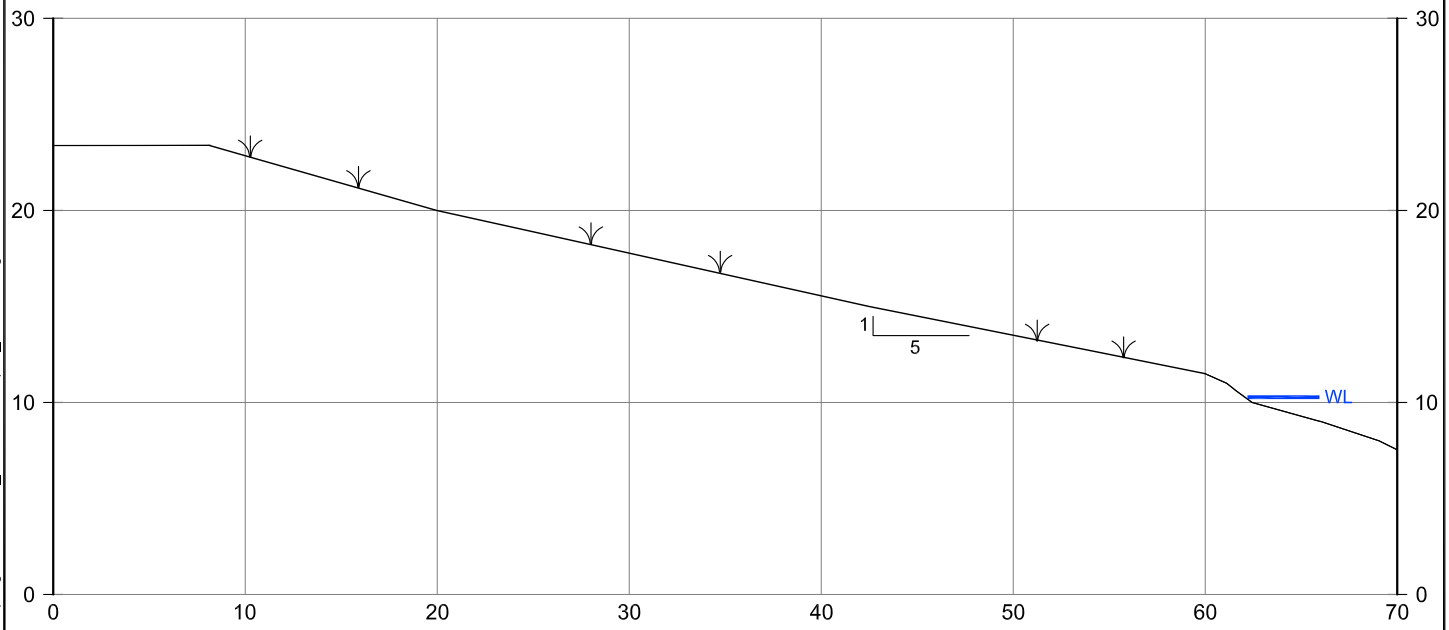
RECOMMENDED REMOVAL ACTION
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/16/12	Project No. 13867
AMEC Geomatrix		Figure 13

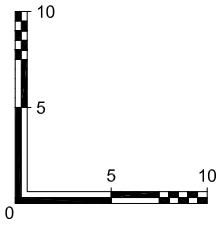
Plot Date: 03/16/12 - 8:54am, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: RecommendRomvalAction_UP-RiverCampus_030112.dwg



CURRENT SHORELINE BANK PROFILE



PROPOSED SHORELINE BANK PROFILE



APPROXIMATE SCALE IN FEET
VERTICAL ELEVATION IN NAVD88 FEET

CROSS SECTION SCHEMATIC
University of Portland, River Campus Property
Portland, Oregon

By: APS	Date: 03/15/12	Project No. 13867
AMEC Geomatrix		Figure 14

Plot Date: 03/15/12 - 2:42pm, Plotted by: adam.stenberg
Drawing Path: S:\13867\006_EECA\CAD\, Drawing Name: Sampling-ExcavAreas_UP-RiverCampus_031512.dwg

APPENDIX A

Re-Use Assessment

RE-USE ASSESSMENT OF THE UNIVERSITY OF PORTLAND RIVER CAMPUS PROPERTY (FORMERLY KNOWN AS "TRIANGLE PARK")

Prepared to Support the Engineering Evaluation/Cost Analysis
Portland, Oregon

1.0 INTRODUCTION

This is a summary Reuse Assessment to support the Engineering Evaluation/Cost Analysis (EE/CA) of and eventual selection of a response action for the University of Portland (UP) River Campus Property (formerly known as "Triangle Park") in Portland, Oregon (Property). This Assessment has been developed by the United States Environmental Protection Agency (EPA) based on information and input from various stakeholders described below. EPA is responsible for ensuring that reasonable assumptions regarding future land use are considered in the selection of a response action. The determination of reasonably anticipated land use and the response actions to be taken at the Property are being coordinated with the State of Oregon, Department of Environmental Quality (DEQ).

This Assessment has been completed to develop realistic assumptions of the reasonably anticipated future use(s) and how these uses relate to possible response actions for the Property, in accordance with the following Directives from the EPA Office of Solid Waste and Emergency Response (OSWER):

- Land Use in the CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04, May 1995;
- Reuse Assessments: A Tool To Implement The Superfund Land Use Directive, OSWER Directive No. 9355.7-06P; June 4, 2001; and,
- Considering Reasonably Anticipated Future Land Use and Reducing Barriers to Reuse at EPA-lead Superfund Remedial Sites, OSWER Directive 9355.7-19, March 17, 2010.

This Assessment provides the key information called for in those Directives. Per the 2001 Reuse Assessment Directive, the scope, level of effort, and organization of the information has been tailored in accordance with the conditions at this Property in order to best describe the Assessment of the Property. Additional relevant information, particularly regarding the details of the environmental condition of the Property, is included in the EE/CA.

2.0 OWNERSHIP AND STAKEHOLDER INFORMATION

The UP entered into an agreement to purchase the Property from the former owner in 2006. During the same time period UP negotiated a Bona Fide Prospective Purchaser Agreement (BFPPA) with EPA as well as a separate Prospective Purchaser Agreement (PPA) with the DEQ. UP closed on the purchase of the Property in December 2006.

EPA is the Lead Agency for response actions at the site pursuant to the Comprehensive Environmental Response and Liability Act (CERCLA), including the EE/CA, this Reuse Assessment and the anticipated CERCLA Non-Time Critical Removal Action (Removal) to follow. The DEQ, City of Portland (the City), relevant Tribes, and the Willamette River Natural Resources Trustees (Trustees) are working with EPA in a review capacity. The City is responsible for local land-use determinations, to include approval of the Master Plan updates and development plans for the Property. The shoreline area of the property has also been identified by the City and the Trustees for the Portland Harbor Superfund site as a candidate for habitat restoration. The City has also viewed the shoreline for an area to extend the City's Greenway trail system. Any development on the Property would be required to go through the City planning process, including extensive public participation. Public participation is also required for any shoreline habitat restoration as part of the Natural Resource Damage mitigation process.

3.0 PHYSICAL LOCATION AND SITE HISTORY

The Property address is 5828 North Van Houten Place in Portland, Oregon. The Property is situated on approximately 35 acres (1,524,600 square feet) bounded by the Willamette River to the west/southwest, the former McCormick and Baxter Creosoting Company property to the north/northwest, the main UP campus and residential properties to the south/southeast (including the area along the river to the southeast), and residential housing and Waud Bluff to the north/northeast. The site is located on a terrace above the Willamette River, and is generally flat, at an elevation of 20 to 40 feet above mean sea level (msl). The 100-year floodplain lies at approximately 28 feet msl. The shoreline is steeply sloped with docks extending from the site.

Between the early 1900s and early 1990s, several companies acquired portions of the site and conducted various industrial operations, including wood products manufacturing and storage, ship building and other marine operations, power generation, cooperage storage, chemical and soap manufacturing, scrap salvage storage, and concrete production. In the 1990s, several structures on the site were used for office, equipment, and materials storage for a hazardous waste remediation and emergency response contractor. Most of the structures at the site were demolished in the 1990s, and the remaining structures were removed in 2009 under EPA oversight per an EPA-approved work

plan under the BFPPA. The Property was vacant for all practical purposes from at least 1997 until present.

4.0 LAND USE CONSIDERATIONS AND ENVIRONMENTAL REGULATIONS

4.1 ZONING/LAND USE

The Property is not currently being used. UP controls the Property and has fenced it and implemented erosion controls to minimize access and exposure pending completion of the EE/CA and removal actions. The Property was previously zoned Heavy Industrial (IH), but zoning has been changed to General Employment 2 (EG2) to accommodate UP's future use of the Property. Adjacent properties to the north/northwest, east/northeast, and south/southeast of the Property are zoned Heavy Industrial (IH), Residential 5,000 (R5), and Residential 2,000 (R2), respectively. The Property is bounded to the north/northwest by the former McCormick and Baxter Creosoting Company property, to the east/northeast by Waud Bluff and residential properties, to the south/southeast by the main UP campus and residential properties, and to the west/southwest by the Willamette River.

4.2 AREA MASTER PLANS

UP is in the process of developing an area master plan in coordination with the City, public, and other stakeholders. Portland's original Bicycle Master Plan, adopted by the City Council in 1996, was superseded by the Portland Bicycle Plan for 2030, adopted in February 2010. The Portland Bicycle Plan for 2030 includes the proposed North Greenway Trail, which currently is planned to run along the existing Union Pacific railway which bisects the Property from north to south. UP intends to develop the Property for use as part of the larger UP campus, and the site will no longer be used for industrial purposes. No permanent residential use of the site is anticipated as the site is not planned for student housing or any other form of residential housing in the short or long term. UP anticipates constructing buildings, sports fields, and other recreation areas, and the Trustees are anticipating that the shoreline area will be restored to habitat suitable to protect fisheries.

4.3 WETLANDS/CRITICAL HABITAT/CULTURAL OR HISTORICAL RESOURCES

Surveys for the presence of wetlands, threatened or endangered species, and/or associated critical habitat have not been completed for the Property; however, based on information provided by the U.S. Fish and Wildlife Service's (USFWS) online Critical Habitat Portal and Wetlands Mapper, it appears that wetland areas and areas designated as final critical habitat for threatened or endangered species are not present on the Property or adjacent properties. Much of the western portion of the Property is located within the 100-year floodplain, which may potentially impact reuse of portions of the Property. A survey for the presence of cultural and/or historical resources has not been completed for the Property. The shoreline area, due to the former industrial nature of the property, is

not considered high quality habitat, and both the City and the Trustees have identified the shoreline as a good and important candidate for habitat improvement.

No cultural or historical resources have been identified at the Property. The Tribes associated with the Natural Resource Trustee Council will be reviewing the development plans along the shoreline area and are expected to comment on cultural resource issues.

4.4 EXISTING INSTITUTIONAL CONTROLS

As part of the BFPPA, the United States covenants not to sue or take administrative action against UP for existing contamination at the Property. Likewise, the UP (and its contractors and employees) covenants not to sue or assert any claims or causes of action against the United States with respect to existing contamination, work at the Property, oversight costs, or the BFPPA. Chevron currently holds an easement for an underground petroleum fuel line that runs across the southeastern portion of the Property. No other institutional controls, including easements and covenants, are known to be currently in place on the Property; however, Union Pacific owns a railroad right-of-way that transects the property from southeast to northwest. The rail line is considered an active line but is seldom used except for occasional train car storage.

5.0 COMMUNITY INPUT

UP is currently in discussions with the City on the Master Plan as part of development of the Property. A key part of the Master Plan process is input from the local community, including both the industrial area adjacent to the Property and the surrounding residential neighborhood. UP has been extremely proactive in the community and has held monthly public meetings with the neighborhood for many years. As a result, the community is very aware of the development plans both for the main UP campus as well as the proposed development on the River Campus Property.

Since the shoreline area has potential for habitat restoration, the Trustees Council for Natural Resource Damages for the Portland Harbor Superfund area will be providing input on development of the Property. The Trustees include the National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and representatives from various Tribes, including the Nez Pierce Tribe and the Confederated Tribes of Grand Ronde, Siletz, Umatilla, and Warm Springs.

5.1 COMMUNITY-SUPPORTED FUTURE REUSES

The community surrounding UP and the River Campus Property are well informed of the proposed development plans and are supportive of the change in use from industrial to campus use as is

evidenced by their support of the zoning change. UP holds monthly public meetings with the community to seek input and support.

5.2 COMMUNITY-OPPOSED FUTURE REUSES

Since the Master Planning for the Property is in its early stages, there has not been much feedback from the community, particularly the residential neighborhood, expressing opposition to future reuse. In fact, the community has been supportive of the zoning change from Heavy Industrial to General Employment. This zoning change resulted in a perception of less truck traffic through the neighborhood and less noise. There has been community input on the preference for a running/walking/biking trail that the City has proposed that would extend the existing trails from the south through the Property. The City originally proposed that trail along the river shoreline and this concept has been favored by the community; however, the Natural Resource Damages Trustees are against a trail along the shoreline and prefer habitat restoration. The City is currently thinking that the trail could be run along the rail line.

6.0 SITE CHARACTERIZATION AND ENVIRONMENTAL CONSIDERATIONS

Environmental investigations have been conducted at the site since the 1980s to document areas affected by releases from historical industrial activities. In preparation for UP's purchase of the Property, AMEC Earth & Environmental, Inc. (AMEC) (on behalf of UP) conducted an investigation at the Property using multi-increment sampling (MIS) to evaluate what portions of the Property may warrant additional removal actions. Based on historical site use and data from previous investigations, the site was initially subdivided into 17 areas for MIS characterization.

Additional characterization was performed by AMEC Geomatrix, Inc., in 2009 and 2010 to refine the understanding of the nature and extent of contamination with regard to:

- MIS Areas based on the 2006 investigation;
- Discrete "hot spots" characterized outside the areas of the MIS investigations that may require removal action; and
- Groundwater downgradient of areas where elevated concentrations of constituents of concern (COCs) are present in soil.

Relevant data from investigations conducted at the site are presented in the EE/CA.

6.1 CONSTITUENTS OF CONCERN

COCs at the site consist primarily of metals, polychlorinated biphenyls (PCBs), dioxins (tetrachlorodibenzo-p-dioxins or TCDDs), and polycyclic aromatic hydrocarbons (PAHs), all of which

have very low mobility in the subsurface. Some hot spot areas are impacted by more mobile constituents, including volatile organic compounds (VOCs). Constituents in soils at the site have been found to exceed one or more chemical-specific, applicable or relevant and appropriate requirements (ARARs) established for the site, including EPA's residential, recreational, and/or industrial-use soil exposure regional screening levels (RSLs), DEQ risk-based concentrations (RBCs), and/or Portland Harbor Joint Source Control Strategy (JSCS) screening level values (SVLs) for soil/stormwater sediment.

6.2 EXPOSURE SCENARIOS OF CONCERN

Human populations are potentially at risk of exposure at the site. Occupational exposure of university users (university students, staff, etc.), recreational exposure of neighborhood residents/recreational users, and/or short-term exposure of construction workers may occur. Potential exposure paths include dermal contact with or incidental ingestion of soils, ingestion of water or fish from the Willamette River, and/or, for construction workers, the inhalation of soil/fugitive dust or contact with impacted groundwater while completing construction activities. No permanent residential use of the site is anticipated as the site is not planned for student housing or any other form of residences in the short or long term.

Ecological receptors are also potentially at risk of exposure. Although the Property is highly disturbed and has been used for industrial purposes for many years, it does include areas of low brush and vegetation, primarily along the river edge, that could act as habitat for plants and wildlife. The Willamette River, bordering the site on the west, is used as habitat by fish and wildlife, including salmonids, sturgeon, and lamprey. Ecological receptors could become exposed to site contaminants through direct contact with, inhalation of, or ingestion of surface soils and/or particulates impacted by constituents of concern; through contact with or ingestion of constituents entering the surface waters of the Willamette River from site soil; or through food chain accumulation via their diet.

6.3 CURRENT AND ANTICIPATED FUTURE LAND USE AND HOW THAT FACTORS INTO THE EE/CA AND ANY RESPONSE ACTION(S)

The Property is not currently being used. UP controls the Property and has fenced it and implemented erosion controls to minimize access and exposure pending completion of the EE/CA and removal actions. UP intends to develop the Property for use as part of the larger campus and the site will no longer be used for industrial purposes. No permanent residential use of the site is anticipated as the site is not planned for student housing or any other form of residential housing in the short or long term. Institutional controls will formally preserve this intention and thereby prevent any residential exposure that would place human receptors at risk. UP anticipates constructing buildings, sports fields, and other recreation areas, and the City wants to extend a path for public access recreational uses such as walking/jogging/biking.

Based on site characterization, risk assessment, and the reasonably anticipated land and resource use, the Property has been divided into categories and sub-areas as shown in Figure 3 of the EE/CA. The categories are described below.

- Areas where soils do not exceed any risk exposure levels or actionable levels for contaminants. These areas are acceptable for unlimited use without restrictions.
- Areas where soils exceed actionable levels based on residential user exposure but do not exceed actionable levels based on occupational/industrial site use exposure.
- Areas where soils exceed actionable levels based on occupational use of the site (occupational/industrial exposure scenario).
- Areas along the river front that exceed actionable levels based on the Portland Harbor Joint Source Control Strategy screening level values.

7.0 RIVER CAMPUS PROPOSED SITE USE AND SCHEDULE

At the present time, UP is working toward adoption of Master Plan updates and approval of development plans by the City of Portland. To accommodate several major new developments on its upper Bluff campus (library expansion in 2012 and a new Recreation/Wellness Center ground-breaking in 2013) UP plans to construct a new sports practice field with associated paved parking areas on the north and northwestern end of the River Campus beginning in the Spring of 2012. In addition, UP has begun discussions with its Athletic Department administrators to finalize plans to begin construction in the summer of 2012 of a new NCAA Division 1 baseball field in the northwest quadrant of the River Campus. The field will be enhanced with lighting, outfield fences, batting facility, team dugouts, temporary bleacher seating, and adjacent paved parking lots. UP hopes to have the new baseball field and other amenities ready to host practices and games by the summer of 2013. Construction of a new baseball stadium with permanent seating will hopefully follow in 2 to 3 years, depending on the availability of funds.

Other projects envisioned by UP in the first 1-3 years following EE/CA approval include paved parking areas in the northeast quadrant of the River Campus, concrete pads marking potential future siting and construction of a Physical Plant complex involving several new buildings, and additional athletic-related facilities. All of the projects mentioned above are intended for areas of the River Campus where removal actions are expected and in which UP hopes to initiate activity early in 2012. The conceptual vision plan UP has produced for its River Campus is designed to phase new development activities to match the availability of funds with a goal of 50 percent to 75 percent completion within 10 to 15 years of final EE/CA approval.

8.0 PROPOSED SITE USE AND REMOVAL ACTIONS

The removal actions being considered to address contamination on the River Campus Property include:

- Institutional Controls to limit site use to non-residential use consistent with the Campus plans for the property;
- Capping of soils that exceed concentrations of contaminants above unacceptable risk levels with at least 2 feet of clean soil to prevent direct contact exposure to site users or use of an equivalent cap such as a building foundation or parking lot;
- Excavation and off-site disposal of soils; and
- Excavation of soils and re-use of the removed soils on site.

The final removal actions will consider the exposure risk to anticipated users of the site, including campus workers, students, occasional maintenance workers, and recreational users, such as area residents. Since most of the contaminated soils on site have low mobility in the environment and are found at relatively low concentrations, it is not considered necessary to excavate and dispose most of the soils. It is anticipated that the most highly impacted areas, such as hot spots, will be excavated and removed but the majority of soils will remain on site. Depending on the decisions in the EE/CA, impacted soils remaining on site will have a cap or institutional controls or both. Capping is designed to prevent people using or occupying the site from having direct contact with soils with concentrations of contaminants above an acceptable risk level. Most areas of the site do not have soils that represent this risk level, but those areas that do will require a cap. UP should consider the planned future use of the Property in determining the type of cap to be used.

UP is proposing development to include parking lots, a physical plant operations building, a practice sports field, and a new baseball stadium with associated structures. These projects currently are proposed to overlay on portions of the site where soils exceed actionable levels. Therefore, EPA will consider the site development plans as part of the final removal action selected.

APPENDIX B

Applicable or Relevant and Appropriate Regulations

APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS

University of Portland River Campus Property
Portland, Oregon

The following is a list of potential applicable or relevant and appropriate regulations (ARARs) to be considered during removal action design and construction.

- Federal RCRA (40 CFR Parts 260 to 268) and Oregon Hazardous Waste Regulations (OAR 340-100 to 340-106) - Federal regulations promulgated under RCRA, and corresponding state law, provide standards for the identification, management and disposal of solid and hazardous waste. These regulations are potentially relevant and appropriate, if not applicable to the response action. Waste sent off-property may need to comply with the Oregon RCRA rules pertaining to the generation, transportation, treatment, storage, and disposal of hazardous waste. The RCRA regulations establish performance standards that are may be relevant and appropriate for the construction and maintenance of caps to the extent that the caps are being designed to prevent direct contact with surface soil contamination and to reduce vertical contaminant migration by minimizing stormwater infiltration. The specific RCRA regulations are 40 CFR §265.l11 (Closure Performance Standards), 40 CFR § 265.117 (Post-Closure Care), and 40 CFR § 265.310 (Landfill Closure).

- Clean Water Act (33 U.S.C. § 1344,33 C.F.R. Parts 320 - 323,40 CFR §230) –Section 404; related to discharging of dredged or fill material into the waters of the United States.

- Clean Water Act Section 401 (33 USC §1341) and Section 402 (33 USC §1342).

- Clean Air Act (40 CFR § 50) - The Clean Air Act (CAA) regulates emissions of fugitive dust, emissions from air pollutant sources, and establishes national ambient air quality standards and national emission standards for hazardous air pollutants. The CAA is applicable to activities that might generate dust, such as excavation. In addition, the Oregon General Emission Standards for Particulate Matter (OAR 340-208-0100 through - 0210) are applicable to visible emissions and nuisance conditions that may be generated by the construction of the response action. Dust generated from earthwork or other disturbance of on-property soils must meet nuisance standards for fugitive emissions.

- Endangered Species Act of 1973 (16 USC 1531 et seq., 50 CFR Part 402) - The federal Endangered Species Act (ESA) requires protection for certain plant and animal species and their habitat. The ESA may be applicable to the response action at this site because the site is adjacent to the Willamette River, which is habitat to and threatened or endangered species listed by the National Marine Fisheries Service.

- Rivers and Harbors Act

- Floodplain Management, Executive Order No. 11988 (40 CFR Part 6 Appendix A)This Executive Order requires that federally funded or authorized actions within the 100-year floodplain avoid, to the maximum extent possible, adverse impacts associated with the development of a floodplain. To the extent that this Site is located within the 100-year floodplain for the Willamette River, this may be a TBC.

- Protection of Wetlands, Executive Order No. 11990 (40 CFR Part 6 Appendix A) – This Executive Order requires federal agencies to minimize the destruction, loss or degradation of wetlands to the extent possible, and to preserve the value of wetlands. To the extent that wetlands are located within the Site, it may be a TBC.

- Migratory Bird Treaty Act of 1918 (16 USC 703 et seq.) – The Migratory Bird Treaty Act makes it unlawful to "hunt, take, capture, kill or take various other actions adversely affecting a broad range of migratory birds, including mallards, chickadees, and robins, and is relevant and appropriate for protecting migratory bird species identified at the site. This Act is applicable to the response action at the Site.

- Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001 et seq., 43 C.F.R. 10 - Pertains to the identification, protection and appropriate disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony.

- Oregon Solid Waste Management Rules (OAR 340-093 through -097) - These rules are potentially applicable to any treatment and disposal of solid waste that may be generated at the Site during implementation of the response action.

- Oregon Well Construction and Abandonment Standards (OAR 690-210 and 690-022). These standards are potentially applicable to the construction, monitoring, and abandonment of any wells at the site.

APPENDIX C

Detailed Cost Analysis

DETAILED COST ANALYSIS

University of Portland River Campus Property

Portland, Oregon

Prepared for:

University of Portland
Portland, Oregon

Prepared by:

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, WA 98101
(206) 342-1760

March 2012

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DETAILED COST ANALYSIS
University of Portland River Campus Property
Portland, Oregon

1.0 INTRODUCTION

This appendix presents detailed cost estimates for each of the removal action options developed as part of the Engineering Evaluation/Cost Analysis (EE/CA) for the University of Portland River Campus Property in Portland, Oregon. The cost estimates were developed based on the conceptual designs for the options described in Sections 5.0 and 6.0 of the EE/CA text. General assumptions and details applied for preparation of the costs estimates for the removal action alternatives are presented below in Section 2.0. Specific assumptions applied to the three types of action areas are described in Section 3.0.

2.0 GENERAL ASSUMPTIONS

Summaries of the cost estimates for the various removal action options are presented in Tables C-1 through C-21. The removal action costs include construction (contractor) work items and engineering-related items (construction oversight and as-built reporting) plus a contingency based on a percentage of the total. Costs in the tables are presented in 2011 dollars.

The quantities shown in the cost tables were estimated based on the assumed scope of the removal action options and preliminary conceptual designs, as described in Sections 5.0 and 6.0 of the EE/CA Report. Reasonable assumptions based on professional judgment were made as appropriate to estimate quantities for individual line items. The cost estimates based on these quantities are, therefore, preliminary estimates suitable for use in this EE/CA Report for comparison of the removal action alternatives on relative terms. These cost estimates are not suitable for final design or for budgeting.

The unit prices for most of the line items presented in the cost estimate tables were based on R.S. Means *Building Construction Cost Data 2011* (R.S. Means, 2011) and engineering experience with similar work.

The following general assumptions were made in estimating costs for each of the alternatives.

- Production rates and prices would be based on a standard 40-hour work week; no overtime or shift differential was included.
- The personal protective equipment would be Level D.

- Any waste generated would be nonhazardous solid waste.
- No unique or specialty equipment or approaches were considered, unless otherwise noted.
- No security guards would be required.
- Work would be performed without interruptions or multiple mobilizations and setups.
- No prevailing wage or union standby labor costs have been included.
- Costs for legal fees associated with gaining access for remedial construction have not been included.
- Confirmation samples will be run on a 24-hour turnaround.
- Any excavated soil considered suitable for re-use based on the evaluation conducted in the EE/CA will be stockpiled and re-used on site.
- All setbacks were assumed to be a 1:1 slope.
- All setback soils were assumed to be uncontaminated and re-used on site
- Each removal action alternative was considered as a stand-alone action (i.e., costs do not compensate for overlapping setbacks from adjacent areas, erosion controls are applied for the perimeter of each area, etc.).
- No operation and maintenance costs (for maintaining a cap for example) have been included.
- Soils not considered suitable for re-use will be excavated and directly loaded to trucks for off-site disposal (no stockpiling of these soils on site).
- Well abandonment is completed by over-drilling each well.
- Excavations less than 4 feet deep do not require setbacks per OSHA regulations.
- No taxes were included.

The engineering costs were estimated as a specified percentage of the contractor cost (see detailed cost estimates for each alternative). The specific line items for professional technical services have been divided into oversight and reporting costs. Consultant costs do not include project management, design, or permitting.

The percentages used for contingency are based on professional engineering experience for the complexity and anticipated cost risk of the various actions.

3.0 SPECIFIC ASSUMPTIONS:

Specific, assumptions made for each type of removal action alternative are described in the following subsections.

3.1 UPLAND AREAS

Detailed cost estimates for Uplands Areas requiring removal actions are presented in Tables C-1 through C-14. Detailed assumptions were made as follows for the Uplands Areas.

- Costs were developed to compare capping using a soil cap (Option 3) and excavation with off-site disposal (Option 4) for all uplands areas where action was deemed necessary.
- Setback volumes were estimated based on the dimensions of the area and assuming a sidewall slope of 1:1.
- Contingency was assumed to be relatively low between 10 and 15% since both action types have a relatively low risk of cost increases.

3.2 RIVER SHORELINE AREAS

Detailed cost estimates for the River Shoreline Areas are presented in Tables C-16 through C-21. Detailed assumptions were made as follows for the River Shoreline Areas.

- Costing for each area was performed for complete excavation and two different types of excavation combined with capping. The slope was based on an average bank height of 15 feet, and grading was assumed to begin at mean high water level. A detailed survey of the bank and hydrographs for the Willamette are not available for the site to provide more detailed design cuts. The following separate costing scenarios are provided in Tables C-16 through C-21:
  - Complete excavation;
  - Excavation to a 5 to 1 slope and capping consistent with a habitat development plan;
  - Excavation to a 1.5 to 1 slope and capping consistent with existing shoreline topography.
- Separate cost tables were provided for off-site disposal of removed soil (Option 4) versus reuse of removed soils in the uplands area (Option 5).
- An average width was used for slope re-grading calculations. The average width was based on a weighted average to best estimate volumes.
- The area of the cap reflects the change in surface area between the different re-grading options. It is not known whether a clean soil cap is needed following excavation in the

shoreline area since deeper borings are not available to evaluate shoreline soils below a depth of 10 feet.

- The base of the excavation for complete excavation was to remove all contamination to a depth of 10 feet below ground surface (bgs).
- The base of the excavation for excavation to a 5 to 1 or 1.5 to 1 slope will start at the mean high water level at approximately 15 feet bgs.

3.3 HOT SPOTS

Detailed cost estimates for hot spots are presented in Table C-15. Detailed assumptions were made as follows for the hot spot areas.

- Cost estimates for ROD hot spots were developed only for excavation and off-site disposal.
- Cost estimates for other potential hot spots included capping and excavation costs for comparison.
- Hot spot cost estimates were developed to be stand alone, except that only minor mobilization and demobilization costs were included. Mobilization/demobilization costs will be significantly greater if hot spot removal actions are the only actions performed.
- Changes in area due to excavation setbacks were considered insignificant for the small areas for the hotspots and were covered under contingency costs.

4.0 REFERENCES

R. S. Means, 2011, Building Construction Cost Data 2011.

TABLES

TABLE C-1

AREA 1B COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) using Off-site Soil		Option 4 - 10' Excavation, dispose and backfill to-grade with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	2.3	$9,488	2.7	$11,139
Erosion and Sediment Control	$1.2	LF	1,700	$1,972	1700	$1,972
Vegetation Removal	$330	ACRE	2.3	$762	2.7	$891
Geotextile	$1.81	SY	11,180	$20,236	0	$0
Excavate and Disposal	$65.00	TON	0	$0	63,356	$4,118,114
Excavate & Stockpile (setbacks)	$1.41	CY	0	$0	3,148	$4,439
Common Earth Fill Import (clean	$15	TON	16,853	$252,789	63,356	$950,334
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	9,913	$14,969	37,268	$56,275
Compaction (stockpiled material)	$1.5	CY	0	$0	3,148	$4,722
Hydroseeding	$4,000	ACRE	2.3	$9,200	2.7	$10,801
Surveying	$3,200	LS	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	1	$1,500	1	$1,500
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$324,116**		**$5,188,187**
Markup	10	%		$32,412		$518,819
Contractor Cost				**$356,527**		**$5,707,005**
CONSULTANT COST						
Engineering Oversight	5	%				$285,350
Closure Report	5	%		$17,826		$285,350
Consultant Cost				**$17,826**		**$570,701**
Capital Cost Subtotal				**$374,353**		**$6,277,706**
Contingency	10	%		$37,435		$627,771
TOTAL PROJECT COST				**$412,000**		**$6,905,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples. One sample will be taken for waste characterization and 5 to verify of clean up.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site. All other soils will be shipped off site for disposal.
10. O&M costs not included.
11. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
12. Clearing & Grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Well abandonment is completed by overdrilling each well.
15. Disposal costs assume all soils are non-hazardous
16. No taxes were included in costs.
17. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
18. Excavations under 4 feet deep do not require set backs per OSHA regulations.
19. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard LF = linear feet SY = square yard
EA = each LS = lump sum

TABLE C-2

AREA 1C COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 4 - Excavate Depths 1'-5' Backfill with New Soil		Option 3 - Capping (1 foot) with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	EA	2	$20,000	1	$10,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	0.6	$2,396	0.5	$2,063
Erosion and Sediment Control	$1.2	LF	560	$650	560	$650
Vegetation Removal	$330	ACRE	0.6	$192	0.5	$170
Geotextile	$1.81	SY	0	$0	2500	$4,525
Excavation & Stockpile	$1.41	CY	1,093	$1,540	0	$0
Excvation & Disposal	$65	TON	5,666	$368,313	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	5,666	$84,995	1417	$21,249
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	3333	$5,033	833	$1,258
Compaction (stockpile)	$1.5	CY	1093	$1,650	0	$0
Hydroseeding	$4,000	ACRE	0.6	$2,323	0.5	$2,000
Surveying	$3,200	LS	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	0	$0
Subtotal				**$490,291**		**$45,114**
Markup	10	%		$49,029		$4,511
Contractor Cost				**$539,320**		**$49,626**
CONSULTANT COST						
Engineering Oversight	5	%		$26,966		$2,481
Closure Report	5	%		$26,966		$2,481
Consultant Cost				**$53,932**		**$4,963**
Capital Cost Subtotal				**$593,252**		**$54,588**
Contingency	10	%		$59,325		$5,459
TOTAL PROJECT COST				**$653,000**		**$60,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site. All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & Grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Disposal costs assume all soils are non-hazardous.
14. No taxes were included in costs.
15. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
16. Excavations under 4 feet deep do not require set backs per OSHA regulations.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-3

AREA 2A COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4A - Excavation, dispose and backfill to-grade 0-1 ft with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-10 ft with New Soil	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	LS	1	$10,000	2	$20,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0	0	$0
Site Preparation- Clearing & Grubbing	$4,125	ACRE	0.5	$2,228	0.5	$2,228	0.8	$3,198
Erosion and Sediment Control	$1.2	LF	1025	$1,189	1025	$1,189	1025	$1,189
Vegetation Removal	$330	ACRE	0.5	$178	0.5	$178	0.8	$256
Geotextile	$1.81	SY	2,614	$4,731	2,614	$4,731	2,614	$4,731
Excavate and disposal (A2-1)	$65.00	TON	0	$0	0	$0	0	$0
Excavation	$1.41	CY	0	$0	871	$1,228	10,610	$14,960
Disposal	$39.00	TON	0	$0	1,481	$57,761	14,810	$577,606
Excavate & Stockpile (setbacks)	$1.41	CY	0	$0	0	$0	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	2962	$44,431	1,481	$22,216	14,810	$222,156
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	1,742	$2,631	871	$1,316	10,610	$16,021
Compaction (stockpiled material)	$1.5	CY	0	$0	0	$0	0	$0
Hydroseeding	$4,000	ACRE	0.5	$2,160	0.5	$2,160	0.8	$3,101
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	1	$1,500	1	$1,500	1	$1,500
Analytical Costs	$800	EA	0	$0	6	$4,800	6	$4,800
Subtotal				**$72,248**		**$122,505**		**$872,718**
Markup	10	%		$7,225		$12,251		$87,272
Contractor Cost				**$79,472**		**$134,756**		**$959,990**
CONSULTANT COST								
Engineering Oversight	6	%		$4,768		$8,085		$57,599
Closure Report	5	%		$3,974		$6,738		$47,999
Consultant Cost				**$8,742**		**$14,823**		**$105,599**
Capital Cost Subtotal				**$88,214**		**$149,579**		**$1,065,589**
Contingency	10	%		$8,821		$14,958		$106,559
TOTAL PROJECT COST				**$97,000**		**$165,000**		**$1,172,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples. One sample will be taken for waste characterization and 5 to verify of clean up.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
10. O&M costs not included.
11. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Well abandonment is completed by overdrilling each well.
15. Disposal costs assume all soils are non-hazardous.
18. No taxes were included in costs.
19. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
20. Excavations under 4 feet deep do not require set backs per OSHA regulations.
21. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-4

AREA 2A1 COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-10 ft with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	LS	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0
Site Preparation-Clearing & Grubbing	$4,125	ACRE	0.2	$730	0.25	$1,014
Erosion and Sediment Control	$1.2	LF	300	$348	300	$348
Vegetation Removal	$330	ACRE	0.2	$58	0.25	$81
Geotextile	$1.81	SY	857	$1,551	857	$1,551
Excavation	$1.41	CY	0	$0	2,856	$4,026
Disposal	$39.00	TON	0	$0	4,855	$189,326
Excavate & Stockpile (setbacks)	$1.41	CY	0	$0	556	$783
Common Earth Fill Import (clean backfill)	$15	TON	971	$14,564	4,855	$72,818
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	571	$862	2,856	$4,312
Compaction (stockpiled material)	$1.5	CY	0	$0	556	$833
Hydroseeding	$4,000.0	ACRE	0.2	$708	0.25	$983
Surveying	$3,200	LS	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$32,021**		**$304,077**
Markup	10	%		$3,202		$30,408
Contractor Cost				**$35,223**		**$334,484**
CONSULTANT COST						
Engineering Oversight	6	%		$2,113		$20,069
Closure Report	5	%		$1,761		$16,724
Consultant Cost				**$3,875**		**$36,793**
Capital Cost Subtotal				**$39,098**		**$371,277**
Contingency	10	%		$3,910		$37,128
TOTAL PROJECT COST				**$43,000**		**$408,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Disposal costs assume all soils are non-hazardous.
14. No taxes were included in costs.
15. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
16. Excavations under 4 feet deep do not require set backs per OSHA regulations.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-5

AREA 2B COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - 0-10' Excavation, disposal, and backfill to-grade with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	LS	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavatio	$1,000	LS	0	$0	0	$0
Site Preparation-Clearing	$4,125	ACRE	3.1	$12,581	3.6	$14,977
Erosion and Sediment Control	$1.2	LF	2,530	$2,935	2,530	$2,935
Vegetation Removal	$330	ACRE	3.1	$1,007	3.6	$1,198
Geotextile	$1.81	SY	14,762	$26,719	14,762	$26,719
Excavate & Disposal (Area A2-3) - 5 feet	$65.00	TON	0	$0	0	$0
Excavate & Stockpile (Area A2-3)	$1.41	CY	0	$0	0	$0
Excavate and Stockpile	$1.41	CY	0	$0	4,685	$6,606
Excavation & Disposal (0-10 ft)	$65.00	TON	0	$0	83,651	$5,437,337
HOTSPOT (A2-3) On-Site Fill	$7	CY	0	$0	0	$0
HOTSPOT (A2-3) Import	$15	TON	0	$0	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	16730	$250,954	83,651	$1,254,770
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compacation	$1.5	CY	9,841	$14,860	49,207	$74,302
Compaction (stockpile)	$1.5	CY	0	$0	4,685	$7,075
Hydroseeding	$4,000	ACRE	3.1	$12,200	3.6	$14,523
Surveying	$3,200	LS	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$334,456**		**$6,868,442**
Markup	10	%		$33,446		$686,844
Contractor Cost				**$367,902**		**$7,555,286**
CONSULTANT COST						
Engineering Oversight	6	%		$22,074		$453,317
Closure Report	5	%		$18,395		$377,764
Consultant Cost				**$40,469**		**$831,081**
Capital Cost Subtotal				**$408,371**		**$8,386,368**
Contingency	20	%		$81,674		$1,677,274
TOTAL PROJECT COST				**$490,000**		**$10,064,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site. All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Disposal costs assume all soils are non-hazardous.
14. No taxes were included in costs.
15. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
16. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-6

AREA 3B COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) New Soil		Option 4 - 0-5' Excavation, dispose and backfill to-grade with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.1	$4,482	1.2	$5,003
Erosion and Sediment Control	$1.2	LF	1,100	$1,276	1100	$1,276
Vegetation Removal	$330	ACRE	1.1	$359	1.2	$400
Geotextile	$1.81	SY	5,259	$9,518	5,259	$9,518
Excavate and Disposal	$65.00	TON	0	$0	14,899	$968,451
Excavate & Stockpile (setbacks)	$1.41	CY	0	$0	509	$718
Common Earth Fill Import (clean backfill)	$15	TON	5,960	$89,395	14,899	$223,489
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	3,506	$5,294	8,764	$13,234
Compaction (stockpiled material)	$1.5	CY	0	$0	509	$764
Hydroseeding	$4,000.0	ACRE	1.1	$4,346	1.2	$4,851
Surveying	$3,200	LS	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	1	$1,500	1	$1,500
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$129,369**		**$1,257,203**
Markup	10	%		$12,937		$125,720
Contractor Cost				**$142,306**		**$1,382,923**
CONSULTANT COST						
Engineering Oversight	5	%		$7,115		$69,146
Closure Report	5	%		$7,115		$69,146
Consultant Cost				**$14,231**		**$138,292**
Capital Cost Subtotal				**$156,537**		**$1,521,216**
Contingency	10	%		$15,654		$152,122
TOTAL PROJECT COST				**$172,000**		**$1,673,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Well abandonment is completed by overdrilling each well.
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-7

AREA 5A COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - 0-5' Excavation, dispose and backfill to-grade with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.6	$6,532	1.7	$7,060
Erosion and Sediment Control	$1.2	LF	1,115	$1,293	1115	$1,293
Vegetation Removal	$330	ACRE	1.6	$523	1.7	$565
Geotextile	$1.81	SY	7,664	$13,872	7,664	$13,872
Excavate and Stockpile	$1.41	CY	0	$0	516	$728
Excavate & Dispose, 0-5'	$65.00	TON	0	$0	21,715	$1,411,474
Excavate and disposal (HOTSPOT)	$65.00	TON	0	$0	0	$0
Compact capping (HOTSPOT)	$0.4	CY	0	$0	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	8686	$130,290	21,715	$325,725
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	5,109	$7,715	12,774	$19,288
Compaction of setbacks	$1.5	CY	0	$0	516	$779
Hydroseeding	$4,000	ACRE	1.6	$6,334	1.7	$6,846
Surveying	$3,200	LS	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$179,759**		**$1,815,630**
Markup	10	%		$17,976		$181,563
Contractor Cost				**$197,735**		**$1,997,193**
CONSULTANT COST						
Engineering Oversight	6	%		$11,864		$119,832
Closure Report	5	%		$9,887		$99,860
Consultant Cost				**$21,751**		**$219,691**
Capital Cost Subtotal				**$219,486**		**$2,216,884**
Contingency	15	%		$32,923		$332,533
TOTAL PROJECT COST				**$252,000**		**$2,549,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal-both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Disposal costs assume all soils are non-hazardous.
14. No taxes were included in costs.
15. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
16. Excavations under 4 feet deep do not require set backs per OSHA regulations.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-8

AREA 5B COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-10 ft with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	AEA	1	$10,000	2	$20,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	3.0	$12,499	3.8	$15,529
Erosion and Sediment Control	$1.2	LF	3200	$3,712	3200	$3,712
Vegetation Removal	$330	ACRE	3.0	$1,000	3.8	$1,242
Geotextile	$1.81	SY	14665	$26,544	14665	$26,544
Excavate and Stockpile	$1.41	CY	0	$0	5,926	$8,356
Excavate & Dispose (10 foot)	$65.00	TON	0	$0	83,103	$5,401,682
Common Earth Fill Import (clean backfill)	$15	TON	16621	$249,308	83,103	$1,246,542
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	9,777	$14,763	48,884	$73,815
Compaction (stockpile)	$1.5	CY	0	$0	5,926	$8,948
Hydroseeding	$4,000.0	ACRE	3.0	$12,120	3.8	$15,058
Surveying	$3,200	LS	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	2	$3,000	2	$3,000
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$336,146**		**$6,832,428**
Markup	10	%		$33,615		$683,243
Contractor Cost				**$369,761**		**$7,515,671**
CONSULTANT COST						
Engineering Oversight	6	%		$22,186		$450,940
Closure Report	5	%		$18,488		$375,784
Consultant Cost				**$40,674**		**$826,724**
Capital Cost Subtotal				**$410,434**		**$8,342,395**
Contingency	15	%		$61,565		$1,251,359
TOTAL PROJECT COST				**$472,000**		**$9,594,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utiltities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Well abandonment is completed by overdrilling each well.
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-9

AREA 6A COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4A - Excavation, dispose and backfill to-grade 0-1 ft with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-10 ft with New Soil	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0	0	$0
Site Preparation-Clearing & Grubbing	$4,125	ACRE	2.4	$9,776	2.4	$9,776	2.7	$11,007
Erosion and Sediment Control	$1.2	LF	1,300	$1,508	1,300	$1,508	1,300	$1,508
Vegetation Removal	$330	ACRE	2.4	$782	2.4	$782	2.7	$881
Geotextile	$1.81	SY	11,471	$20,762	11,471	$20,762	11,471	$20,762
Excavate and Stockpile	$1.41	CY	0	$0	0	$0	2,407	$3,394
Excavate & Dispose	$65.00	TON	0	$0	6,500	$422,508	65,001	$4,225,078
Excavate and disposal (HOTSPOT)	$65.00	TON	0	$0	0	$0	0	$0
Compact capping (HOTSPOT)	$0.4	CY	0	$0	0	$0	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	13000	$195,004	6,500	$97,502	65,001	$975,018
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	7,647	$11,547	3,824	$5,774	38,236	$57,736
Compaction of setbacks	$1.5	CY	0	$0	0	$0	2,407	$3,635
Hydroseeding	$4,000	ACRE	2.4	$9,480	2.4	$9,480	2.7	$10,674
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800	6	$4,800
Abandon Monitoring Well	$1,500	EA	1	$1,500	1	$1,500	1	$1,500
Subtotal				**$263,559**		**$597,592**		**$5,339,194**
Markup	10	%		$26,356		$59,759		$533,919
Contractor Cost				**$289,915**		**$657,351**		**$5,873,113**
CONSULTANT COST								
Engineering Oversight	6	%		$17,395		$39,441		$352,387
Closure Report	5	%		$14,496		$32,868		$293,656
Consultant Cost				**$31,891**		**$72,309**		**$646,042**
Capital Cost Subtotal				**$321,806**		**$729,660**		**$6,519,156**
Contingency	15	%		$48,271		$109,449		$977,873
TOTAL PROJECT COST				**$370,000**		**$839,000**		**$7,497,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Well abandonment is completed by overdrilling each well.
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-10

AREA 6B COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4A - Excavation, dispose and backfill to-grade 0-1 ft with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-10 ft with New Soil	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000	2	$20,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.5	$6,064	1.5	$6,064	1.7	$7,049
Erosion and Sediment Control	$1.2	LF	1040	$1,206	1040	$1,206	1040	$1,206
Vegetation Removal	$330	ACRE	1.5	$485	1.5	$485	1.7	$564
Geotextile	$1.81	SY	7,115	$12,878	7,115	$12,878	0	$0
Excavate & Stockpile	$1.41	CY	0	$0	0	$0	1,926	$2,716
Excavation & Disposal	$65.00	TON	0	$0	4,032	$262,062	40,317	$2,620,618
Common Earth Fill Import (clean backfill)	$15	TON	8063	$120,952	4,032	$60,476	40,317	$604,758
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.4	CY	4,743	$6,688	2,372	$3,344	23,716	$33,440
Compaction (stockpile)	$1.4	CY	0	$0	0	$0	1,926	$2,716
Hydroseeding	$4,000	ACRE	1.5	$5,880	1.5	$5,880	1.7	$6,835
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800	6	$4,800
Subtotal				**$167,353**		**$380,395**		**$3,307,901**
Markup	10	%		$16,735		$38,039		$330,790
Contractor Cost				**$184,088**		**$418,434**		**$3,638,691**
CONSULTANT COST								
Engineering Oversight	8	%		$14,727		$33,475		$291,095
Closure Report	5	%		$9,204		$20,922		$181,935
Consultant Cost				**$23,931**		**$54,396**		**$473,030**
Capital Cost Subtotal				**$208,019**		**$472,830**		**$4,111,720**
Contingency	10	%		$20,802		$47,283		$411,172
TOTAL PROJECT COST				**$229,000**		**$520,000**		**$4,523,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Disposal costs assume all soils are non-hazardous.
14. No taxes were included in costs.
15. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
16. Excavations under 4 feet deep do not require set backs per OSHA regulations.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-11

AREA 6C COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-10 ft with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0
Site Preparation-Clearing	$4,125	ACRE	2.2	$9,034	2.6	$10,928
Erosion and Sediment Control	$1.2	LF	2,000	$2,320	2,000	$2,320
Vegetation Removal	$330	ACRE	2.2	$723	2.6	$874
Geotextile	$1.81	SY	10,600	$19,185	10,600	$19,185
Excavate and Stockpile	$1.41	CY	0	$0	3,704	$5,222
Excavation & Disposal (0-10')	$65.00	TON	0	$0	60,064	$3,904,186
Common Earth Fill Import (clean backfill)	$15	TON	12,013	$180,193	60,064	$900,966
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	7,066	$10,670	35,332	$53,351
Compaction (stockpile)	$1.5	CY	0	$0	3,704	$5,593
Hydroseeding	$4,000.0	ACRE	2.2	$8,760	2.6	$10,597
Surveying	$3,200	LS	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800
Abandon Existing Wells	$1,500	EA	2	$3,000	2	$3,000
Subtotal				**$247,085**		**$4,944,222**
Markup	10	%		$24,709		$494,422
Contractor Cost				**$271,794**		**$5,438,644**
CONSULTANT COST						
Engineering Oversight	6	%		$16,308		$326,319
Closure Report	5	%		$13,590		$271,932
Consultant Cost				**$29,897**		**$598,251**
Capital Cost Subtotal				**$301,691**		**$6,036,895**
Contingency	10	%		$30,169		$603,689
TOTAL PROJECT COST				**$332,000**		**$6,641,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site. All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Well abandonment is completed by overdrilling each well.
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-12

AREA 6D COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping with New Soil (2 feet)		Option 4 - 0-5' Excavation, disposal, and backfill to-grade with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	EA	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	EA	0	$0	0	$0
Site Preparation-Clearing & Grubbing	$4,125	ACRE	4	$16,376	4.4	$18,043
Erosion and Sediment Control	$1.2	LF	1,760	$2,042	1760	$2,042
Vegetation Removal	$330	ACRE	4	$1,310	4.4	$1,443
Geotextile	$1.81	SY	19215	$34,779	19215	$34,779
Excavate and Disposal (HOTSPOT)	$65.00	TON	0	$0	0	$0
Excavation & Stockpile	$1.41	CY	0	$0	3,259	$4,596
Excavate & Disposal	$65.00	TON	0	$0	54442	$3,538,726
Common Earth Fill Import (clean backfill)	$15	TON	21777	$326,652	54442	$816,629
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	12810	$19,343	32025	$48,357
Compaction (stockpile)	$1.5	CY	0	$0	3259	$4,921
Hydroseeding	$4,000	ACRE	4.0	$15,880	4.4	$17,496
Surveying	$3,200	LS	1	$3,200	1	$3,200
Analytical Costs	$800	EA	0	$0	6	$4,800
Abandon Monitoring Well	$1,500	EA	3	$4,500	3	$4,500
Subtotal				**$434,081**		**$4,519,532**
Markup	10	%		$43,408		$451,953
Contractor Cost				**$477,489**		**$4,971,485**
CONSULTANT COST						
Engineering Oversight	6	%		$28,649		$298,289
Closure Report	5	%		$23,874		$248,574
Consultant Cost				**$52,524**		**$546,863**
Capital Cost Subtotal				**$530,013**		**$5,518,348**
Contingency	15	%		$79,502		$827,752
TOTAL PROJECT COST				**$610,000**		**$6,346,000**

Assumptions
1. Costs are in 2011 dollar.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. Work will be completed in level D personal protective equipment.
7. Density of soils assumed to be 1.7 tons per cubic yard.
8. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
9. O&M costs not included.
10. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no onsite stock piling of soils prior to disposal).
13. Well abandonment is completed by overdrilling each well.
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Excavations under 4 feet deep do not require set backs per OSHA regulations.
18. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-13

AREA 6D1 COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-1 ft with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	LS	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.3	$5,528	1.3	$5,528
Erosion and Sediment Control	$1.2	LF	1000	$1,160	1000	$1,160
Vegetation Removal	$330	ACRE	1.3	$442	1.3	$442
Geotextile	$1.81	SY	6,486	$11,739	6,486	$11,739
Excavation	$1.41	CY	0	$0	2,162	$3,048
Disposal	$39.00	TON	0	$0	3,675	$143,332
Excavate & Stockpile (setbacks)	$1.41	CY	0	$0	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	7350	$110,255	3,675	$55,128
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	4,324	$6,529	2,162	$3,264
Compaction (stockpiled material)	$1.5	CY	0	$0	0	$0
Hydroseeding	$4,000	ACRE	1.3	$5,360	1.3	$5,360
Surveying	$3,200	LS	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	2	$3,000	2	$3,000
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$157,213**		**$260,001**
Markup	10	%		$15,721		$26,000
Contractor Cost				**$172,934**		**$286,001**
CONSULTANT COST						
Engineering Oversight	6	%		$10,376		$17,160
Closure Report	5	%		$8,647		$14,300
Consultant Cost				**$19,023**		**$31,460**
Capital Cost Subtotal				**$191,957**		**$317,461**
Contingency	10	%		$19,196		$31,746
TOTAL PROJECT COST				**$211,000**		**$349,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples. One sample will be taken for waste characterization and 5 to verify of clean up.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
10. O&M costs not included.
11. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Well abandonment is completed by overdrilling each well.
15. Disposal costs assume all soils are non-hazardous.
16. No taxes were included in costs.
17. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
18. Excavations under 4 feet deep do not require set backs per OSHA regulations.
19. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-14

AREA 6D3 COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 3 - Capping (2 feet) with New Soil		Option 4 - Excavation, dispose and backfill to-grade 0-1 ft with New Soil	
			Quantity	Cost	Quantity	Cost
CONTRACTOR COST						
Mob/Demob	$10,000	LS	1	$10,000	2	$20,000
Additional mob/demob for hotspot excavation	$1,000	LS	0	$0	0	$0
Site Preparation- Clearing & Grubbing	$4,125	ACRE	1.3	$5,528	1.3	$5,528
Erosion and Sediment Control	$1.2	LF	950	$1,102	950	$1,102
Vegetation Removal	$330	ACRE	1.3	$442	1.3	$442
Geotextile	$1.81	SY	6,486	$11,739	6,486	$11,739
Excavation	$1.41	CY	0	$0	2,162	$3,048
Disposal	$39.00	TON	0	$0	3,675	$143,332
Excavate & Stockpile (setbacks)	$1.41	CY	0	$0	0	$0
Common Earth Fill Import (clean backfill)	$15	TON	7350	$110,255	3,675	$55,128
Common Earth Fill On-site Source	$7	CY	0	$0	0	$0
Compaction	$1.5	CY	4,324	$6,529	2,162	$3,264
Compaction (stockpiled material)	$1.5	CY	0	$0	0	$0
Hydroseeding	$4,000	ACRE	1.3	$5,360	1.3	$5,360
Surveying	$3,200	LS	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	0	$0	0	$0
Analytical Costs	$800	EA	0	$0	6	$4,800
Subtotal				**$154,155**		**$256,943**
Markup	10	%		$15,415		$25,694
Contractor Cost				**$169,570**		**$282,637**
CONSULTANT COST						
Engineering Oversight	6	%		$10,174		$16,958
Closure Report	5	%		$8,479		$14,132
Consultant Cost				**$18,653**		**$31,090**
Capital Cost Subtotal				**$188,223**		**$313,727**
Contingency	10	%		$18,822		$31,373
TOTAL PROJECT COST				**$207,000**		**$345,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples. One sample will be taken for waste characterization and 5 to verify of clean up.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site.
   All other soils will be shipped off site for disposal.
10. O&M costs not included.
11. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Well abandonment is completed by overdrilling each well.
15. Disposal costs assume all soils are non-hazardous.
16. No taxes were included in costs.
17. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
18. Excavations under 4 feet deep do not require set backs per OSHA regulations
19. Cost for design, permitting, and project management are not included in consultant costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-15

HOT SPOT COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Hotspot excavation, backfill and compacation with New Soil A2-1		Hotspot excavation, backfill and compacation with New Soil A2-3		Hotspot excavation, backfill and compacation with New Soil WS-3A-2A		Hotspot Capping with New Soil WS-3A-2A	
			Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST										
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	0.06	$227	0.02	$66	0.01	$52	0.01	$52
Erosion and Sediment Control	$1.2	LF	193	$224	75	$87	75	$87	75	$87
Vegetation Removal	$330	ACRE	0.06	$18	0.02	$5	0.01	$4	0.01	$4
Geotextile	$1.81	SY	267	$483	78	$141	61	$111	61	$111
Excavate and disposal (A2-1)	$65.00	TON	1662	$108,044	0	$0	0	$0	0	$0
Excavate and disposal (A2-3)	$65.00	TON	0	$0	220	$14,324	0	$0	0	$0
Excavate and disposal (WS-3A-2A)	$65.00	TON	0	$0	0	$0	35	$2,251	0	$0
Excavate & Stockpile	$1.41	CY	432	$610	35	$49	322	$454	0	$0
Compaction (A2-1)	$1.5	CY	978	$1,476	0	$0	0	$0	0	$0
Compaction (A2-3)	$1.5	CY	0	$0	130	$196	0	$0	0	$0
Compaction (WS-3A-2A)	$1.5	CY	0	$0	0	$0	204	$308	41	$62
Compaction (setbacks)	$1.5	CY	432	$653	35	$52	139	$210	0	$0
Common Earth Fill Import	$15	TON	1662	$24,933	220	$3,306	35	$519	69	$1,039
Common Earth Fill On-Site Source	$6	CY	0	$0	0	$0	0	$0	0	$0
Hydroseeding	$4,000	ACRE	0.06	$220	0.016	$64	0.013	$51	0.013	$51
Surveying	$1,000	LS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Analytical Costs	$800	EA	6	$4,800	6	$4,800	6	$4,800	0	$0
Subtotal				**$143,689**		**$25,090**		**$10,846**		**$3,405**
Markup	10	%		$14,369		$2,509		$1,085		$340
Contractor Cost				**$158,058**		**$27,599**		**$11,931**		**$3,745**
CONSULTANT COST										
Engineering Oversight	6	%		$9,484		$1,656		$716		$225
Closure Report	5	%		$7,903		$1,380		$597		$187
Consultant Cost				**$17,386**		**$3,036**		**$1,312**		**$412**
Capital Cost Subtotal				**$175,445**		**$30,635**		**$13,243**		**$4,157**
Contingency	20	%		$35,089		$6,127		$2,649		$831
TOTAL PROJECT COST				**$211,000**		**$37,000**		**$16,000**		**$5,000**

TABLE C-15

HOT SPOT COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Hotspot excavation, backfill and compacation with New Soil A5-11		Hotspot excavation, backfill and compacation with New Soil A5-12A/B		Hotspot excavation, backfill and compacation with New Soil A5-13		Hotspot excavation, backfill and compacation with New Soil A4-5	
			Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST										
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Site Preparation- Clearing & Grubbing	$4,125	ACRE	0.03	$104	0.18	$734	0.01	$38	0.02	$76
Erosion and Sediment Control	$1.2	LF	130	$151	350	$406	65	$75	100	$116
Vegetation Removal	$330	ACRE	0.03	$8	0.18	$59	0.01	$3	0.02	$6
Geotextile	$1.81	SY	122	$221	861	$1,559	44	$80	89	$161
Excavate and disposal (A5-11)	$65.00	TON	485	$31,513	0	$0	0	$0	0	$0
Excavate and disposal (A5-12A/B)	$65.00	TON	0	$0	1464	$95,153	0	$0	0	$0
Excavate and disposal (A5-13)	$65.00	TON	0	$0	0	$0	13	$819	0	$0
Excavate and disposal (A4-5)	$65.00	TON	0	$0	0	$0	0	$0	302	$19,644
Excavate & Stockpile	$1.41	CY	550	$776	0	$0	0	$0	67	$94
Compaction (A5-11)	$1.5	CY	489	$738	0	$0	0	$0	0	$0
Compaction (A5-12A/B)	$1.5	CY	0	$0	861	$1,300	0	$0	0	$0
Compaction (A5-13)	$1.5	CY	0	$0	0	$0	7	$11	0	$0
Compaction (A4-5)	$1.5	CY	0	$0	0	$0	0	$0	178	$268
Compaction (stockpiled material)	$1.5	CY	550	$831	0	$0	0	$0	67	$101
Common Earth Fill Import	$15	TON	485	$7,272	1464	$21,958	13	$189	302	$4,533
Common Earth Fill On-Site Source	$6	CY	0	$0	0	$0	0	$0	0	$0
Hydroseeding	$4,000	ACRE	0.03	$101	0.178	$712	0.01	$37	0.02	$73
Surveying	$1,000	LS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Analytical Costs	$800	EA	6	$4,800	6	$4,800	6	$4,800	6	$4,800
Subtotal				**$48,516**		**$128,680**		**$8,052**		**$31,873**
Markup	10	%		$4,852		$12,868		$805		$3,187
Contractor Cost				**$53,368**		**$141,548**		**$8,857**		**$35,060**
CONSULTANT COST										
Engineering Oversight	6	%		$3,202		$8,493		$531		$2,104
Closure Report	5	%		$2,668		$7,077		$443		$1,753
Consultant Cost				**$5,870**		**$15,570**		**$974**		**$3,857**
Capital Cost Subtotal				**$59,238**		**$157,119**		**$9,832**		**$38,917**
Contingency	20	%		$11,848		$31,424		$1,966		$7,783
TOTAL PROJECT COST				**$71,000**		**$189,000**		**$12,000**		**$47,000**

TABLE C-15

HOT SPOT COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Hotspot excavation, backfill and compacation with New Soil (Stained Soil Under Slab)		Hotspot Capping with New Soil (Stained Soil Under Slab)		Hotspot excavation, backfill and compacation with New Soil WS-RS-3-1		Hotspot Capping with New Soil WS-RS-3-1	
			Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST										
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Site Preparation- Clearing & Grubbing	$4,125	ACRE	0.02	$95	0.02	$95	0.01	$52	0.01	$52
Erosion and Sediment Control	$1.2	LF	110	$128	110	$128	75	$87	75	$87
Vegetation Removal	$330	ACRE	0.02	$8	0.02	$8	0.01	$4	0.01	$4
Geotextile	$1.81	SY	111	$201	111	$201	61	$111	61	$111
Excavate and disposal (Stained Soil Under Slab)	$65.00	TON	252	$16,370	0	$0	0	$0	0	$0
Excavate and disposal (WS-RS-3-1)	$65.00	TON	0	$0	0	$0	104	$6,753	0	$0
Excavate & Stockpile	$1.41	CY	0	$0	0	$0	191	$269	0.0	$0
Compaction (Stained Soil Under Slab)	$1.5	CY	148	$224	74	$112	0	$0	0	$0
Compaction (WS-RS-3-1)	$1.5	CY	0	$0	0	$0	163	$246	41	$62
Compaction (setbacks)	$1.5	CY	0	$0	0	$0	89	$134	0.0	$0
Common Earth Fill Import	$15	TON	252	$3,778	126	$1,889	104	$1,558	69	$1,039
Common Earth Fill On-Site Source	$6	CY	0	$0	0	$0	0	$0	0	$0
Hydroseeding	$4,000	ACRE	0.02	$92	0.023	$92	0.01	$51	0.01	$51
Surveying	$1,000	LS	1	$1,000	1	$1,000	1	$1,000	1	$1,000
Analytical Costs	$800	EA	6	$4,800	0	$0	6	$4,800	0	$0
Subtotal				**$27,695**		**$4,524**		**$16,065**		**$3,405**
Markup	10	%		$2,769		$452		$1,606		$340
Contractor Cost				**$30,464**		**$4,976**		**$17,671**		**$3,745**
CONSULTANT COST										
Engineering Oversight	6	%		$1,828		$299		$1,060		$225
Closure Report	5	%		$1,523		$249		$884		$187
Consultant Cost				**$3,351**		**$547**		**$1,944**		**$412**
Capital Cost Subtotal				**$33,815**		**$5,523**		**$19,615**		**$4,157**
Contingency	20	%		$6,763		$1,105		$3,923		$831
TOTAL PROJECT COST				**$41,000**		**$7,000**		**$24,000**		**$5,000**

TABLE C-15

HOT SPOT COST ESTIMATES
University of Portland River Campus Property
Portland, Oregon

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples. One sample will be taken for waste characterization and 5 to verify of clean up.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Soil from setbacks and non-contaminated areas/depths will be stockpiled and re-used for backfilll on site. All other soils will be shipped off site for disposal.
10. O&M costs not included.
11. Volumes and mass of soil for setback excavations for each area have been included assuming no adjacent areas are being excavated.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Cost for design, permitting, and project management are not included in consultant costs.
18. Hot spots are assumed to be in addition to work on site, so only additional mob/demob costs were included.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-16

AREA RS-1 COST ESTIMATES - DISPOSAL
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 4 - Excavate 10', Dispose and Backfill to 5:1 grade with New Soil		Option 4 - Excavate to 5:1 slope, dispose and Cap with New Soil (15 feet bgs)		Option 4 - Excavate to 1.5:1 slope, Dispose and Cap to with New Soil (15 feet bgs)	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	each	3	$30,000	3	$30,000	3	$30,000
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.0	$4,315	1.0	$4,315	1.0	$4,315
Erosion and Sediment Control	$1.2	LF	2200	$2,552	2200	$2,552	2200	$2,552
Vegetation Removal	$330	ACRE	1.0	$345	1.0	$345	1.0	$345
Geotextile	$1.81	SY	5,063	$9,163	5,063	$9,163	5,063	$9,163
Excavation for 5:1 Slope Regrading and dispose	$65.00	TON	0	$0	25,500	$1,657,500	0	$0
Excavate (10ft) and dispose	$65.00	TON	28,688	$1,864,739	0	$0	0	$0
Excavation for 1.5:1 Slope Regrading and dispose	$65.00	TON	0	$0	0	$0	13,813	$897,813
Common Earth Fill Import	$15	TON	22,667	$340,000	0	$0	0	$0
Common Earth Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Capping Fill Import	$15	TON	0	$0	7,027	$105,400	7,310	$109,650
Capping Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	13,333	$20,133	4,133	$6,241	4,300	$6,493
Hydroseeding	$4,000	ACRE	1.046	$4,184	1.046	$4,184	1.046	$4,184
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Analytical Costs	$800	EA	11	$8,800	11	$8,800	11	$8,800
Subtotal				**$2,288,432**		**$1,832,701**		**$1,077,515**
Markup	10	%		$228,843		$183,270		$107,751
Contractor Cost				**$2,517,275**		**$2,015,971**		**$1,185,266**
CONSULTANT COST								
Engineering Oversight	8	%		$201,382		$161,278		$94,821
Closure Report	5	%		$125,864		$100,799		$59,263
Consultant Cost				**$327,246**		**$262,076**		**$154,085**
Capital Cost Subtotal				**$2,844,521**		**$2,278,047**		**$1,339,351**
Contingency	20	%		$568,904		$455,609		$267,870
TOTAL PROJECT COST				**$3,413,000**		**$2,734,000**		**$1,607,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Contingency set at 20% due to regrading and presence of dioxins and TBTs.
10. Costs do not include excavation or disposal of soils from setbacks.
11. O&M costs not included.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Excavations under 4 feet deep do not require set backs per OSHA regulations.
18. Cost for design, permitting, and project management are not included in consultant costs.
19. Option 1 assumes a 10-foot excavation and backfilling to obtain 5:1 slope.
20. Option 2 assumes excavating to 5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
21. Option 3 assumes excavating to 1.5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
22. Excavation of setbacks not included in costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-17

AREA RS-1 COST ESTIMATES - STOCKPILE/BACKFILL
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 5 - Excavate 10', Stockpile, and Backfill to 5:1 grade with New Soil		Option 5 - Excavate to 5:1 slope, Stockpile, and Cap with New Soil (15 feet bgs)		Option 5 - Excavate to 1.5:1 slope, Stockpile, and Cap to with New Soil (15 feet bgs)	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	3	$30,000	3	$30,000	3	$30,000
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.0	$4,315	1.0	$4,315	1.0	$4,315
Erosion and Sediment Control	$1.2	LF	2200	$2,552	2200	$2,552	2200	$2,552
Vegetation Removal	$330	ACRE	1.0	$345	1.0	$345	1.0	$345
Geotextile	$1.81	SY	5,063	$9,163	5,063	$9,163	5063	$9,163
Excavate and stockpile	$8.00	CY	16,875	$134,995	0	$0	0	$0
Excavation for 5:1 Slope Regrading and stockpile	$8.00	CY	0	$0	15,000	$119,993	0	$0
Excavation for 1.5:1 Slope Regrading and stockpile	$8.00	CY	0	$0	0	$0	8125	$64,996
Common Earth Fill Import	$15	TON	22,667	$340,000	0	$0	0	$0
Common Earth Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Capping Fill Import	$15	TON	0	$0	7,027	$105,400	7310	$109,650
Capping Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	13,333	$20,133	4,133	$6,241	4300	$6,493
Hydroseeding	$4,000	ACRE	1.0	$4,184	1.0	$4,184	1.0	$4,184
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Analytical Costs	$800	EA	11	$8,800	11	$8,800	11	$8,800
Subtotal				**$558,688**		**$295,193**		**$244,698**
Markup	10	%		$55,869		$29,519		$24,470
Contractor Cost				**$614,557**		**$324,712**		**$269,168**
CONSULTANT COST								
Engineering Oversight	8	%		$49,165		$25,977		$21,533
Closure Report	5	%		$30,728		$16,236		$13,458
Consultant Cost				**$79,892**		**$42,213**		**$34,992**
Capital Cost Subtotal				**$694,449**		**$366,925**		**$304,160**
Contingency	20	%		$138,890		$73,385		$60,832
TOTAL PROJECT COST				**$833,000**		**$440,000**		**$365,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Contingency set at 20% due to regrading and presence of dioxins and TBTs.
10. Costs do not include excavation or disposal of soils from setbacks.
11. O&M costs not included.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Excavations under 4 feet deep do not require set backs per OSHA regulations.
18. Cost for design, permitting, and project management are not included in consultant costs.
19. Option 1 assumes a 10 foot excavation and backfilling to obtain 5:1 slope.
20. Option 2 assumes excavating to 5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
21. Option 3 assumes excavating to 1.5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
22. Excavation of setbacks not included in costs.
23. Soils will be stockpiled on uplands areas of the site.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-18

AREA RS-2 COST ESTIMATES - DISPOSAL
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 4 - Excavate 10', Dispose and Backfill to 4:1 grade with New Soil		Option 4 - Excavate to 4:1 slope, dispose and Cap with New Soil (15 feet bgs)		Option 4 - Excavate to 1.5:1 slope, Dispose and Cap to with New Soil (15 feet bgs)	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	3	$30,000	3	$30,000	3	$30,000
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	0.9	$3,878	0.9	$3,878	0.9	$3,878
Erosion and Sediment Control	$1.2	LF	1750	$2,030	1750	$2,030	1750	$2,030
Vegetation Removal	$330	ACRE	0.9	$310	0.9	$310	0.9	$310
Geotextile	$1.81	SY	4,550	$8,235	4,550	$8,235	4,550	$8,235
Excavation for 1:4 Slope Regrading and dispose	$65.00	TON	0	$0	23,233	$1,510,167	0	$0
Excavate (Area A5-13) and dispose	$65.00	TON	0	$0	0	$0	0	$0
Excavate and Dispose (10ft)	$65.00	TON	25,781	$1,675,769	0	$0	0	$0
Excavation for 1.5:1 Slope Regrading and dispose	$65.00	TON	0	$0	0	$0	12,585	$818,007
Common Earth Fill Import	$15	TON	20,652	$309,778	0	$0	0	$0
Common Earth Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Capping Fill Import	$15	TON	0	$0	6,402	$96,031	6,660	$99,903
Capping Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	12,148	$18,344	3,766	$5,687	3,918	$5,916
Hydroseeding	$4,000	ACRE	0.9	$3,760	0.9	$3,760	0.9	$3,760
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Analytical Costs	$800	EA	11	$8,800	11	$8,800	11	$8,800
Subtotal				**$2,065,103**		**$1,673,097**		**$985,039**
Markup	10	%		$206,510		$167,310		$98,504
Contractor Cost				**$2,271,614**		**$1,840,406**		**$1,083,542**
CONSULTANT COST								
Engineering Oversight	8	%		$181,729		$147,233		$86,683
Closure Report	5	%		$113,581		$92,020		$54,177
Consultant Cost				**$295,310**		**$239,253**		**$140,861**
Capital Cost Subtotal				**$2,566,923**		**$2,079,659**		**$1,224,403**
Contingency	20	%		$513,385		$415,932		$244,881
TOTAL PROJECT COST				**$3,080,000**		**$2,496,000**		**$1,469,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Contingency set at 20% due to regrading and presence of dioxins and TBTs.
10. Costs do not include excavation or disposal of soils from setbacks.
11. O&M costs not included.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Excavations under 4 feet deep do not require set backs per OSHA regulations.
18. Cost for design, permitting, and project management are not included in consultant costs.
19. Option 1 assumes a 10-foot excavation and backfilling to obtain 5:1 slope.
20. Option 2 assumes excavating to 5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
21. Option 3 assumes excavating to 1.5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
22. Excavation of setbacks not included in costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-19

AREA RS-2 COST ESTIMATES - STOCKPILE/BACKFILL
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 5 - Excavate 10', Stockpile, and Backfill to 5:1 grade with New Soil		Option 5 - Excavate to 5:1 slope, Stockpile, and Cap with New Soil (15 feet bgs)		Option 5 - Excavate to 1.5:1 slope, Stockpile, and Cap to with New Soil (15 feet bgs)	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	3	$30,000	3	$30,000	3	$30,000
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	0.9	$3,878	0.9	$3,878	0.9	$3,878
Erosion and Sediment Control	$1.2	LF	1,750	$2,030	1,750	$2,030	1,750	$2,030
Vegetation Removal	$330	ACRE	0.9	$310	0.9	$310	0.9	$310
Geotextile	$1.81	SY	4550	$8,235	4,550	$8,235	4550	$8,235
Excavate and stockpile (10 ft)	$8.00	CY	15165	$121,315	0	$0	0	$0
Excavation for 5:1 Slope Regrading and stockpile	$8.00	CY	0	$0	13,667	$109,327	0	$0
Excavation for 1.5:1 Slope Regrading and stockpile	$8.00	CY	0	$0	0	$0	7403	$59,219
Common Earth Fill Import	$15	TON	20652	$309,778	0	$0	0	$0
Common Earth Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Capping Fill Import	$15	TON	0	$0	6,402	$96,031	6660	$99,903
Capping Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	12148	$18,344	3,766	$5,687	3918	$5,916
Hydroseeding	$4,000	ACRE	0.9	$3,760	0.9	$3,760	0.9	$3,760
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Analytical Costs	$800	EA	11	$8,800	11	$8,800	11	$8,800
Subtotal				**$510,649**		**$272,257**		**$226,250**
Markup	10	%		$51,065		$27,226		$22,625
Contractor Cost				**$561,714**		**$299,482**		**$248,875**
CONSULTANT COST								
Engineering Oversight	8	%		$44,937		$23,959		$19,910
Closure Report	5	%		$28,086		$14,974		$12,444
Consultant Cost				$73,023		**$38,933**		$32,354
Capital Cost Subtotal				**$634,737**		**$338,415**		**$281,229**
Contingency	20	%		$126,947		$67,683		$56,246
TOTAL PROJECT COST				**$762,000**		**$406,000**		**$337,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Contingency set at 20% due to regrading and presence of dioxins and TBTs.
10. Costs do not include excavation or disposal of soils from setbacks.
11. O&M costs not included.
12. Clearing & grubbing will occur prior to vegetation removal- both are required.
13. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Excavations under 4 feet deep do not require set backs per OSHA regulations
18. Cost for design, permitting, and project management are not included in consultant costs.
19. Option 1 assumes a 10-foot excavation and backfilling to obtain 5:1 slope.
20. Option 2 assumes excavating to 5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
21. Option 3 assumes excavating to 1.5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
22. Excavation of setbacks not included in costs.
23. Soils will be stockpiled on uplands areas of the site.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-20

AREA RS-3 COST ESTIMATES - DISPOSAL
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 4 - Excavate 10', Dispose and Backfill to 5:1 grade with New Soil		Option 4 - Excavate to 5:1 slope, dispose and Cap with New Soil (15 feet bgs)		Option 4 - Excavate to 1.5:1 slope, Dispose and Cap to with New Soil (15 feet bgs)	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	3	$30,000	3	$30,000	3	$30,000
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.7	$7,013	1.7	$7,013	1.7	$7,013
Erosion and Sediment Control	$1.2	LF	2200	$2,552	2200	$2,552	2200	$2,552
Vegetation Removal	$330	CY	1.7	$561	1.7	$561	1.7	$561
Geotextile	$1.81	SY	8228	$14,893	8,228	$14,893	8228	$14,893
Excavate 1:4 Slope Regrading and dispose	$65.00	TON	0	$0	32,473	$2,110,714	0	$0
Excavate (10ft) and dispose	$65.00	TON	46625	$3,030,647	0	$0	0	$0
Excavation for 1.5:1 Slope Regrading and dispose	$65.00	TON	0	$0	0	$0	18577	$1,207,530
Excavate and dispose (HOTSPOT)	$65.00	TON	0	$0	0	$0	0	$0
Common Earth Fill Import	$15	TON	37727	$565,911	0	$0	0	$0
Common Earth Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Capping Fill Import	$15	TON	0	$0	10,510	$157,647	10847	$162,699
Capping Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	22193	$33,511	6,182	$9,335	6380	$9,634
Hydroseeding	$4,000	ACRE	1.7	$6,800	1.7	$6,800	1.7	$6,800
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	3	$4,500	3	$4,500	3	$4,500
Analytical Costs	$800	EA	11	$8,800	11	$8,800	11	$8,800
Subtotal				**$3,709,387**		**$2,357,014**		**$1,459,182**
Markup	10	%		$370,939		$235,701		$145,918
Contractor Cost				**$4,080,325**		**$2,592,715**		**$1,605,100**
CONSULTANT COST								
Engineering Oversight	6	%		$244,820		$155,563		$96,306
Closure Report	5	%		$204,016		$129,636		$80,255
Consultant Cost				$448,836		**$285,199**		$176,561
Capital Cost Subtotal				**$4,529,161**		**$2,877,914**		**$1,781,661**
Contingency	20	%		$905,832		$575,583		$356,332
TOTAL PROJECT COST				**$5,435,000**		**$3,453,000**		**$2,138,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
10. Contingency set at 20% due to regrading and presence of dioxins and TBTs.
11. Costs do not include excavation or disposal of soils from setbacks.
12. O&M costs not included.
13. Clearing & grubbing will occur prior to vegetation removal- both are required.
14. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
15. Well abandonment is completed by overdrilling each well.
16. Disposal costs assume all soils are non-hazardous.
17. No taxes were included in costs.
18. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
19. Excavations under 4 feet deep do not require set backs per OSHA regulations.
20. Cost for design, permitting, and project management are not included in consultant costs.
21. Option 1 assumes a 10-foot excavation and backfilling to obtain 5:1 slope.
22. Option 2 assumes excavating to 5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
23. Option 3 assumes excavating to 1.5:1 slope to a 15 foot depth at the edge of the bank, then capping entire area with 2 foot cap.
24. Excavation of setbacks not included in costs.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard

TABLE C-21

AREA RS-3 COST ESTIMATES - STOCKPILE/BACKFILL
University of Portland River Campus Property
Portland, Oregon

Description	Rate	Units	Option 5 - Excavate 10', Stockpile, and Backfill to 5:1 grade with New Soil		Option 5 - Excavate to 5:1 slope, Stockpile, and Cap with New Soil (15 feet bgs)		Option 5 - Excavate to 1.5:1 slope, Stockpile, and Cap to with New Soil (15 feet bgs)	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
CONTRACTOR COST								
Mob/Demob	$10,000	EA	3	$30,000	3	$30,000	3	$30,000
Additional mob/demob for hotspot excavation	$1,000	LS	1	$1,000	1	$1,000	1	$1,000
Site Preparation-Clearing & Grubbing	$4,125	ACRE	1.7	$7,013	1.7	$7,013	1.7	$7,013
Erosion and Sediment Control	$1.2	LF	2200	$2,552	2200	$2,552	2200	$2,552
Vegetation Removal	$330	ACRE	1.7	$561	1.7	$561	1.7	$561
Geotextile	$1.81	SY	8228	$14,893	8,228	$14,893	8228	$14,893
Excavate and stockpile (10 ft)	$8.00	CY	27427	$219,400	0	$0	0	$0
Excavate 5:1 Slope Regrading and stockpile	$8.00	CY	0	$0	19,101	$152,802	0	$0
Excavation for 1.5:1 Slope Regrading and stockpile	$8.00	CY	0	$0	0	$0	10928	$87,417
Common Earth Fill Import	$15	TON	37727	$565,911	0	$0	0	$0
Common Earth Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Capping Fill Import	$15	TON	0	$0	10,510	$157,647	10847	$162,699
Capping Fill On-Site Source	$7	CY	0	$0	0	$0	0	$0
Compaction	$1.5	CY	22193	$33,511	6,182	$9,335	6380	$9,634
Hydroseeding	$4,000	ACRE	1.7	$6,800	1.7	$6,800	1.7	$6,800
Surveying	$3,200	LS	1	$3,200	1	$3,200	1	$3,200
Abandon Existing Monitoring Well	$1,500	LS	3	$4,500	3	$4,500	3	$4,500
Analytical Costs	$800	EA	11	$8,800	11	$8,800	11	$8,800
Subtotal				**$898,140**		**$399,102**		**$339,069**
Markup	10	%		$89,814		$39,910		$33,907
Contractor Cost				**$987,954**		**$439,013**		**$372,976**
CONSULTANT COST								
Engineering Oversight	6	%		$59,277		$26,341		$22,379
Closure Report	5	%		$49,398		$21,951		$18,649
Consultant Cost				$108,675		**$48,291**		$41,027
Capital Cost Subtotal				**$1,096,629**		**$487,304**		**$414,004**
Contingency	20	%		$219,326		$97,461		$82,801
TOTAL PROJECT COST				**$1,316,000**		**$585,000**		**$497,000**

Assumptions
1. Costs are in 2011 dollars.
2. Work will be conducted in standard work week.
3. Prevailing wage is not applicable to this project.
4. Fieldwork will proceed uninterrupted, once mobilized to the site.
5. There are no subsurface utilities, so no private utility locate was included.
6. 24-hour turnaround time on samples.
7. Work will be completed in level D personal protective equipment.
8. Density of soils assumed to be 1.7 tons per cubic yard.
9. Contingency set at 20% due to regrading and presence of dioxins and TBTs.
10. O&M costs not included.
11. Clearing & grubbing will occur prior to vegetation removal- both are required.
12. Assumes direct loading of contaminated soils from excavation to truck (no on-site stock piling of soils prior to disposal).
13. Well abandonment is completed by overdrilling each well.
14. Disposal costs assume all soils are non-hazardous.
15. No taxes were included in costs.
16. Erosion controls are based on perimeter for each individual area, assuming no adjacent areas are being excavated.
17. Excavations under 4 feet deep do not require set backs per OSHA regulations
18. Cost for design, permitting, and project management are not included in consultant costs.
19. Option 1 assumes a 10-foot excavation and backfilling to obtain 5:1 slope.
20. Option 2 assumes excavating to 5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
21. Option 3 assumes excavating to 1.5:1 slope to a 15-foot depth at the edge of the bank, then capping entire area with 2-foot cap.
22. Excavation of setbacks not included in costs.
23. Soils will be stockpiled on uplands areas of the site.

Abbreviations
CY = cubic yard
EA = each
LF = linear feet
LS = lump sum
SY = square yard