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Central Waterfront Site
Bellingham, Washington

Final Cleanup Action Plan

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Toxics Cleanup Program
Northwest Regional Office
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ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
ASB	Aerated Stabilization Basin
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
CD	Consent Decree
City	City of Bellingham, Washington
CMP	Compliance Monitoring Plan
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
cy	cubic yard
DCA	disproportionate cost analysis
DNR	Washington Department of Natural Resources
Ecology	Washington State Department of Ecology
GP	Georgia-Pacific
IC	institutional control
ICP	Institutional Controls Plan
LNAPL	light non-aqueous phase liquid
mg/kg	milligram per kilogram
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
PAH	polycyclic aromatic hydrocarbon
Port	Port of Bellingham
PSE	Puget Sound Energy
RAO	remedial action objective
RCW	Revised Code of Washington
RI/FS	Remedial Investigation/Feasibility Study
Site	Central Waterfront Site
SSC	Sanitary Services Company
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbon
TPH-D	TPH-diesel range
TPH-G	TPH-gasoline range
TPH-MO	TPH-motor oil range
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code

1 Introduction

This Cleanup Action Plan (CAP) describes the Cleanup Action selected by the Washington State Department of Ecology (Ecology) for the cleanup of contamination at the Central Waterfront Site (Site) in Bellingham, Washington. This CAP was developed using information presented in the *Final Remedial Investigation and Feasibility Study Report, Central Waterfront Site, Bellingham, Washington* (RI/FS; Anchor QEA 2018). This document has been prepared to satisfy the requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D Revised Code of Washington (RCW), administered by Ecology under the MTCA Cleanup Regulation, Chapter 173-340 Washington Administrative Code (WAC).

1.1 Site Description and Background

The Site encompasses approximately 51 acres of upland waterfront industrial property in Bellingham, Washington. The Site is bordered on the north by I&J Waterway, on the east by Roeder Avenue, on the south by Whatcom Waterway, and on the west by the former Aerated Stabilization Basin (ASB) and Bellingham Bay (Figure 1-1). The Site consists of upland areas. Adjacent intertidal and sediment areas are not included within the Site boundary, with the exception of sediment impacts in the nearshore area of Whatcom Waterway. Figure 1-2 shows the Site property ownership within the Site, including the Port of Bellingham (Port), Sanitary Services Company (SSC), Puget Sound Energy (PSE), and the State. The State also owns adjacent aquatic land in Whatcom and I&J Waterways that is managed by the Washington Department of Natural Resources (DNR). The City of Bellingham (City) has rights-of-way within the Site.

1.2 Purpose and Scope

This CAP was developed using information presented in the RI/FS. Ecology issued the draft RI/FS for public comment in September of 2017. The RI/FS was then revised to address public comments received, and approved by Ecology in March of 2018. The RI/FS summarized approximately 30 years of environmental investigations performed under Ecology direction to characterize the nature and extent of contamination at the Site. The RI/FS also screened cleanup technologies and evaluated different potential cleanup alternatives consistent with MTCA regulatory criteria.

The purpose of this CAP is to describe Ecology's Selected Cleanup Action for the Site, and consistent with MTCA (WAC 173-340-380) requirements, the following information is included herein:

- Summary of Site background and history, current and future land use, and current Site conditions (Section 2)
- Cleanup requirements applicable to the Site, including cleanup standards and other federal, state, and local laws applicable to the Cleanup Action (Section 3)

- Summary of the remedial alternatives considered and evaluated in the RI/FS (Section 4)
- Description of the Selected Cleanup Action and appropriate Institutional Controls (Section 5)
- Impacted media and contaminant types and quantities remaining on Site (Section 5)
- Rationale for selecting the Cleanup Action and preliminary determination for regulatory compliance of the Selected Cleanup Action (Section 5)
- Schedule for implementing the Cleanup Action (Section 6)

1.3 Coordination with Sediment Cleanup and Waterfront Development

The Site is situated between two ongoing sediment cleanup projects: the Whatcom Waterway and I&J Waterway sites. This CAP was developed to be compatible with the cleanup of these adjacent sediment sites and to prevent migration of upland contaminants into adjacent sediments following cleanup activities. In addition, this CAP was developed in parallel with ongoing land-use planning and development activities being performed by the Port and the City. A community vision of the future of the Bellingham waterfront is underway (referred to as the Waterfront District), and the Site plays a vital role in development opportunities to revitalize a working waterfront.

2 Site Background

This section describes background information relevant to the cleanup of the Site.

2.1 Site History

The following presents a general summary of the Site history; detailed information is available in the RI/FS (Anchor QEA 2018).

2.1.1 Dredging and Filling History

The Central Waterfront shoreline was initially created during early development of Whatcom Waterway and I&J Waterway. Early dredging activities in the Whatcom Waterway and I&J Waterway areas in the early 1900s included dredging of shallow channels, with side-casting of the dredged materials behind bulkheads for creation of shoreline fill areas. Additional localized dredging events were performed between 1961 and 1979.

The ASB, located to the west of the Site, was constructed in 1978 and 1979, along with installation of wastewater pipelines beneath Whatcom Waterway, and installation of an outfall line offshore of the ASB.

2.1.2 Historical Site Use and Operations

The Site has been used for industrial activities by multiple parties since the 1880s. Industrial operations conducted within the area include, but are not limited to, lumber mill, truck dispatching,

shallow-water marine area used for log rafting, boat maintenance and storage, bulk fuel terminals, foundry operations, coal storage and shipping, cement warehouse, electrical equipment operations, seafood distribution, fueling operations with underground storage tank (UST) use, municipal landfill, olivine rock processing plant, U.S. Naval Reserve, gravel hauling, PSE substation, disposal company, and warehousing.

The historical operations of the Site are presented for four general Site areas based on significant operations and geographic areas. Figure 2-1 shows the locations of associated historical operations, including the former Chevron Terminal, Colony Wharf, Roeder Avenue Landfill, and Olivine Uplands areas.

The former Chevron Terminal area is located within the southwest portion of the Site and was operated as a bulk fuel terminal from approximately 1913 until the late 1980s. The former terminal included two tank farms, a marine vessel loading dock with associated piping, three tanker truck loading racks, a rail loading rack, product storage warehouse and office, and facility piping and stormwater management features. Former terminal features, including aboveground storage tanks and loading racks, have been demolished and removed from the property.

The Colony Wharf area is located within the southeastern portion of the Site and, since the early 1900s, has been used for a variety of industrial activities. Historical land uses include sales of building products (coal, lime, cement, plaster, brick, and tile); steel casting company; foundry operations; truck garage; manufacture of cement products; boat repair and maintenance; machine shop and welding; fish and seafood distribution; and electrical equipment manufacture, sales, and repair. In addition, two USTs and an associated fuel dispenser were used at the property for gasoline storage and fueling.

Prior to 1965, the area of the site occupied by the Roeder Avenue Landfill consisted of a shallow-water marine area used for log rafting. In 1965, the Roeder Avenue landfill was constructed largely on Georgia-Pacific (GP)-owned property by first constructing a clay berm extending north-south between the Hilton Avenue and C Street areas, and then placing refuse and soil cover within the enclosed area. According to the City of Bellingham records (RETEC 1996, 1997), the berm was constructed of inexpensive clay overburden, on top of the tide flats between the Hilton Avenue bulkhead and the Chevron property. Between 1965 and 1974, the Roeder Avenue Landfill was operated as a disposal site for wood waste and other material from the GP mill and as the main disposal site for municipal refuse by the City.

The former Olivine Uplands area is located within the northern portions of the Site along Hilton Avenue, immediately north of the Roeder Avenue Landfill. Operations included lumber mill operations, truck fueling and equipment maintenance, and olivine ore and cement processing. In the

western portion of the area, a former bulk fuel terminal (former Time Oil) operated from approximately the early 1960s to the mid-1980s.

2.1.3 Environmental Investigations

Numerous environmental investigations have been performed at the Site since the mid-1980s as part of environmental activities at four previously independent sites: the former Chevron Terminal, Colony Wharf, former Olivine Uplands, and former Roeder Avenue Landfill. These four independent sites were consolidated into the Site in 2003, and subsequent environmental studies were performed on a site-wide basis.

The Site RI was initiated in 2007 and 2008 with supplemental RI activities completed from 2009 to 2016. Table 2-1 provides a listing and description of environmental investigations at the Site, including the study author and the party for which the study was prepared. The locations of Site investigation sampling are shown in Figure 2-2.

2.1.4 Previous Cleanup Actions

Cleanup actions have been performed in portions of the Site, including the following:

- Decommissioning of eleven USTs at seven locations between 1987 and 2003 (see Figure 2-1)
- Completion of remedial actions at the former Chevron Terminal to address petroleum-related contamination to prevent the migration to Bellingham Bay, including 1) soil bioremediation efforts between 1993 and 1994; 2) removal of contaminated soil and product accumulation in the southern corner of the site during 2001; and 3) an interim action in 2013 along the southwest shoreline to remove impacted soil and sediments, in the area where sheens had been observed, and creosote-treated pilings
- Construction in 2000 to 2001 of a 250,000-square-foot warehouse building by GP over the central portion of the former Roeder Avenue Landfill, in addition to grading, capping, and installation of a landfill gas control system beneath the warehouse
- Completion in 2016 to 2017 of the C Street Terminal project by the Port, including 1) rehabilitation of utilities and upland infrastructure; 2) enhancement of stormwater collection and treatment of the existing C Street waterfront terminal and adjacent right-of-way areas located at C Street and Maple Street; and 3) associated impacted soil removal and disposal
- Construction in 2016 of the 54,000-square-foot All American Marine building over the southeastern portion of the former Olivine Uplands area, in addition to grading, hardscape, landscape, installation of a landfill gas control system beneath the building, and associated impacted soil removal and disposal

In addition to these actions, cleanup work was implemented in parallel with Phase 1 of the Whatcom Waterway cleanup as described in Section 2.2.

2.2 Adjacent MTCA Cleanup Sites

The Port, with Ecology oversight, has initiated separate cleanup agreements for contaminated sediments located within the Whatcom Waterway and I&J Waterway sites, which bound the Site to the south and north, respectively.

The design and implementation of the cleanup of the Whatcom Waterway site is being performed in two cleanup phases, with two separate and independent construction projects, each addressing distinct areas of the site. Phase 1 of the Whatcom Waterway cleanup was performed from mid-2015 through mid-2016, and involved work along the southern Central Waterfront Site boundary, including in-water work performed to address Central Waterfront contaminants. That work included dredging and construction of engineered capping, shoreline stabilization, some structure demolition and removal, and bulkhead construction (steel sheet pile containment walls) that provided source control. The design of the Phase 2 construction project will address remaining Whatcom Waterway areas, by using a combination of dredging, capping, confined aquatic disposal, and institutional controls (ICs) to achieve cleanup levels. These activities may be performed in association with certain waterfront redevelopment activities.

A CAP has been developed for the I&J Waterway site. An Agreed Order requires the development of detailed design documents for the sediment removal work described in the CAP.

2.3 Current and Future Land Use

Land within the Site is owned by a variety of both public and private entities as shown in Figure 1-2. The majority of the parcels within the Site boundaries are owned by the Port. The City owns certain street rights-of-way and a small parcel adjacent to the electrical substation. The Port leases certain parcels to tenants for a variety of uses. Current tenant and private operations include boat maintenance and storage (Landings at Colony Wharf), electrical substation (PSE), refuse and recycling truck maintenance and storage (SSC), Technology Development Center for educational purposes (Bellingham Technical Institute) within the warehouse building, seafood processing (Bornstein Seafoods), boat storage and lift service (Hilton Harbor), concrete floats and shore-protection structures (Bellingham Marine Industries), ship manufacturing (All American Marine), and public trail and parking.

As part of land use planning, the Port and City completed the Waterfront District Sub-Area Plan (Port/City 2013), to include an area-wide rezoning from industrial to a mixed use Marine Trade designation (i.e., combination of commercial, industrial, and institutional mixed-uses). Key planning elements that affect the Site are described in RI/FS Section 3.6. The Waterfront District Sub-Area Plan is currently being updated and undergoing City of Bellingham and public review. Figure 2-3 presents the current draft area-wide zoning plan.

In addition, as part of the Waterfront District Sub-Area Plan's selected land use for the Whatcom Waterway site and in conjunction with Ecology, the ASB (located along the western boundary of the Site) and its impacted sediments will be dredged and removed. The ASB breakwater will then be opened, reconnecting the inner basin with the tidally influenced marine waters of the Bay. The ASB will be redeveloped as a new marina with integrated public shoreline access and habitat enhancements.

2.4 Site Subareas

During the RI/FS, the Site was divided into three subareas that have been identified as having soil, groundwater, sediment, and/or landfill gas and soil vapor contamination, based on evaluation of data obtained during the past 30 years of environmental investigations and cleanups. The three Site subareas are: Landfill and Perimeter subarea (including the former Roeder Avenue landfill and adjacent perimeter areas), C Street Properties subarea (including properties along the southern shoreline of the Site that previously included the former Chevron Terminal and Colony Wharf areas), and Hilton Avenue Properties subarea (including properties along the northern shoreline of the Site that previously included the former Olivine Uplands and former Time Oil fuel facility). Figure 2-4 shows the subarea boundaries.

2.5 Current Site Conditions

Current site conditions were described in the Conceptual Site Model, as part of RI/FS Section 6. Groundwater contaminants of concern (COCs) within the Landfill and Perimeter subarea were identified as metals, petroleum hydrocarbons (total petroleum hydrocarbon-gasoline range [TPH-G], TPH-diesel range [TPH-D], and TPH-motor oil range [TPH-MO]), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), benzene, and semivolatile organic compounds (SVOCs). Landfill refuse and soil contamination within the landfill boundary were delineated based on historical information and extensive test pitting and borings and are assumed to pose a threat to human health or the environment through direct contact. Landfill gas impacts and distribution covered the entire landfill footprint and areas adjacent to refuse (i.e., landfill perimeter). Landfill impacts are a source of contamination to groundwater outside of the Landfill footprint, particularly in the northern and southern landfill perimeters. Dissolved metals in groundwater (sourced at the Landfill) appeared to co-mingle with metals from historical operations within the C Street Properties subarea and have the potential to migrate from the vicinity of the shoreline to surface water. Therefore, the groundwater to surface water and sediment pathways were considered complete during the RI/FS evaluation. In addition, there is a potential for contaminant transport in groundwater to the ASB, when future conditions assume surface water receptors consistent with the marina development.

Petroleum hydrocarbons and associated constituents (TPH-G, TPH-D, and TPH-MO), benzene, PAHs, metals, VOCs in soil, soil gas, groundwater, sediment porewater, and sediment were identified as COCs within the C Street Properties subarea. Contaminated sediments in the adjacent Whatcom Waterway were remediated by dredging and capping completed during Phase 1 of the Whatcom Waterway cleanup (RI/FS Section 2.4). Although soil impacts are a source of contamination to groundwater and porewater, recent RI monitoring (i.e., in 2013 and 2016) indicated that groundwater contamination had generally not reached the southern shoreline of this subarea, except for a few locations where petroleum hydrocarbons and metals had exceedances in porewater and/or groundwater. Nearshore monitoring wells in the western portion of this subarea indicate migration of metals from groundwater to adjacent surface water/sediments is a potential pathway.

Petroleum hydrocarbons (TPH-G), metals (arsenic and lead), and PAHs in soil were identified as COCs within the Hilton Avenue Properties subarea. However, the soil impacts are not a source of contamination to groundwater, as monitoring over time has indicated empirically that soil contamination is not leaching to groundwater.

Table 2-2 provides a detailed summary of the principle RI/FS findings, including the nature and extent of contaminants, fate and transport, and current and future pathways and receptors for each subarea. Figure 2-4 depicts the extent of soil and groundwater contamination developed as part of the RI/FS.

3 Cleanup Action Requirements

Cleanup Action requirements must be met by the cleanup of the Site, consistent with MTCA, through the following:

- **Remedial Action Objectives (RAOs)**, which are specific goals to be achieved by the Cleanup Action and designed to adequately protect human health and the environment under a specific land use
- **Cleanup Standards**, which include both cleanup levels (chemical- and media-specific concentration of a contaminant that is protective of human health and the environment via all exposure pathways) and a point of compliance (the location where the cleanup level must be attained to achieve protectiveness) and are consistent with the current and anticipated future land use
- **Applicable or Relevant and Appropriate Requirements (ARARs)**, which are other regulatory requirements that apply to the Site's Cleanup Action

Site-related sediment contamination has been addressed by the cleanups at the Whatcom Waterway sediment site. As a result, cleanup requirements for the sediment areas of the Site are not addressed in this CAP.

3.1 Remedial Action Objectives

The RAOs for surface/subsurface soil, groundwater, landfill-associated gas, refuse, and soil gas considered the applicable exposure pathways for those media. Table 3-1 summarizes the RAOs by the various Site subareas.

Each RAO is achieved by meeting chemical- and media-specific cleanup standards (cleanup levels and points of compliance) that are based on the specific exposure pathways, and/or otherwise by preventing exposure through containment with associated engineering and/or ICs.

3.2 Cleanup Standards

The MTCA Cleanup Regulations (WAC Sections 173-340-720, -730, and -740) were followed to develop cleanup levels for groundwater, soil, and air for this Site, which are consistent with those applied across cleanup sites throughout Bellingham Bay. As such, established cleanup levels addressing potentially complete exposure pathways are compatible with the respective screening levels developed in RI/FS Section 4 and the determination of the nature and extent of contamination presented in RI/FS Section 6.

Tables 3-2, 3-3, and 3-4 present the cleanup levels for groundwater, soil, and air (soil vapor), respectively, consistent with the potentially complete exposure pathways identified in the Conceptual Site Model (RI/FS Section 6). Table 3-2 includes the most stringent of the groundwater cleanup levels based on protection of the adjacent marine environment (surface water and sediment) or vapor intrusion to existing, occupied, and future structures (indoor air) or outdoor ambient air on the Site. Table 3-3 includes the soil cleanup levels based on protection of groundwater for the Landfill Footprint and C Street Properties subareas) and based on protection of human direct contact (for the Hilton Avenue Properties subarea), for unrestricted land use. Table 3-4 includes the air (soil vapor) cleanup levels based on protection of indoor air and landfill gas (methane) pathways.

Compliance with groundwater cleanup standards also encompasses the MTCA requirement to remove soil with light non-aqueous phase liquid (LNAPL) (i.e., "free product") exceeding the residual saturation concentration. A site-specific soil TPH remediation level of 19,000 milligrams per kilogram (mg/kg) was derived as protective of the soil-to-groundwater pathway (protective of LNAPL accumulation) and is applicable exclusively to the C Street Properties subarea (RI/FS Appendix F).

Remediation of Site-related sediment contamination located within the Whatcom Waterway along the southern Site boundary was completed in 2015 in conjunction with the Whatcom Waterway Phase 1 cleanup action. The Phase 1 work is described in detail in the Whatcom Waterway EDR (Anchor QEA 2015). Completion of that cleanup has addressed all Site-associated sediments exceeding screening levels identified in the RI/FS.

3.3 Points of Compliance

3.3.1 Groundwater

The highest beneficial use of this Site's groundwater is discharge to marine water. Therefore, a groundwater point of compliance shall be established that is protective of the marine sediment (bioactive zone) and marine water column (Whatcom and I&J Waterways and Bellingham Bay).

Under MTCA (WAC 173-340-720(8)(b)), the standard groundwater point of compliance is throughout the Site (regardless of whether groundwater is potable or not). However, MTCA (WAC 173-340-720(8)(c)) states:

> Where it can be demonstrated under WAC 173-340-350 through 173-340-390 that it is not practicable to meet the cleanup level throughout the site (e.g., within the refuse) within a reasonable restoration timeframe, [Ecology] may approve a conditional point of compliance that shall be as close as practicable to the source of hazardous substances, and except as provided under (d) of this subsection, not to exceed the property boundary. Where a conditional point of compliance is proposed, the person responsible for undertaking the cleanup action shall demonstrate that all practicable methods of treatment be used in the site cleanup.

It is anticipated that it would not be practicable[1] (as demonstrated in the Disproportionate Cost Analysis [DCA] in RI/FS Section 10) to meet groundwater cleanup levels throughout the Site within a reasonable timeframe with a standard point of compliance. Due to the solid waste landfill present at this Site and the DCA, groundwater conditional points of compliance are defined at the landfill north and south perimeters—between the area of known contamination (Landfill footprint) and the shorelines.

A standard point of compliance applies throughout the C Street Properties subarea because it is anticipated that, with a reasonable restoration timeframe, groundwater concentrations will attain the cleanup levels.

For vapor intrusion protection of volatile groundwater contaminants, the groundwater point of compliance for the Site is set throughout the shallowest aquifer (Site Groundwater Unit; see RI/FS Section 3.2.1.5 and 3.3.1).

[1] Practicability is based on a determination that a more permanent cleanup action is not practicable based on the Disproportionate Cost Analysis in WAC 173-340-360(3)(e).

3.3.2 Soil

The standard soil points of compliance are established throughout the Site based on protection of groundwater and from vapors (from the ground surface to the uppermost groundwater saturated zone). However, for the direct-contact exposure pathway (i.e., throughout the Site from the ground surface to 15 feet below ground surface), the standard soil point of compliance is not applicable to this Cleanup Action because it is a containment-based remedy (i.e., capping), as described in Section 5. Per WAC 173-340-700(4)(c):

> Where a cleanup action involves containment of soils with hazardous substances above cleanup levels, the cleanup action may be determined to comply with cleanup standards provided the compliance monitoring program is designed to ensure the long-term integrity of the containment system, and the other requirements for containment in this chapter are met.

ICs will be used to limit or prohibit activities that may interfere with the integrity of the containment system and provide inspection and maintenance of the site-wide cap to assure the continued protection of both human health and the environment.

3.3.3 Air (Soil Vapor)

The standard air point of compliance under MTCA (WAC 173-340-750(6)) is defined as ambient air throughout the Site, whether indoors or outdoors. It is assumed that, given the range of current and potential future land uses, air (soil vapor) hazards at the Site are primarily associated with enclosed spaces (e.g., buildings). Therefore, engineering controls such as under-building venting systems have been incorporated in the Cleanup Action, including passive venting for methane gas associated with the Landfill footprint and Perimeter subarea and vapor intrusion controls for VOCs/TPH soil gases associated with the C Street Properties subarea. The need for engineering controls to prevent vapor intrusion into existing buildings will be evaluated during remedial design. The need for engineering controls to prevent vapor intrusion into future buildings will be evaluated during design of those buildings. In addition, ICs requiring the use of these engineering controls will also be used, when necessary, to limit or prohibit activities that may interfere with the integrity of the Cleanup Action.

3.4 Applicable, Relevant, and Appropriate Requirements

WAC 173-340-710 provides that MTCA cleanup actions must comply with applicable local, state, and federal laws (ARARs), in addition to environmental standards. It is anticipated that the Cleanup Action will be conducted under a Consent Decree (CD) entered into by Ecology, the Port, and potentially other PLPs. In performing the Cleanup Action under a CD, the Cleanup Action would be exempt from the procedural requirements of RCW 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58, and of any laws requiring or authorizing local government permits or approvals (see WAC 173-340-710(9)(b)).

However, the Cleanup Action must still comply with the substantive requirements of such permits or approvals (WAC 173-340-710(9)(c)).

The applicable ARARs to this Site (chemical-, location-, and action-specific), as well as local and state requirements identified as applicable but procedurally exempt for cleanup actions at the Site, are described in RI/FS Section 7.2. Additional permits, approvals, and substantive requirements may be further identified during remedial design, and their approval shall reflect Ecology's determination on which ones apply and may be listed as an exhibit to the CD.

4 Remedial Alternatives Considered in the RI/FS

In the RI/FS, six remedial alternatives were developed to provide a range of remedial scopes with the objective of protecting human health and the environment; these alternatives were evaluated with respect to criteria defined by MTCA (RI/FS Sections 9 and 10). Figures 4-1 through 4-6 depict the cleanup action elements for each of the six remedial alternatives considered, as summarized below:

- **Alternative A.** This alternative primarily relies on capping, groundwater monitored natural attenuation (MNA), clay berm/ASB physical diversion wall on the western boundary of the Landfill footprint subarea, contingent targeted groundwater treatment on the southeastern boundary of the C Street Properties subarea, engineering controls for vapor intrusion/landfill gas, ICs, and a hotspot soil removal in the C Street Properties subarea.
- **Alternative B.** In addition to the elements of Alternative A, Alternative B includes targeted shoreline groundwater treatment in the C Street Properties subarea.
- **Alternative C.** In addition to the elements of Alternative A, Alternative C includes targeted shoreline groundwater treatment in the Landfill footprint and the C Street Properties subareas.
- **Alternative D.** In addition to the elements of Alternative C, Alternative D includes in situ soil and groundwater treatment in the C Street Properties subarea.
- **Alternative E.** In addition to the elements of Alternative B, Alternative E includes in situ soil and groundwater treatment in the C Street Properties subarea, and a groundwater barrier wall at the downgradient boundary of the Landfill footprint subarea.
- **Alternative F.** This alternative includes full excavation, transport, and off-site disposal of contaminated soils and refuse in the three subareas, including the hotspot in the C Street Properties subarea.

In addition, the above six remedial alternatives included common scope elements such as mobilization/demobilization, groundwater compliance monitoring, institutional controls, and previously completed and ongoing interim remedial actions and cleanups at the Site (i.e., Chevron Area Interim Action, All American Marine Building Interim Action, C Street Terminal Interim Action, and Whatcom Waterway Phase 1 cleanup action; see RI/FS Section 9.1.5).

Table 4-1 summarizes the total costs for each alternative, including costs by subarea. The total cost for each alternative includes approximately $9.9 million of spent costs, related to previously completed or ongoing interim actions or cleanups (listed above).

The remedial alternatives were developed to be independent of other Site-specific redevelopment and interim remedial actions, but they were designed to be compatible with these actions (RI/FS Section 9.1).

5 The Selected Cleanup Action

5.1 Description of the Selected Cleanup Action

Alternative A was identified in the RI/FS Section 10 as the remedial alternative that is permanent to the maximum extent practicable for the Site and is, therefore, the Selected Cleanup Action. The Selected Cleanup Action consists of the following cleanup action elements (Figure 5-1):

- Previously completed and ongoing interim remedial actions and cleanups at the Site (i.e., Chevron Area Interim Action, All American Marine Building Interim Action, C Street Terminal Interim Action, and work performed in conjunction with the Whatcom Waterway Phase 1 cleanup action, referred to as "spent costs" of approximately $9.9 million).

- **Hotspot soil removal in the C Street Properties subarea.** Soils exceeding the TPH remediation level of 19,000 mg/kg will be removed, transported, and disposed of off site. The hotspot was delineated in the RI/FS with an estimated in-place volume of 1,000 cubic yards (cy).

- **Reduced-permeability caps in the Landfill footprint and in the C Street Properties subareas.** Reduced-permeability caps will limit infiltration of surface water and mobility of contaminants into groundwater and will prevent direct contact and erosion in these subareas. Capping will consist of a combination of existing asphalt pavement, concrete building foundations, new buildings and pavement, and/or new soil covers. Existing surface conditions in the Landfill footprint subarea and the southwestern portion of the C Street Properties subarea are expected to limit infiltration sufficiently to meet the requirements of a reduced-permeability cap (RI/FS Section 9.3). Under the Selected Cleanup Action, a physical barrier (e.g. soil/gravel and/or hard surface) is needed to supplement existing graveled areas to address the soil pathway for direct contact and erosion of soils.

  The physical barrier will be evaluated during remedial design and may consist of either a hard surface (e.g., asphalt paving) or soil/gravel cap. New hard surfaces will be composed of a minimum 3 inches of concrete/asphalt or building foundations, and their design will need to

incorporate applicable stormwater collection and control systems. A soil/gravel cap will consist of a 2-foot cap with a marker/separation layer, to be placed on the contaminated areas that currently have a soil/gravel surface (a minimum of 24 inches of uncontaminated soil and/or gravel). The actual environmental cap will be determined during the design process and may consist of a combination of soil/gravel and/or hard surfaces. Site grading will be designed to maintain the required remediation performance standards and will be integrated with current Site conditions and drainage.

Future development at the Site has the potential to encounter different contaminants with varying degrees of impact, depending on the project location. Because of this variability, each future development project will need to be evaluated on a case-by-case basis to determine the appropriate management of any contaminated materials that may be encountered.

An environmental covenant will be established to prevent disturbance of the cap and to restrict certain future activities to be consistent with the CAP.

- **Physical barrier cap in the Hilton Avenue Properties subarea.** A physical barrier cap in this subarea will address the soil pathway for direct contact and erosion of surface and subsurface contaminated soils, because infiltration reduction is not required. Under the Selected Cleanup Action, the physical barrier will be evaluated during remedial design and may consist of a hard surface (e.g., asphalt paving) or soil/gravel cap. New hard surfaces will be composed of a minimum 3 inches of concrete/asphalt or building foundations, and their design will need to incorporate applicable stormwater collection and control systems. A soil/gravel cap will consist of a 2-foot soil/gravel cap (consisting of a minimum 24 inches of uncontaminated soil and/or gravel with a marker/separation layer). The physical barrier will be placed on the contaminated areas that currently have a soil/gravel surface. The actual environmental cap will be determined during the design process and may consist of a combination of soil/gravel and/or hard surfaces.
- **Clay berm/ASB groundwater diversion wall on the western boundary of the Landfill footprint subarea.** As described in RI/FS Section 8.4, the clay berm is currently performing as an effective "hanging" low-permeability physical diversion wall down to the native layer, not only containing groundwater within the Landfill subarea, but also diverting it and increasing its flow path and travel time prior to discharging to adjacent surface water. Also, under current conditions, the ASB water level is about a half-foot higher than the adjacent groundwater elevation of the landfill and creates a relatively flat groundwater gradient and area of stagnation.

  As described in RI/FS Section 3.6, the Whatcom Waterway cleanup and plans include the development of a marina within the current ASB footprint. This action would result in

groundwater flow and associated potential contaminant transport from the landfill toward the future tidally influenced marina. Under this potential future scenario, surface water receptors would potentially be affected. The timeline for the marina development is currently unknown. However, if the marina development occurs, monitoring of shallow groundwater and intertidal porewater would be required to evaluate groundwater flow and contaminant transport from the landfill into the marina. Results from this monitoring would be the basis to inform the decision of whether a treatment action in the western shoreline of the landfill is necessary.

- **Groundwater MNA.** As described in the RI/FS Section 8.5.1, MNA relies on natural processes (physical, chemical, or biological) that can lead to the reduction of mass, toxicity, mobility, volume, or concentration of organic contaminants in soil or groundwater. MNA will be applied in the C Street Properties subarea through performance sampling to address residual contamination in groundwater that exceeds applicable groundwater cleanup levels (in conjunction with the clay berm/ASB physical diversion wall). Based on RI/FS Section 6, the COCs that currently exceed cleanup levels in groundwater are metals (including arsenic, cadmium, copper, chromium, lead, mercury, nickel, zinc, and manganese); benzene, toluene, ethylbenzene, and xylenes (BTEX); carcinogenic polycyclic aromatic hydrocarbons (cPAHs); and TPH compounds. However, as demonstrated in the RI/FS Appendix H, natural attenuation is effectively reducing concentrations of these groundwater COCs in each of the subareas.

  Targeted contingent actions will be considered for implementation if MNA fails to restore groundwater quality below required cleanup levels within a reasonable restoration timeframe and is determined not to be protective of human health and the environment. Targeted contingent actions could include in situ treatment or downgradient groundwater treatment and/or control. Design of a contingent action would be conducted if potential failure of MNA is demonstrated by groundwater compliance monitoring results, at which time substantial additional information would be available to determine the causes of failure and, therefore, the most effective and practicable means to remedy it.

- **Engineering controls.** The need for engineering controls will be evaluated for existing and future buildings to prevent exposure to soil vapors and landfill gas through indoor inhalation. The remedial design will include pre-remedial design investigation activities to determine the need for engineering controls at existing and occupied buildings. The need for engineering controls to prevent vapor intrusion into future buildings will be evaluated during design of those buildings. Engineering controls may consist of vapor intrusion control systems for VOCs and TPH in soil vapor and groundwater (in the C Street Properties subarea), and a landfill gas collection system for methane (in the Landfill footprint). The type of system would be selected based on building specifics, including its current and future use.

- **Appropriate ICs.** The Port and Ecology will develop an Institutional Controls Plan (ICP) for the Site that includes environmental covenants in accordance with WAC 173-340-440 and RCW 64.70. ICs will include the following:
  - Fences and warning signs to limit access to the Site or specific areas on the Site
  - Deed restrictions (restrictive environmental covenants) addressing land use and soil excavation
  - Notification regarding the presence of residual contaminated materials and regulation of the disturbance/management of those materials and any of the cleanup action components
  - Requirements for groundwater and intertidal porewater monitoring to evaluate groundwater flow and contaminant transport from the landfill into the marina if the ASB is breached. Results from this monitoring would be the basis to inform the decision of whether a treatment action in the western shoreline of the landfill is necessary.
  - Prohibition on extracting groundwater and its preclusion for consumptive use
  - Restrictions to prevent disturbance of caps without Ecology approval
  - Engineered controls evaluation in future buildings to address potential landfill gas or vapor intrusion
  - Provision for long-term inspection and maintenance of cleanup actions including long-term monitoring and maintenance, and inspection of the containment wall previously installed in conjunction with the Whatcom Waterway Phase 1 cleanup action
  - Prohibition of conveyance of any interest in any portion of the Site without providing for the continued adequate and complete operation maintenance and monitoring of remedial actions and continued compliance with the restrictive covenant
  - Restriction to lease any portion of the Site to uses and activities consistent with the restrictive covenant and notification of all lessees of the restrictions on the use of the Site
  - Specific worker protection standards applicable to specific areas of the Site
  - Identification of responsibilities for IC implementation

A Compliance Monitoring Plan (CMP) will be developed during remedial design to describe the long-term monitoring program of the Cleanup Action. It will be implemented to evaluate the performance of MNA, hotspot removal, and engineering controls to verify the attainment of the groundwater, soil, and air (soil vapor) cleanup standards defined in the CAP. Therefore, the CMP will consist of the following:

1) A groundwater monitoring program, which will include location of monitoring wells (shallow wells most likely distributed in the Landfill Perimeters and in the C Street Properties subarea and shoreline, and deep wells along the Landfill shoreline), monitoring frequency, location-specific monitoring analytes, and analytical methods)

2) A soil confirmation sampling program, which will include location and depth of soil samples, analytes, and analytical methods)

3) An indoor air monitoring program, which will include both existing and future occupied buildings. Future buildings will follow construction quality assurance monitoring (to be conducted during installation of an engineered control), indoor air monitoring (to be done prior to occupancy and during normal operation to screen for potential accumulations of gases in the building), and vent monitoring (to evaluate gas conditions below concrete slabs, confirming the mitigation system performance).

In addition, protection monitoring will be described in the CMP to ensure worker health and safety during implementation of the Cleanup Action.

A contingent targeted groundwater treatment on the southeastern portion of the C Street Properties subarea was included in RI/FS Alternative A (RI/FS Section 9.3) to prevent metal-contaminated groundwater from migrating into surface water and sediments. However, based on groundwater monitoring conducted during wet and dry seasons (summer and winter of 2016, and summer of 2017) the results demonstrated a contingent action is not needed as part of the Selected Cleanup Action described in this CAP (see Appendix A for a summary of the groundwater monitoring results) because the groundwater to surface water pathway in this area is not complete.

In addition, sampling and analysis of a white sandy, fine-grained material in the area of the former Olivine operations was conducted at Ecology's request in March 2018. This material was originally exposed in surface soils (the upper 1 foot) in the I&J Waterway shoreline due to bank erosion at the end of the east bulkhead adjacent to the former Olivine Uplands (within the Hilton Avenue subarea). However, based on the analytical results, the need for potential targeted removal and capping of this material is not warranted nor included in the Selected Cleanup Action described in this CAP. Appendix B compares the analytical results for this material with the cleanup levels and demonstrates the material is not impacted.

The Selected Cleanup Action will comply with WAC 173-340-360. It will be protective of human health and the environment and provide for compliance monitoring. The soil is anticipated to comply with cleanup standards upon completion of remedy design and construction (estimated at 1 to 2 years) and the groundwater is anticipated to comply with groundwater cleanup standards throughout the Site between 20 and 25 years. The total estimated cost for the Selected Cleanup Action is $13.2 million.[2]

[2] The total cost for the Selected Cleanup Action ($13.2 million) differs from the total cost of Alternative A in the RI/FS ($13.5 million) because the contingent targeted groundwater treatment on the southeastern portion of the C Street Properties subarea was excluded in this CAP, per Section 5.1 and Appendix A. The total cost for the Selected Cleanup Action includes $9.9 million of spent

5.2 Impacted Media Remaining on Site

Following implementation of the Selected Cleanup Action (Figure 5-1), and subject to final engineering design and permitting, the following impacted media will remain on Site:

- **Hilton Avenue Properties Subarea.** An estimated 11,200 cy of contaminated surface/subsurface soils with metals (lead and arsenic), BTEX, TPH-G, and cPAHs will remain in the Hilton Avenue Properties Subarea (based on an average contamination depth of 9 feet). These contaminated soils will be capped with a physical barrier that will address the soil pathways for direct contact and erosion. This cap will be subject to long-term maintenance and monitoring requirements, to be specified in the CMP. This capped area will also be addressed in the restrictive covenants to be filed following completion of the Cleanup Action.

- **Landfill Footprint Subarea.** An estimated 725,300 cy of refuse, surface/subsurface soils, and groundwater contaminated with metals, cPAHs, TPH, BTEX, and naphthalene will remain in the Landfill Footprint Subarea (based on an average contamination depth of 23 feet). Refuse and contaminated soils will be capped with a reduced-permeability cap that will control and reduce infiltration and migration of dissolved contaminants into groundwater, toward the Landfill Perimeter areas, the clay berm, and the C Street Properties subarea. This cap will be subject to long-term maintenance and monitoring requirements, to be specified in the CMP. This capped area will also be managed through restrictive covenants to be recorded following completion of the Cleanup Action.

  In addition, landfill gas (e.g., methane) will remain present within the landfill refuse boundary, and will be addressed with a landfill gas evaluation to determine the need for an engineered collection system to be constructed beneath existing and future buildings to prevent inhalation. All existing and future landfill gas collection systems will be subject to long-term monitoring requirements, to be specified in the CMP.

- **C Street Properties Subarea.** An estimated 76,100 cy of surface/subsurface soils and groundwater contaminated with metals, cPAHs, TPH, BTEX, and naphthalene will remain in the C Street Properties Subarea (based on an average contamination depth of 7.5 feet). These contaminated soils will be capped with a reduced-permeability cap that will control and reduce infiltration and migration of dissolved contaminants into groundwater, toward the western shoreline of the C Street Properties subarea. This cap will be subject to long-term maintenance and monitoring requirements, to be specified in the CMP. This capped area will

costs, related to previously completed or ongoing interim actions or cleanups (i.e., Chevron Area Interim Action, All American Marine Building Interim Action, C Street Terminal Interim Action, and Whatcom Waterway Phase 1 Cleanup Action; see RI/FS Section 9.1.5).

also be addressed in the restrictive covenants to be filed following completion of the Cleanup Action.

In addition, VOCs and TPH in soil vapor will remain present within the C Street Properties subarea, and will be addressed with vapor intrusion evaluation to determine the need for engineered control systems, to be constructed beneath existing and future buildings, to prevent exposure through indoor inhalation. An engineering control will be subject to long-term monitoring requirements, to be specified in the CMP.

5.3 Rationale for Selecting the Cleanup Action

Per RI/FS Section 10, a comparative evaluation of the six remedial alternatives was performed within the framework of MTCA requirements, in accordance with WAC 173-340-360, as follows:

- Threshold requirements (WAC 173-340-360(2)(a)):
  - Protect human health and the environment
  - Comply with cleanup standards
  - Comply with applicable state and federal laws
  - Provide for compliance monitoring
- Other requirements (WAC 173-340-360(2)(b)):
  - Use permanent solutions to the maximum extent practicable
  - Provide for a reasonable restoration timeframe
  - Consider public concerns

It was determined that all six remedial alternatives developed in the RI/FS met the threshold requirements. Estimated restoration timeframes ranged from 20 to 25 years for Alternatives A, B, and C; 10 years for Alternative D; 5 years for Alternative E; and 2 to 3 years for Alternative D. These restoration timeframes were determined to be reasonable (Table 5-1).

Consideration of public concerns is an inherent part of the cleanup process under MTCA. The RI/FS report was issued for public review and comment in September of 2017. The RI/FS was then revised based on the public comments received and approved by Ecology in March of 2018.

A DCA was conducted to assess the extent to which the remedial alternatives would use permanent solutions to the maximum extent practicable. The DCA quantified the environmental benefits of each alternative, and then compared them to its total costs. Costs are disproportionate to benefits if the incremental costs of a more permanent remedial alternative are greater than the incremental degree of environmental benefits achieved by that alternative over that of lower cost remedial alternatives (WAC 173-340-360(3)(e)(i)). Based on the results of the DCA (Table 5-2 and Figure 5-2), Alternative A was determined to be the most cost-effective and, therefore, met the definition of permanent to the maximum extent practicable under MTCA. Additional details on the DCA evaluation criteria,

weightings, and overall environmental benefits and costs for the remedial alternatives evaluated are included in RI/FS Section 10.

Consistent with MTCA remedy selection criteria (WAC 173-340-360), Ecology concludes that Alternative A accomplishes the following:

- Complies with MTCA cleanup standards and with other applicable regulatory requirements
- Achieves human health and environmental protection in a reasonable timeframe (20 to 25 years), compared with the range of alternatives evaluated, and to the extent practicable with respect to groundwater restoration
- Improves the overall environmental quality by reducing the long-term risks over time
- Reduces the volume and mobility of impacted media and COCs in the environment
- Provides long-term effectiveness by eliminating a source of COCs (hotspot soil removal) in the C Street Properties subarea and by effectively reducing groundwater contamination through the clay berm and ASB groundwater diversion wall. Long-term effectiveness for the Cleanup Action is dependent on groundwater and cap compliance monitoring, and ICs will remain in place to ensure reliability and effectiveness of management of any residual risks.
- Has minimal and easily manageable short-term construction risks (associated with capping and hotspot soil removal), compared with the range of alternatives evaluated
- Is easily implementable, with low technical challenges associated with extensive capping in the three subareas and the hotspot removal, and some administrative challenges related to the effective implementation of ICs, if parcels are sold
- Considers and addresses public concerns
- Is cost-effective, relative to the range of alternatives evaluated
- Includes long-term monitoring and ICs that will be defined in the CMP and ICP to ensure long-term effectiveness in accordance with WAC 173-340-400 and 173-340-410
- Is protective under the current industrial land uses for which the property is zoned, but it is also compatible with ongoing land-use planning and future development activities being performed by the Port and the City
- Provides source control by preventing migration of upland contaminants into adjacent sediments following cleanup of the adjacent sediment sites (Whatcom Waterway and I&J Waterway)

6 Next Steps for Cleanup Implementation

A schedule of design deliverables is included as an exhibit to the Agreed Order. Implementation of the cleanup action will be conducted under a future amendment to the Agreed Order, or a future

Consent Decree. The anticipated deliverables and milestones for design and implementation of the cleanup action are listed below:

- Complete pre-remedial design investigation and then design of the Cleanup Action construction components (i.e., reduced-permeability cap, physical barrier cap, landfill gas collection systems for existing and occupied buildings in the Landfill and Perimeter Subarea, TPH-impacted hot spot soil removal in the C Street Properties subarea)
- Complete hotspot soil removal from the C Street Properties subarea and initiate reduced-permeability and physical barrier capping
- Develop a CMP that includes monitoring requirements for groundwater, indoor air, and capping
- Develop and initiate implementation of an ICP

Groundwater MNA compliance monitoring will continue until groundwater cleanup levels are achieved throughout the Site. The RI/FS estimated that it may take up to 25 years, with the limiting factor being groundwater natural attenuation in the Landfill Footprint and C Street Properties subareas.

7 References

Anchor QEA (Anchor QEA, LLC), 2015. *Final Engineering Design Report, Whatcom Waterway Cleanup in Phase 1 Site Areas*. Prepared for the Port of Bellingham. February 2015.

Anchor QEA, 2018. *Final Remedial Investigation and Feasibility Study Report, Central Waterfront Site, Bellingham, Washington*. Prepared for Ecology on behalf of the Port of Bellingham. March 2018.

Port/City (Port of Bellingham/City of Bellingham), 2013. *The Waterfront District Sub-Area Plan*.

RETEC, 1996. *Feasibility Analysis for the Roeder Avenue Warehouse Project: Phase 1 – Framework for Decision-Making*. Prepared for Port of Bellingham. Seattle, WA: Remediation Technologies.

RETEC, 1997. *Pre-Design Testing Report for the Roeder Avenue Warehouse Project.* Prepared for Port of Bellingham. Seattle, WA: Remediation Technologies.

Tables

Table 2-1
Summary of Environmental Studies for the Central Waterfront Site

Site Area/Study	Date	Author	Well Logs	Description/Comments
Central Waterfront Site-wide				
Historical Ground Water Monitoring Data Analysis: Bellingham Bay Central Waterfront Site	12/2/2003	Ecology	No	Washington State Department of Ecology Technical Memorandum - groundwater data analysis
Central Waterfront Agreed Order	9/26/2006	Ecology	No	Agreed Order
Central Waterfront RI/FS Work Plan-DRAFT	3/9/2007	RETEC	No	Draft RI/FS Work Plan
Central Waterfront RI/FS Work Plan Addendum	7/17/2007	ENSR/AECOM	No	Work Plan Addendum
Draft RI/FS for the Central Waterfront Site	8/2009	AECOM	Yes	Draft AECOM RI/FS report submittal to Ecology
Quality Assurance Evaluation of Central Waterfront RI/FS	1/16/2012	AECOM	No	Quality assurance review of RI/FS following cost error findings in spreadsheets
Central Waterfront Agreed Order Amendment	7/12/2012	Ecology	No	Agreed Order amendment for Chevron area interim action
RI/FS Work Plan Addendum No. 2 for the Central Waterfront Site	04/13/12	AECOM	No	Work Plan Addendum for beach test pits and borings to investigate sheen and scope Chevron area interim action
Technical Memorandum for Central Waterfront RI/FS Work Plan Addendum No. 2	8/30/2012	AECOM	Yes	Technical Memorandum presenting results of beach investigation performed in accordance with RI/FS Work Plan Addendum No. 2
RI/FS Work Plan Addendum No. 3 for the Central Waterfront Site	July 2012	Anchor QEA	No	Work Plan Addendum for Supplemental Shoreline Investigation
Interim Action Work Plan, Central Waterfront Site, Chevron Subarea	9/27/2012	Anchor QEA	No	Interim Action Work Plan to excavate and remove NAPL petroleum and petroleum-impacted soil and sediments from the Chevron subarea beach to prevent petroleum sheen on Whatcom Waterway
Supplemental Central Waterfront Shoreline Investigation Work Plan Addendum No. 4	10/19/2012	Anchor QEA	No	Work Plan for Central Waterfront Shoreline Geotechnical Investigation
Central Waterfront RI/FS Work Plan Addendum No. 5	10/23/2012	Anchor QEA	No	Technical Memorandum providing technical support for use of silica gel cleanup before determining diesel range TPH concentrations in site soil and groundwater
Whatcom Waterway Engineering Design Report	Feb 2013	Anchor QEA	No	Design report for Whatcom Waterway that includes Central Waterfront Investigations
Central Waterfront Supplemental Investigation	Feb 2013	Anchor QEA	No	Appendix H to the Whatcom Waterway Engineering Design Report. Presents results of July 2012 supplemental investigation at Central Waterfront.

Table 2-1
Summary of Environmental Studies for the Central Waterfront Site

Site Area/Study	Date	Author	Well Logs	Description/Comments
Results of Additional Geotechnical and Environmental Testing Along the Central Waterfront Site	Feb 2013	Anchor QEA	No	Appendix M to the Whatcom Waterway Engineering Design Report. Presents results of July 2012 supplemental investigation at Central Waterfront.
Completion Report, Central Waterfront Site, Chevron Subarea Interim Action	6/5/2013	Anchor QEA	No	Completion Report documenting Chevron beach area interim action activities and completion
Central Waterfront RI/FS Work Plan Addendum No. 6	10/1/2013	Anchor QEA	No	Work Plan Addendum for Data Gaps Investigation to support the Draft RI
Central Waterfront RI/FS Work Plan Addendum No. 7	7/8/2016	Anchor QEA	No	Supplemental Draft RI Work Plan to support compliance monitoring (groundwater, porewater, seep) within C Street Properties subarea.
Central Waterfront RI/FS Work Plan Addendum No. 8	11/10/2016	Anchor QEA	No	Supplemental Draft RI Work Plan to support compliance monitoring (groundwater, porewater, seep) within C Street Properties subarea.
Former Chevron Terminal Area				
Report of Geotechnical Services – Diesel Fuel Leak	12/16/1986	GeoEngineers	Yes	Reports site conditions and recovery system construction/monitoring. Completion of 5 borings and monitoring wells (MW-1 to MW-7). Well construction table for shallow wells installed by hand auger.
Subsurface Explorations and Testing	3/18/1987	GeoEngineers	Yes	Subsurface testing including monitoring well installation and 18 borings, including 9 hand auger and 9 truck mount. 18 monitoring wells installed (MW-8 to MW-25).
Subsurface Contamination Investigation	1988	GeoEngineers	Yes	Subsurface testing including monitoring well installation
Phase-Separated Hydrocarbon Recovery Operations And Subsurface Exploration	9/1989	Thorne Environmental	Yes	Subsurface testing including monitoring well installation and product recovery testing. Installed 10 monitoring wells and completed 5 soil borings for sampling (MW-33 to MW-42 and B-1 to B-5). Two samples analyzed for PCBs (B-2, B-5) at non-detect concentrations (Aroclors).
Results of Biotreatability Investigation: Proposed In-Situ Bioremedial Soil and Water Cleanup	1/17/1990	Thorne Environmental	No	Biotreatability testing results
Comprehensive Soil and Groundwater Remediation Plan Volume 1	6/12/1990	Thorne Environmental	Yes	Summary of previous environmental work and site conditions. Includes MW-26 to MW-32 and MW-42 to MW-45 well logs.
Comprehensive Soil and Groundwater Remediation Plan Volume 2	6/12/1990	Thorne Environmental	No	Summary of remedial activities including excavation, on-site biotreatment, product recovery, and monitoring
Status Update: July 1990	8/20/1990	Thorne Environmental	No	Groundwater and product monitoring/recovery
Status Update: August 1990	9/12/1990	Thorne Environmental	No	Groundwater and product monitoring/recovery

Table 2-1
Summary of Environmental Studies for the Central Waterfront Site

Site Area/Study	Date	Author	Well Logs	Description/Comments
Early Notice Letter - Port of Bellingham/ Chevron	1/17/1991	Ecology	No	Ecology early notice letter
Surface Soil Sampling Activities and Analytical Results	1/28/1991	Thorne Environmental	No	Dock and South Tank area surface soil sampling results (locations DAS-1 to DAS-5). Investigation initiated from heavy equipment storage and maintenance.
Draft - Excavation and Biotreatment Cell Construction/Operation Specifications	3/1991	Thorne Environmental	Yes	Summary of excavation and biotreatment activities
Seawall Investigation and Recommendations	6/28/1991	Applied Geotechnology	Yes	Test pit investigation along Whatcom Waterway. Logs for test pits TP-3 and TP-4 and observations of hydrocarbon contamination.
Plan for Importing Soil	7/11/1991	Applied Geotechnology	No	Soil excavation and backfill
Draft - Site Investigations - June and September 1991	6/1/1992	Applied Geotechnology	Yes	Soil investigation including test pits and hand augers. 38 test pits and 5 hand augers completed. Analytical results for test pits TP-23 to TP-38 and HA-1 to HA-5. Test pit logs for all test pits - includes hydrocarbon observations at those locations where samples were not analyzed.
Proposed Plan of Action - Site Restoration	10/7/1993	Applied Geotechnology	No	Summary of treated soil reuse options
Draft - Site History	11/16/1993	Applied Geotechnology	No	Summary of history to date - 1993
Limited Geotechnical Engineering Evaluation	6/22/1995	AGRA Earth & Environmental	Yes	Geotech engineering evaluation re: excavation backfill (logs for MW-5A, MW-6A, MW-8A, MW-10A, and MW-12A available)
Additional Site Assessment and Project Status Update	6/28/1995	AGRA Earth & Environmental	Yes	Review of previous environmental work (investigation/cleanup), identification of data gaps, and additional investigation work. Installed MW-1A to MW-12A monitoring wells with analytical results - TPH, BTEX, and PAH-soil and groundwater.
Summary of Backfill and Leveling Operations	1/8/1996	AGRA Earth & Environmental	No	Excavation backfill summary
Spill at Property located at 1020 C Street	8/20/1997	Ecology	No	Response to spill observed in Bellingham Bay. Includes checklist and reporting information.
Response Activities - Soil Probe Investigation	9/3/1997	Pacific Environmental Group	Yes	Test pit and temporary probe borings to investigate "oil seep" at shoreline. 32 temporary soil probes completed (P-1 to P-19 and SP-1 to SP-13). No analytical sampling - only observations. Installed 4 temporary 1-inch casings at P-14, P-17, P-19, and SP-3 to observe product accumulation.

Table 2-1
Summary of Environmental Studies for the Central Waterfront Site

Site Area/Study	Date	Author	Well Logs	Description/Comments
Dual Vacuum Extraction/Entrainment Extraction Pilot Study	10/31/1997	Terra Vac	Yes	Pilot for product recovery. Installation of wells N-1 to N-2; no analytical sampling - only product recovery testing.
Letter of October 9, 1997 - Prep for Ecology site hazard assessment	11/14/1997	Chevron	No	Chevron letter to Ecology summarizing site in preparation for Ecology site hazard assessment. Includes history and description of site. Includes selected data from previous investigations.
Monitoring Well Installation Report	1/20/1999	Gettler-Ryan	Yes	Monitoring well installation. MW-50 to MW-62. Includes soil sampling results.
Monitoring Well Installation Report	1/27/1999	Chevron	Yes	As above with full appendices - analytical data reports
Preliminary Estimate of Remediation Costs for the Chevron Terminal Property	5/31/2000	RETEC	No	Draft letter report - site background and cleanup options/costs
Site Hazard Score Worksheets	6/15/2000	Ecology	No	Ecology site hazard index score information
Site Conceptual Model Report	10/27/2000	RRM Engineering	Yes	Summary of site history, investigations, and remediation activities. Includes good collection of well logs.
Environmental Remediation Activities	3/28/2002	KHM Environmental	No	Excavation description for shoreline "seep" area
Request for Review: Independent Remedial Action	2/26/2002	Ecology	No	Voluntary Cleanup Program application
Environmental Investigation Work Plan	7/2002	KHM Environmental	No	Work Plan for RI activities
Groundwater Monitoring Report - Event of November 3, 4, 5, and 6, 2003	1/19/2004	Gettler-Ryan	No	Groundwater monitoring report - November 2003 sampling. Includes analytical report.
Colony Wharf Area / Bellingham Marine Industries				
Phase 1 Environmental Site Assessment	5/24/1990	GeoEngineers	No	Phase 1 assessment
Phase 2 Environmental Site Assessment	3/18/1992	GeoEngineers	Yes	Phase 2 investigation report. Analytical results for soil and groundwater (MW-1 to MW-12).
Phase 3 Environmental Site Assessment	7/7/1992	GeoEngineers	Yes	Phase 3 investigation report. Analytical results for soil and groundwater (MW-13 to MW-19 and B-1 to B-3, and C-1 to C-2).
Site Environmental Review	11/22/1995	Landau Associates	No	Review of current conditions and remedial issues/cost estimating
Results of Waterfront Material Characterization and Limited Metals Assessment	10/23/2002	GeoEngineers	Yes	Shoreline soil investigation and groundwater metals sampling. Three soil samples and two groundwater samples (MW-3 and MW-13).
Biological Evaluation: Shoreline Improvements	2/2002	Anchor Environmental	No	Biological evaluation for shoreline work impacts

Table 2-1
Summary of Environmental Studies for the Central Waterfront Site

Site Area/Study	Date	Author	Well Logs	Description/Comments
Methane Sampling at Bellingham Marine Industries	2/13/2002	Whatcom Environmental Services, Inc.	No	Methane monitoring in buildings
Hydrocarbon Contamination Summary and Draft Cleanup Action Plan	5/29/2003	GeoEngineers	No	Site history and draft cleanup plan - includes UST removal report (summarizes previous data-no new data)
Metals in Soil & Groundwater in Former Foundry Area	4/16/2004	GeoEngineers	No	Soil and groundwater metals investigation report including cover letter to City of Bellingham
Former Roeder Avenue Landfill Area				
Historic Landfill documents	1965	Various	No	Historic landfill documents
Site Inspection Report for Old Bellingham Landfill	6/12/1987	Ecology and Environment	No	Landfill inspection worksheets
Resource Protection Well Report(s)	1994	Ecology	Yes	Ecology logs
Roeder Avenue Landfill - Ecology background	3/22/1996	Dept. of Health	No	Department of Health determination of hazardous waste to landfill
Evaluation of Groundwater Contamination at Roeder Avenue Landfill	9/1996	Ecology	No	Ecology groundwater evaluation
Pre-Design Testing Report for the Roeder Avenue Warehouse Project	12/16/1997	RETEC	Yes	Pre-design testing for warehouse project including borings (RGB-1 to RGB-6) and wells/gas probes (RGP-1 to RGP-4), and test pits (RTP-1 to RTP-46)
Preliminary Geotechnical and Environmental Design Input - Warehouse	7/14/1998	Golder Associates	Yes	Geotechnical investigation for proposed warehouse
Methane and H_2S (Hydrogen Sulfide) Emission Inventory	2/18/1999	Antec Env. Services	No	Vapor evaluation
Determination of Potential Liable Person Status	2/3/2003	Ecology	No	Determination status
Draft Remedial Investigation/Feasibility Study	10/1/2001	ThermoRetec	Yes	RI/FS report for investigation and feasibility study evaluation (draft)
Former Olivine Uplands Area				
Environmental Site Assessment - Proposed U.S. Coast Guard Search and Rescue Station	7/15/1994	USCG	Yes	Phase 1 information and upland/sediment sampling
Soil, Sediment, and Groundwater Investigation	3/27/1995	Harding Lawson Associates	Yes	Investigation of soil, groundwater, and sediment
Environmental Assessment for Relocation and Expansion	6/1996	USCG	No	Evaluation to proceed with Environmental Impact Statement

Table 2-1
Summary of Environmental Studies for the Central Waterfront Site

Site Area/Study	Date	Author	Well Logs	Description/Comments
Recommended Design Wind and Wave Conditions For the New Boathouse Facility	8/1997	Northwest Weathernet, Inc.	No	Environmental stress evaluation
Fisheries Habitat Survey at I&J Waterway	9/2/1997	SAIC	No	Preliminary eelgrass and macroalgae habitat survey
Draft Work Plan for a Remedial Investigation/Feasibility Study	10/28/1998	WCEC	No	RI/FS Work Plan for uplands and sediments
Work Plan for a Remedial Investigation/Feasibility Study	6/8/2000	WCEC/ThermoRetec	No	RI/FS Work Plan for uplands and sediments
Subsurface Exploration and Chemical Testing-Former Army Reserve Site	12/7/2000	GeoEngineers	Yes	Investigation at neighboring former Army Reserve property. Limited test pit investigation and geotech study. Two former USTs at the property.

Notes:
BTEX: benzene, toluene, ethylbenzene, and xylene
Ecology: Washington State Department of Ecology
NAPL: non-aqueous phase liquid
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RI/FS: Remedial Investigation/Feasibility Study
TPH: total petroleum hydrocarbon
USCG: U.S. Coast Guard
UST: underground storage tank

Table 2-2
RI Conclusions and Protectiveness

Contaminants of Concern	Principle Remedial Investigation Findings	Fate and Transport Remedial Investigation Findings	Current and Future Potentially Complete Pathways and Receptors
Landfill and Perimeter Subarea			
Landfill refuse	Delineation of landfill refuse is complete.	Landfill refuse is contained within placement footprint.	Direct contact (dermal contact, incidental ingestion) for patrons and workers.
			Inhalation of impacted dust during excavation or other construction-related activities for patrons and workers.
Landfill associated gas (e.g., methane)	Distribution of landfill gas has been adequately delineated by direct monitoring.	Landfill gas is limited to landfill perimeter area.	Vapor inhalation by workers and patrons, where gas accumulation is a potential (e.g., existing and future buildings).
Metals, TPH-G, TPH-D, TPH-MO, PAHs, Benzene, and BEHP in groundwater	Delineation of landfill-related metals in groundwater is complete.	Landfill-associated dissolved metals in groundwater appear to attenuate with distance from the landfill, but are co-mingled with metals (in particular chromium) from historical operations within the C Street Properties subarea.	Direct contact of contaminated groundwater during excavation or other construction-related activities for workers.
			Transport to surface water/sediment is addressed by the comparable pathway in an adjacent subarea located closer to potential receptors (surface water/sediment).
		Dissolved metals exceed screening levels along ASB at wells RMW-2, RMW-5, and RMW-7.	Future conditions for FS evaluation will assume a pathway from the landfill into sediment and surface water and associated impacted receptors, based on future marina conditions (current ASB).
C Street Properties Subarea			
Surface and subsurface soil TPH-G, TPH-D, TPH-MO, PAHs, benzene, and metals	Soil impacts are delineated in soil as shown in RI/FS Figures 6-4 to 6-7.	Soil impacts have the potential for erosion to adjacent surface water and sediment.	Direct contact (dermal contact, incidental ingestion) of contaminated soils for patrons and workers.
		Soil impacts have the potential to leach to groundwater.	Surface soils runoff to sediments from erosion to stormwater drainage system, with subsequent exposure to aquatic ecological and human receptors via consumption of seafood.
Groundwater TPH-G, TPH-D, TPH-MO, PAHs, benzene, and metals	Groundwater impacts are delineated in groundwater as shown in RI/FS Figures 6-4 to 6-7.	Attenuation of petroleum and related constituents with the exception of porewater at one location (CW-PW-05) as shown in RI/FS Figures 6-4 and 6-5.	Direct contact (dermal contact, incidental ingestion) for workers during excavation or other construction-related activities.
			Inhalation of contaminated indoor air (via vapor intrusion) by volatile contaminants originated from shallow groundwater.
			Groundwater protective of surface water and sediment for aquatic and human health receptors.
Petroleum soil gas	Petroleum soil gas is present in areas as shown in RI/FS Figure 6-9.	Attenuation of petroleum soil gas is limited to areas of existing soil and/or groundwater contamination.	Soil gas inhalation by workers and patrons, where gas accumulation is a potential[1] (e.g., current and future buildings).
NAPL saturation	Free product is no longer observed at the Site.	Residual saturation has been estimated at 19,000 ppm TPH based on petrophysical testing.	Free product is no longer observed at the site. However, areas of the Site with TPH concentrations exceeding the residual saturation concentration of 19,000 ppm may warrant further evaluation in the FS.
Metals in sediment adjacent to Colony Wharf dock	Copper, zinc, and TBT impacts in sediment off-shore of C Street Properties as shown in RI/FS Figure 6-7.	Groundwater from the Site may recontaminate sediments in Whatcom Waterway.	Benthic and aquatic organisms may be directly exposed to surface water or sediment from impacted groundwater migration.
			Higher trophic food chain effects associated with the potential bioaccumulation of contaminants.
			Human consumption of seafood impacted by discharge of groundwater to sediment or surface water.
			Direct contact (dermal contact) by workers with impacted sediment during excavation or other construction-related activities.
Hilton Avenue Properties Subarea			
Surface and subsurface soil TPH-G, PAHs, and metals	Soil impacts are delineated in soil as shown in RI/FS Figures 6-4 to 6-7.	Soil impacts have the potential for erosion to adjacent surface water/sediment.	Direct contact (dermal contact, incidental ingestion) for patrons and workers during excavation or other construction-related activities.
		Soil impacts are not a source to groundwater.	Surface soils runoff to sediments from erosion to the stormwater drainage system.

Notes:
1. This exposure pathway also addresses inhalation risk associated with soil and groundwater sources of volatile compounds that may accumulate in indoor air.

ASB: Aerated Stabilization Basin
BEHP: bis(2-ethylhexyl)phthalate
COC: contaminant of concern
FS: Feasibility Study
NAPL: non-aqueous phase liquid
PAH: polycyclic aromatic hydrocarbon
ppm: parts per million
RI: Remedial Investigation
TBT: tributyltin
TPH-D: total petroleum hydrocarbons - diesel range
TPH-G: total petroleum hydrocarbons - gasoline range
TPH-MO: total petroleum hydrocarbons - motor oil range

Table 3-1
Remedial Action Objectives

Subarea	Remedial Action Objective
Landfill Footprint and Perimeter	**RAO 1** — Prevent direct contact with soil, groundwater, and refuse impacted with metals, TPH, PAHs, benzene, and BEHP, and prevent erosion of soils.
	RAO 2 — Prevent inhalation of landfill-associated gas (e.g., methane) and impacted dust.
C Street Properties	**RAO 3** — Prevent direct contact with soils and groundwater impacted with metals, TPH, PAHs, and benzene, and prevent erosion of soils.
	RAO 4 — Prevent inhalation of contaminated indoor air[1], vapors, soil gas, and impacted dust.
Hilton Avenue Properties	**RAO 5** — Prevent direct contact with and erosion of soils impacted with metals, TPH, and PAHs.
Site-wide	**RAO 6** — Meet groundwater cleanup standards throughout the Site, outside the Landfill Footprint.

Notes:
1. Inhalation risk associated with soil and shallow groundwater sources of volatile compounds that may accumulate in indoor air (via vapor intrusion).

BEHP: bis (2-ethylhexyl) phthalate
PAH: polycyclic aromatic hydrocarbon
RAO: remedial action objective
TPH: total petroleum hydrocarbon

Table 3-2
Groundwater Cleanup Levels

Analyte (by Group)	Groundwater Cleanup Level for Unrestricted Land Use (µg/L)	
	Value	Basis[1]
Total Petroleum Hydrocarbons (TPH)		
Gasoline Range Hydrocarbons	800	*(sw-a)*
Diesel Range Hydrocarbons	500	*(sw-a)*
Oil Range Hydrocarbons	500	*(sw-a)*
Total TPHs	800	*(sw-a)*
Heavy Metals		
Arsenic	5	*(back)*
Cadmium	8.8	*(ma-cwa)*
Chromium (Total)	260	*(sed)*
Chromium (III)	93700	*(sw-b)*
Chromium (VI)	50	*(ma-wac)*
Copper	3.1	*(ma-wac)*
Lead	8.1	*(ma-wac)*
Mercury	0.059	*(sed)*
Nickel	8.2	*(ma-wac)*
Selenium	71	*(ma-wac)*
Silver	1.9	*(ma-wac)*
Zinc	81	*(ma-wac)*
Volatile Organic Compounds		
Benzene	2.4	*(vi-b)*
Polycyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	3.3	*(sed)*
Anthracene	9.6	*(sed)*
Fluoranthene	3.3	*(sed)*
Fluorene	3	*(sed)*
Pyrene	15	*(sed)*
Naphthalene	83	*(sed)*
Benz(a)anthracene	0.02	*(pql)*
Benzo(a)pyrene	0.02	*(pql)*
Benzo(b)fluoranthene	0.02	*(pql)*
Benzo(k)fluoranthene	0.02	*(pql)*
Chrysene	0.02	*(pql)*
Dibenzo(a,h)anthracene	0.02	*(pql)*
Indeno(1,2,3-cd)pyrene	0.02	*(pql)*
Total cPAHs TEQ	0.02	*(pql)*
Other Semi-Volatile Organics		
Bis(2-ethylhexyl) phthalate	1	*(pql)*

Note:
1. Groundwater cleanup levels are the most stringent value, protective of all exposure pathways.

(back): Natural Background
(ma-cwa): Surface Water, Marine Aquatic Life, Clean Water Act §304
(ma-wac): Surface Water, Marine Aquatic Life, Ch. 173-201A WAC
(pql): Applicable Practical Quantitation Level
(sed): Calculated Porewater Concentration Protective of Marine Sediment
(sw-a): Surface Water, Method A, Most Restrictive
(sw-b): Surface Water, Method B, Most Restrictive, Adjusted for Fish Consumption Rate
(vi-b): Vapor Intrusion, Method B for Unrestricted Land Use
cPAHs: carcinogenic polycyclic aromatic hydrocarbons
FS: Feasibility Study
RI: Remedial Investigation
TEQ: toxic equivalent quotient
WAC: Washington Administrative Code
µg/L: microgram per liter

Table 3-3
Soil Cleanup Levels

Analyte (by Group)	Landfill Footprint and C Street Properties Subareas				Hilton Avenue Properties Subarea	
	Cleanup Level for Unrestricted Land Use - Unsaturated Soil (mg/kg)		Cleanup Level for Unrestricted Land Use - Saturated Soil (mg/kg)		Cleanup Level for Unrestricted Land Use (mg/kg)	
	Value	Basis[1]	Value	Basis[1]	Value	Basis[1]
Total Petroleum Hydrocarbons (TPH)						
Gasoline Range Hydrocarbons	30	*(mA)*	30	*(mA)*	--	--
Diesel Range Hydrocarbons	2000	*(mA)*	2000	*(mA)*	--	--
Oil Range Hydrocarbons	2000	*(mA)*	2000	*(mA)*	--	--
Total TPHs	2000	*(mA)*	2000	*(mA)*	--	--
Heavy Metals						
Arsenic	20	*(mA)*	20	*(mA)*	20	*(mA)*
Cadmium	1.2	*(gwl-u)*	2	*(mA)*	80	*(mB)*
Chromium (Total)	5200	*(gwl-u)*	260	*(gwl-s)*	--	--
Chromium (VI)	48	*(back)*	48	*(back)*	240	*(mB)*
Copper	36	*(back)*	36	*(back)*	3200	*(mB)*
Lead	250	*(mA)*	250	*(mA)*	250	*(mA)*
Mercury	2	*(gwl-u)*	0.1	*(gwl-s)*	24	*(mB)*
Nickel	48	*(back)*	48	*(back)*	1600	*(mB)*
Selenium	7.4	*(gwl-u)*	1	*(pql)*	400	*(mB)*
Silver	0.32	*(gwl-u)*	0.02	*(pql)*	400	*(mB)*
Zinc	100	*(gwl-u)*	85	*(back)*	24000	*(mB)*
Volatile Organic Compounds						
Benzene	0.034	*(gwl-u)*	0.005	*(pql)*	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthene	2.5	*(gwl-u)*	0.13	*(gwl-s)*	--	--
Anthracene	34	*(gwl-u)*	1.7	*(gwl-s)*	--	--
Fluoranthene	25	*(gwl-u)*	1.3	*(gwl-s)*	--	--
Fluorene	3.6	*(gwl-u)*	0.18	*(gwl-s)*	--	--
Pyrene	160	*(gwl-u)*	8	*(gwl-s)*	--	--
1-Methylnaphthalene	35	*(mB)*	35	*(mB)*	--	--
2-Methylnaphthalene	320	*(mB)*	320	*(mB)*	--	--
Naphthalene	16	*(gwl-u)*	0.8	*(gwl-s)*	1600	*(mB)*
Benz(a)anthracene	1.1	*(gwl-u)*	0.056	*(gwl-s)*	--	--
Benzo(a)pyrene	0.14	*(mB)*	0.14	*(mB)*	--	--
Benzo(b)fluoranthene	1.4	*(mB)*	0.19	*(gwl-s)*	--	--
Benzo(k)fluoranthene	3.7	*(gwl-u)*	0.19	*(gwl-s)*	--	--
Chrysene	1.2	*(gwl-u)*	0.062	*(gwl-s)*	--	--
Dibenzo(a,h)anthracene	0.14	*(mB)*	0.14	*(mB)*	--	--
Indeno(1,2,3-cd)pyrene	1.4	*(mB)*	0.55	*(gwl-s)*	--	--
Total cPAHs TEQ	0.14	*(mB)*	0.14	*(mB)*	0.14	*(mB)*
Other Semi-Volatile Organics						
Bis(2-ethylhexyl) phthalate	17	*(gwl-u)*	0.86	*(gwl-s)*	--	--

Notes:

1. Soil cleanup levels are based on unrestricted land use. Cleanup levels are the most stringent value: 1) protective of groundwater and adjusted upward for background or Method A criteria, for the Landfill Footprint and C Street Properties subareas; and 2) protective of direct contact for the Hilton Avenue Properties subarea.

2. Soil cleanup levels based on protection of groundwater may be adjusted based on site-specific leaching tests during development of the cleanup action plan, during remedial design, or during compliance monitoring.

(back): Natural Background
(gwl-s): Saturated Soil Concentration Protective of Leachability to Groundwater for Unrestricted Land Use
(qwl-u): Unsaturated Soil Concentration Protective of Leachability to Groundwater for Unrestricted Land Use
(mA): Soil, Direct Contact, Method A for Unrestricted Land Use
(mB): Soil, Direct Contact (ingestion only), Method B, Most-Restrictive Standard Formula Value for Unrestricted Land Use
(pql): Applicable Practical Quantitation Level
cPAHs: carcinogenic polycyclic aromatic hydrocarbons
FS: Feasibility Study
mg/kg: milligram per kilogram
RI: Remedial Investigation
TEQ: toxic equivalent quotient

Table 3-4
Air (Soil Vapor) and Landfill Gas Cleanup Levels

Analyte	Air and Landfill Gas Cleanup Level (µg/m^3)	
	Value	**Basis[1]**
Methane	10% LEL	*(air quality)*
C_5-C_8 Aliphatic Hydrocarbons	2,700	*(indoor air - non carc)*
C_9-C_{12} Aliphatic Hydrocarbons	140	*(indoor air - non carc)*
C_9-C_{12} Aromatic Hydrocarbons	180	*(indoor air - non carc)*
1,3-Butadiene	0.08	*(indoor air - carc)*
2-Methylnaphthalene	1.4	*(indoor air - non carc)*
Benzene	0.32	*(indoor air - carc)*
Ethylbenzene	460	*(indoor air - non carc)*
m,p -Xylene	46	*(indoor air - non carc)*
Methyl Tert-Butyl Ether	1,400	*(indoor air - non carc)*
Naphthalene	1.4	*(indoor air - non carc)*
o-Xylene	46	*(indoor air - non carc)*
Toluene	2,200	*(indoor air - non carc)*

Note:
1. Air/landfill gas cleanup levels are the most stringent value, protective of all exposure pathways.

(carc): carcinogenic
(non-carc): non-carcinogenic
FS: Feasibility Study
LEL: lower explosive limit
RI: Remedial Investigation
µg/m^3: microgram per cubic meter

Table 4-1
Alternative Cost Summary

Item	Remedial Alternative					
	A	B	C	D	E	F
Landfill Footprint and Perimeter Subarea						
Capital Costs						
Subtotal (Capital Costs)	$539,711	$539,711	$2,175,770	$2,175,770	$4,522,780	$124,404,372
Annual Costs						
Subtotal (Annual Costs)	$125,037	$125,037	$125,037	$125,037	$1,242,107	$0
Other Costs						
Subtotal (Other Costs)	$465,746	$465,746	$1,638,800	$1,638,800	$4,025,361	$89,197,935
Total for Landfill Footprint and Perimeter Subarea	**$1,130,000**	**$1,130,000**	**$3,940,000**	**$3,940,000**	**$9,790,000**	**$213,602,000**
C Street Properties Subarea						
Capital Costs						
Subtotal (Capital Costs)	$773,230	$2,339,352	$2,339,352	$3,046,984	$2,981,664	$20,907,985
Annual Costs						
Subtotal (Annual Costs)	$56,577	$54,735	$54,735	$150,991	$150,991	$0
Other Costs						
Subtotal (Other Costs)	$590,050	$1,711,798	$1,711,798	$2,279,811	$2,232,977	$14,991,025
Total for C Street Properties Subarea	**$1,420,000**	**$4,106,000**	**$4,106,000**	**$5,478,000**	**$5,366,000**	**$35,899,000**
Hilton Avenue Properties Subarea						
Capital Costs						
Subtotal (Capital Costs)	$57,056	$57,056	$57,056	$57,056	$57,056	$1,649,882
Annual Costs						
Subtotal (Annual Costs)	$7,056	$7,056	$7,056	$7,056	$7,056	$0
Other Costs						
Subtotal (Other Costs)	$45,355	$45,355	$45,355	$45,355	$45,355	$1,182,966
Total for Hilton Avenue Properties Subarea	**$109,000**	**$109,000**	**$109,000**	**$109,000**	**$109,000**	**$2,833,000**
Site-Wide Costs						
Subtotal (Site-Wide Costs)	$903,878	$953,878	$1,003,878	$1,053,878	$1,103,878	$500,000
Total for Hilton Avenue Properties Subarea	**$904,000**	**$954,000**	**$1,004,000**	**$1,054,000**	**$1,104,000**	**$500,000**
Spent Costs						
Subtotal (Spent Costs)	$9,931,270	$9,931,270	$9,931,270	$9,931,270	$9,931,270	$9,931,270
Total for Spent Costs	**$9,931,000**	**$9,931,000**	**$9,931,000**	**$9,931,000**	**$9,931,000**	**$9,931,000**
Grand Total per Alternative (rounded)	**$13,495,000**	**$16,231,000**	**$19,090,000**	**$20,512,000**	**$26,300,000**	**$262,765,000**

Note:

1. Net present value costs are estimated in 2017 dollars and were calculated using a discount factor of 0.7%. The costs shown are rounded to three significant figures. Detailed cost estimates are provided in Appendix I of the RI/FS (Anchor QEA, 2018).

Table 5-1
Evaluation of Reasonable Restoration Timeframe

Factors Used to Determine Whether Restoration Timeframe is Reasonable (WAC 173-340-360(4)(b))	Remedial Alternative					
	A (Figure 4-1)	**B (Figure 4-2)**	**C (Figure 4-3)**	**D (Figure 4-4)**	**E (Figure 4-5)**	**F (Figure 4-6)**
Potential risks posed by the Site to human health and the environment	Low level of risk under Alternative A because water is nonpotable, capping addresses direct contact and soil erosion, under-building venting systems address vapor/soil gas inhalation, and hotspot removal action eliminates a source of COCs. Natural attenuation of COCs in GW is currently occurring and will continue to occur. Some risks associated with the construction of the targeted treatment (i.e., PRB) in the southeastern boundary of the C Street Properties subarea. Overall potential risks to human health and the environment are not substantial.	Alternative B has similar level of risks as Alternative A, plus some risks associated with the construction of the targeted treatment (i.e., PRB) in the western shoreline of the C Street Properties subarea. Overall potential risks to human health and the environment are not substantial.	Alternative C has similar level of risks as Alternative A, plus some risks associated with the construction of the targeted treatment (i.e., PRB) in the western shoreline of the Landfill Footprint and C Street Properties subareas. Overall potential risks to human health and the environment are not substantial.	Alternative D has similar level of risks as Alternative C, plus some risks associated with the installation of the *in situ* treatment system (i.e., AS) in the C Street Properties subarea. Overall potential risks to human health and the environment are not substantial.	Alternative E has similar level of risks as Alternative D, plus some risks associated with the construction of the barrier wall (i.e., slurry wall) in the Landfill Footprint subarea. Overall potential risks to human health and the environment are not substantial.	Although Alternative F has several potential short-term risks associated with implementation because it includes extensive excavation and intrusive activities, these risks will occur only during construction, until the Site is restored.
Practicability of achieving shorter restoration timeframe	Under Alternative A, capping is the only engineered control to address exposure at the Site; therefore, it needs to be combined with long-term GW monitoring and ICs. Alternatives B through F would likely achieve a shorter restoration timeframe, compared to Alternative A.	Alternative B would likely achieve a shorter restoration timeframe than Alternative A due to the targeted shoreline treatment (i.e., PRB) in the C Street Properties subarea, which provides added protection against GW migrating into surface water and sediments.	Alternative C would likely achieve a shorter restoration timeframe than Alternative B due to the targeted shoreline treatment (i.e., PRB) in the Landfill and C Street Properties subareas, which provides added protection against GW migration to the C Street Properties subarea, and therefore, into surface water and sediments.	Alternative D would likely achieve a shorter restoration timeframe than Alternatives A through C due to *in situ* treatment (i.e., AS) in the C Street Properties subarea, reducing VOCs/TPH adsorbed onto soils and dissolved in GW, and therefore, reducing migration into surface water and sediments.	Alternative E would likely achieve a shorter restoration timeframe than Alternatives A through D due to the barrier wall (i.e., slurry wall) and GW extraction system in the Landfill Footprint subarea, which address contaminated GW migration into the C Street Properties subarea, therefore reducing potential migration into surface water and sediments.	Alternative F would likely achieve the shortest restoration timeframe, compared to Alternatives A through E, because of Site-wide removal of contaminated soils and refuse. Alternative F does not require long-term GW monitoring nor ICs.
Current and potential future use of Site, surrounding areas, and associated resources that are, or may be, affected by the releases from the Site	Current/future tenants and land use of the Site is consistent with a combination of commercial, industrial, and institutional mixed-uses and the Site cleanup actions.					
Availability of alternate water supplies	City of Bellingham municipal water supply is readily available and would not be affected by the Site cleanup actions.					
Likely effectiveness and reliability of institutional controls	ICs are expected to be effective and reliable at limiting groundwater usage and at ensuring protection and maintenance of remedy elements.					Not applicable, because ICs would not be necessary for Alternative F.
Ability to control and monitor migration of hazardous substances from the Site	All remedial alternatives are scoped in the FS to effectively address the current and future potentially complete exposure pathways to COCs in GW, soil, and soil gas.					
Toxicity of the hazardous substances at the Site	The hazardous substances at the Site have a relatively low toxicity.					
Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the Site or under similar Site conditions	Natural attenuation processes for various COCs have been documented to occur at the Site.[1]					The restoration timeframe of Alternative F does not rely on natural attenuation of COCs.
Estimated Restoration Timeframe	20–25 years	20–25 years	20–25 years	10 years	5 years	2–3 years
Is Restoration Timeframe Reasonable?	Yes	Yes	Yes	Yes	Yes	Yes

Note:
1. See "Groundwater Quality Evaluation for Total Petroleum Hydrocarbons and Dissolved Metals in the C Street Properties Subarea, Central Waterfront Site" Memorandum (Anchor QEA 2017).

AS: air sparging system
COC: contaminant of concern
FS: feasibility study
GW: groundwater
IC: institutional control
PRB: permeable reactive barrier
TPH: total petroleum hydrocarbon
VOC: volatile organic compound
WAC: Washington Administrative Code

Table 5-2
Disproportionate Cost Analysis

Criteria to Evaluate Use of Permanent Solutions to the Maximum Extent Practicable (WAC 173-340-360(3)(e))			Remedial Alternative					
			A (Figure 4-1)	B (Figure 4-2)	C (Figure 4-3)	D (Figure 4-4)	E (Figure 4-5)	F (Figure 4-6)
Overall Protectiveness	30% [1]	Description	Hotspot removal action eliminates a source of COCs in the C Street Properties subarea. Capping addresses direct contact, soil erosion, dust inhalation, and limits groundwater generation. The clay berm effectively performs as a "hanging" low-permeability physical diversion wall, not only containing groundwater within the Landfill subarea, but also diverting it and increasing its flow path and travel time prior to discharging to adjacent surface water. Alternative A's targeted treatment (i.e., PRB) in the southeastern boundary of the C Street Properties subarea provides added protection of downgradient GW migrating into surface water and sediments. Under-building venting systems address vapor and soil gas. Relies on long-term GW compliance monitoring and ICs.	In addition to the protective elements of Alternative A, Alternative B's targeted treatment (i.e., PRB) in the C Street Properties subarea provides added protection of downgradient GW migrating into surface water and sediments at the western shoreline, assuring that cleanup levels will be met at the property boundary.	In addition to the protective elements of Alternative A, Alternative C's targeted treatment (i.e., PRB) in the western shoreline of the Landfill Footprint and C Street Properties subareas provides added protection of downgradient GW migrating into surface water and sediments at the western shoreline, assuring that cleanup levels will be met at the property boundary.	In addition to the protective elements of Alternative C, Alternative D's *in situ* treatment (i.e., AS) in the C Street Properties subarea provides added protection by reducing VOCs/TPH adsorbed onto soils and dissolved in GW, decreasing migration into surface water and sediments, and therefore, reducing the time to achieve cleanup levels at the conditional POC.	In addition to protective elements of Alternative D, Alternative E's barrier wall (i.e., slurry wall) and GW extraction system in the Landfill Footprint subarea addresses contaminated GW migration into the C Street Properties subarea, reducing potential migration into surface water and sediments, and therefore reducing the time to meet cleanup levels at the conditional POC.	Future risks are addressed because of Site-wide removal of contaminated soils and refuse. Does not require long-term GW monitoring and does not rely on ICs for protectiveness.
		Score [2]	5	6	7	8	9	10
		Weighted Score	**1.5**	**1.8**	**2.1**	**2.4**	**2.7**	**3.0**
Permanence	20% [1]	Description	Alternative A permanently reduces volume and mobility of COCs through the hotspot removal action by eliminating a source of contamination in the C Street Properties subarea. Natural attenuation is already effectively reducing GW contaminant mass. Capping reduces direct contact risks and potential mobility via erosion. Alternative A's targeted treatment (i.e., PRB) in the southeastern boundary of the C Street Properties subarea reduces contaminant mass and toxicity in GW as it migrates into surface water and sediments.	In addition to the permanent elements of Alternative A, Alternative B's targeted treatment (i.e., PRB) in the western shoreline of the C Street Properties subarea reduces contaminant mass and toxicity in GW as it migrates into surface water and sediments.	In addition to the permanent elements of Alternative A, Alternative C's targeted treatment (i.e., PRB) in the western shoreline of the Landfill Footprint and C Street Properties subareas reduces contaminant mass and toxicity in GW as it migrates into surface water and sediments.	In addition to the permanent elements of Alternative C, Alternative D's *in situ* treatment (i.e., AS) in the C Street Properties subarea permanently destroys COCs in soil and GW, reducing their toxicity, mobility, and volume.	In addition to permanent elements of Alternative D, Alternative E's barrier wall (i.e., slurry wall) and GW extraction system in the Landfill Footprint subarea reduces mobility of contaminated GW into the C Street Properties subarea, therefore reducing potential migration into surface water and sediments.	Alternative F permanently reduces mobility of COCs by eliminating all sources of contamination, through full removal and off-site disposal of soils and refuse. However, contaminant toxicity and volume would only be reduced by potential natural attenuation in the off-site landfill.
		Score [2]	5	6	7	9	9	10
		Weighted Score	**1.0**	**1.2**	**1.4**	**1.8**	**1.8**	**2**
Long-term Effectiveness	20% [1]	Description	The hotspot removal action eliminates a source of COCs in the C Street Properties subarea. Long-term effectiveness of Alternative A is dependent on GW and cap compliance monitoring and ICs will remain in place to ensure reliability and effectiveness of management of any residual risks. Alternative A's targeted treatment (i.e., PRB) in the southeastern boundary of the C Street Properties subarea effectively reduces GW contamination in the long-term.	In addition to the effective elements of Alternative A over long-term, Alternative B's targeted treatment (i.e., PRB) in the western shoreline of the C Street Properties subarea effectively reduces GW contamination in the long-term.	In addition to the effective elements of Alternative A over long-term, Alternative C's targeted treatment (i.e., PRB) in the western shoreline of the Landfill Footprint and the C Street Properties subareas effectively reduces GW contamination in the long-term.	In addition to the effective elements of Alternative C over long-term, Alternative D's in situ treatment (i.e., AS) in the C Street Properties subareas effectively reduces soil and GW contamination in the long-term.	In addition to the effective elements of Alternative D over long-term, Alternative E's barrier wall (i.e., slurry wall) and GW extraction system in the Landfill Footprint subarea effectively reduces long-term migration of contaminated GW into the C Street Properties subarea.	All contaminated soils and refuse will be removed under Alternative F, eliminating all sources of contamination and any residual risk. Alternative F provides the greatest long-term benefit. Neither GW compliance monitoring nor ICs will be required to ensure long-term effectiveness.
		Score [2]	6	6	7	8	9	10
		Weighted Score	**1.2**	**1.2**	**1.4**	**1.6**	**1.8**	**2**

Table 5-2
Disproportionate Cost Analysis

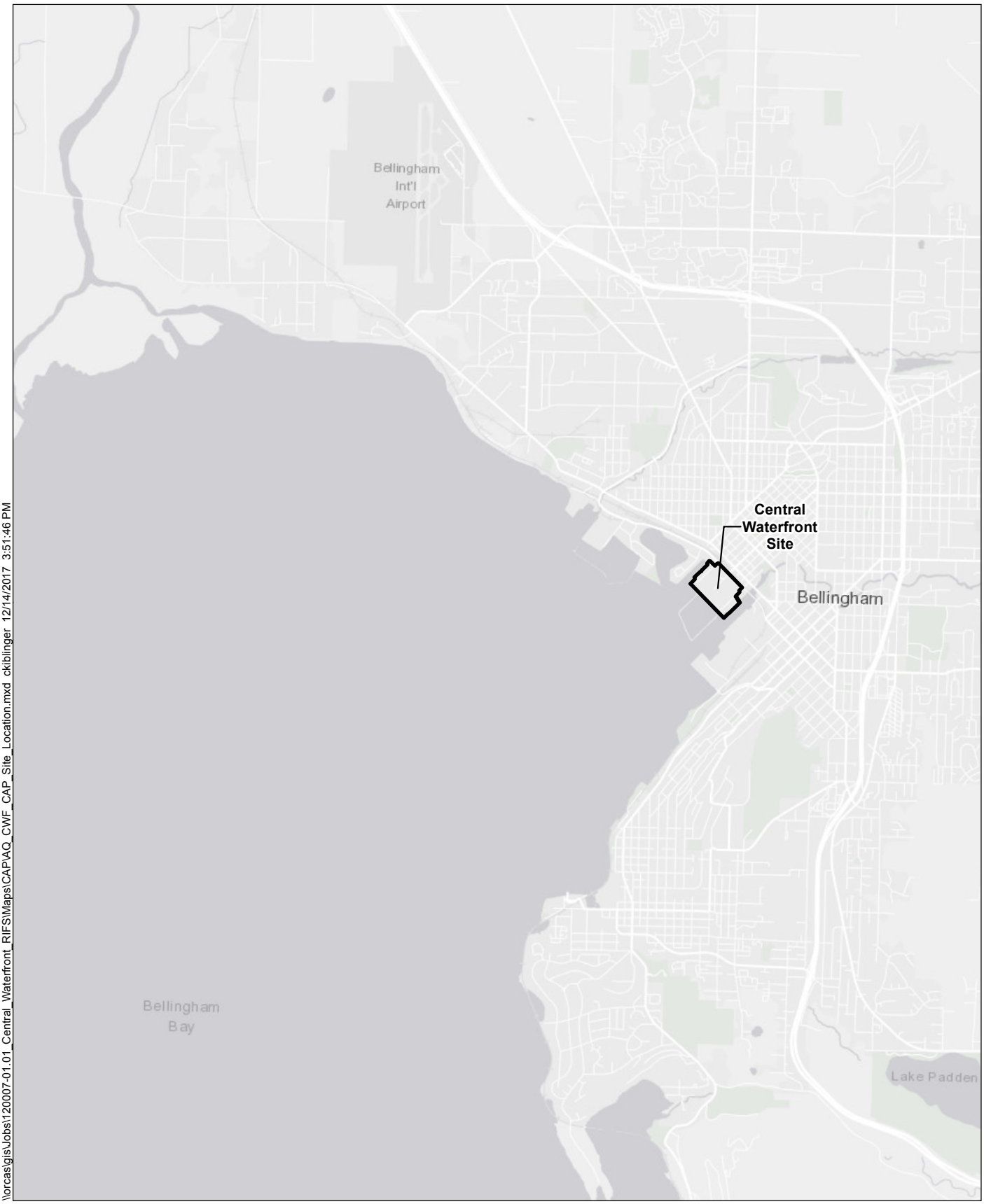
Criteria to Evaluate Use of Permanent Solutions to the Maximum Extent Practicable (WAC 173-340-360(3)(e))			Remedial Alternative					
			A (Figure 4-1)	B (Figure 4-2)	C (Figure 4-3)	D (Figure 4-4)	E (Figure 4-5)	F (Figure 4-6)
Short-term Risk Management	10% [1]	Description	Under Alternative A, minimal short-term risks associated with capping and hotspot removal action (worker safety, dust/erosion control, etc.) are anticipated. Alternative A has some risks associated with the construction of the targeted treatment (i.e., PRB) in the southeastern boundary of the C Street Properties subarea, but overall potential risks to human health and the environment as a result of construction and implementation are still not substantial.	In addition to the minimal short-term risks of Alternative A, Alternative B has some risks associated with the construction of the targeted treatment (i.e., PRB) in the western shoreline of the C Street Properties subarea, but overall potential risks to human health and the environment as a result of construction and implementation are still not substantial.	In addition to the minimal short-term risks of Alternative A, Alternative C has slightly higher risks associated with the construction of the targeted treatment (i.e., PRB) in the western shoreline of the Landfill Footprint and C Street Properties subareas, but overall potential risks to human health and the environment as a result of construction and implementation are still not substantial.	In addition to the short-term risks of Alternative C, Alternative D has slightly more short-term risks associated with installation of the *in situ* treatment system (i.e., AS) because of worker safety. Best management practices will be implemented to control these risks through planning and oversight.	In addition to the short-term risks of Alternative D, Alternative E has some short-term risks associated with the construction of the barrier wall (i.e., slurry wall) in the Landfill Footprint subarea, because the barrier wall will require trenching during installation. Existing utilities will need to be located to allow the slurry wall to be installed around them.	Alternative F has the most potential short-term risks associated with implementation because it includes extensive excavation and intrusive activities. Dewatering and soil management/transport/off-site disposal will be critical components of this work since large excavations occur along the shorelines and within the Landfill Footprint and C Street Properties subareas. Transportation of soils through the community and for long distances poses additional risk of exposure to airborne contaminants and dust and local truck traffic could be impacted. These risks can be minimized with pre-mobilization planning, oversight, and close implementation management.
		Score [2]	9	8	6	5	4	1
		Weighted Score	**0.9**	**0.8**	**0.6**	**0.5**	**0.4**	**0.1**
Technical and Administrative Implementability	10% [1]	Description	Alternative A is the easiest to implement. Low/moderate technical challenges for Alternative A are associated with extensive capping in the three subareas and the hotspot removal action. Moderate technical challenges related to the installation of the targeted treatment (i.e., PRB) in the southeastern boundary of the C Street Properties subarea, because of the need to accommodate existing utilities and other structures. Some administrative challenges are associated with shoreline permitting for the PRB. Some administrative challenges are anticipated regarding the effective implementation of ICs, if parcels are sold.	In addition to implementation challenges identified for Alternative A, moderate technical challenges are anticipated for Alternative B, related to the installation of the targeted treatment (i.e., PRB) in the western shoreline of the C Street Properties subarea, because it will require extensive work along the western Site shoreline and accommodating for existing utilities and other structures. Some administrative challenges are associated with shoreline permitting for the PRB.	In addition to implementation challenges identified for Alternative A, moderate technical challenges are anticipated for Alternative C, related to the installation of the targeted treatment (i.e., PRB) in the western shoreline of the Landfill Footprint and C Street Properties subareas, because it will require extensive work along the western Site shoreline and accommodating for existing utilities and other structures. More administrative challenges are anticipated (compared to Alternative B), associated with shoreline permitting for a longer PRB.	In addition to implementation challenges identified for Alternative C, minor challenges are anticipated for Alternative D in relation to the installation of the *in situ* treatment system (i.e., AS) in the C Street Properties subarea, which can be accomplished with conventional drilling equipment.	In addition to the implementation challenges of Alternative D, moderate/high technical challenges are anticipated for Alternative E, related to the construction of the barrier wall (i.e., slurry wall) in the Landfill Footprint subarea, because it will require extensive work along the western Site shoreline and accommodating for existing utilities and other structures.	Alternative F is the most technically difficult alternative to implement due to the magnitude and complexity of earthwork (e.g., extensive intrusive operations, major dewatering, large soil management for off-site disposal, traffic impacts on the local community, existing utilities, physical hazards, and exposure during soil excavation). Administrative and regulatory requirements and overall coordination will pose high challenges.
		Score [2]	9	8	5	4	3	1
		Weighted Score	**0.9**	**0.8**	**0.5**	**0.4**	**0.3**	**0.1**
Consideration of Public Concerns[3]	10% [1]	Description	All of the remedial alternatives have some public concerns and are based on past public concerns and comments on adjacent projects to CWS. Additional public concerns will be addressed following the public comment period for the RI/FS.					
		Score	1	3	5	7	9	10
		Weighted Score	**0.1**	**0.3**	**0.5**	**0.7**	**0.9**	**1**
Overall Environmental Benefit Score (weighted)		[4]	**5.6**	**6.1**	**6.5**	**7.4**	**7.9**	**8.2**
Estimated Total Costs ($, Millions)		[5]	**$13.5**	**$16.2**	**$19.1**	**$20.5**	**$26.3**	**$263**
Benefit-to-Cost Ratio (Benefit Score / $ Million)		[6]	**0.41**	**0.38**	**0.34**	**0.36**	**0.30**	**0.03**

Table 5-2
Disproportionate Cost Analysis

Notes:
1. The weighting factors are based on Ecology input provided for FSs conducted on other Port of Bellingham sites.
2. A scale of 1 to 10 is used to score the remedial alternatives with respect to the criteria, where "1" indicates the criterion is satisfied to a very low degree, and "10" indicates the criterion is satisfied to a very high degree.
3. Ecology considered and responded to all public comments received on the Draft Final RI/FS in 2017, as part of the cleanup process under MTCA.
4. The overall environmental benefit score was obtained by multiplying the score for each criterion by its weighting factor and summing the results for the first five criteria.
5. Net present value costs are estimated in 2017 dollars and were calculated using a discount factor of 0.7%. The costs shown are rounded to three significant figures. Detailed cost estimates are provided in Appendix I of the RI/FS (Anchor QEA, 2018).
6. The benefit-to-cost ratio was obtained by dividing the remedial alternative's overall environmental benefit score by its estimated cost.

AS: air sparging system
CAP: Cleanup Action Plan
COC: contaminant of concern
FS: feasibility study
GW: groundwater
IC: institutional control
MTCA: Model Toxics Control Act
POC: point of compliance
PRB: permeable reactive barrier
RI: remedial investigation
TPH: total petroleum hydrocarbon
VOC: volatile organic compound
WAC: Washington Administrative Code

Figures



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State of Washington

Feet
0 2,500 5,000

Figure 1-1
Site Location
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

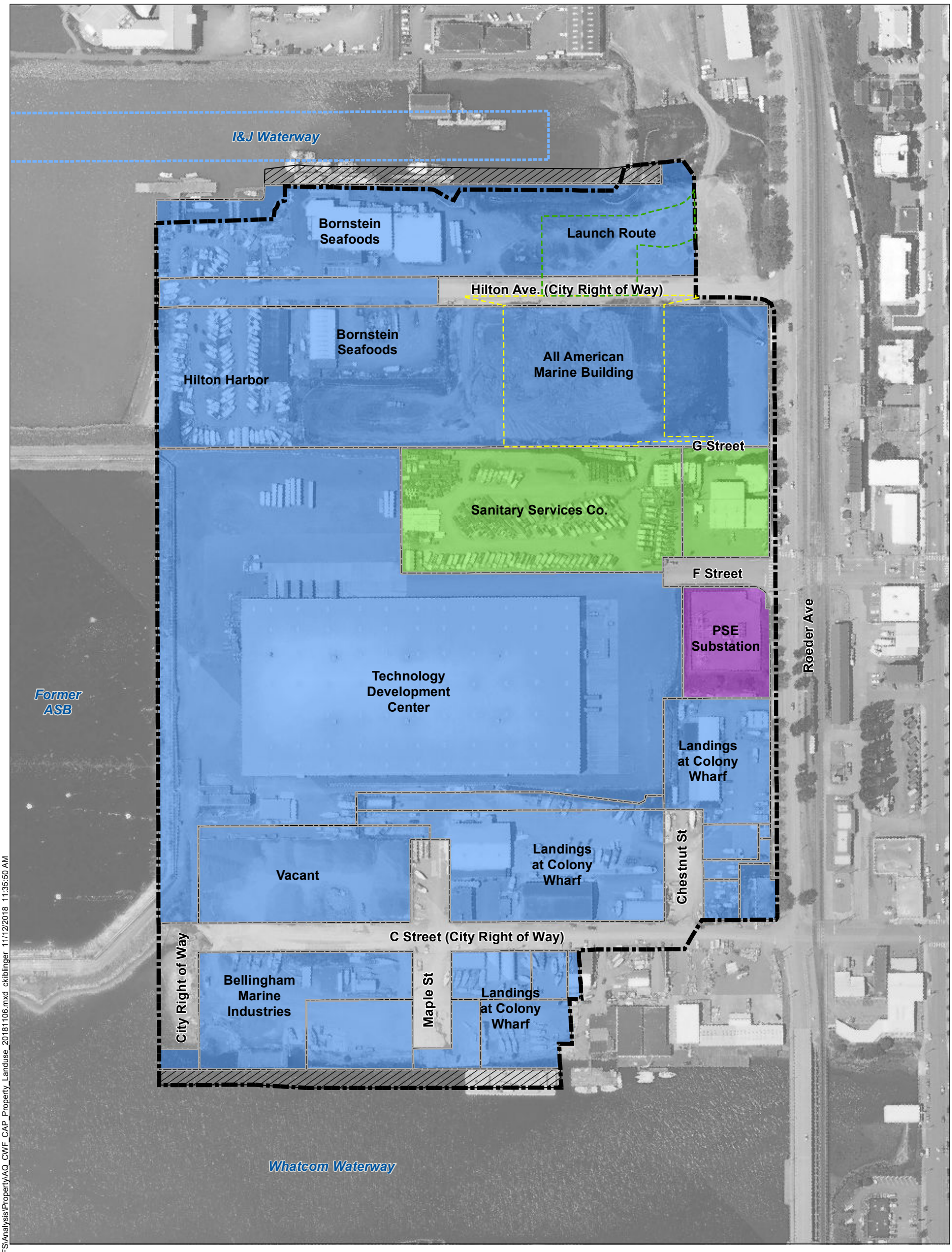

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Figure 1-2
Site Property Ownership and Current Land Use
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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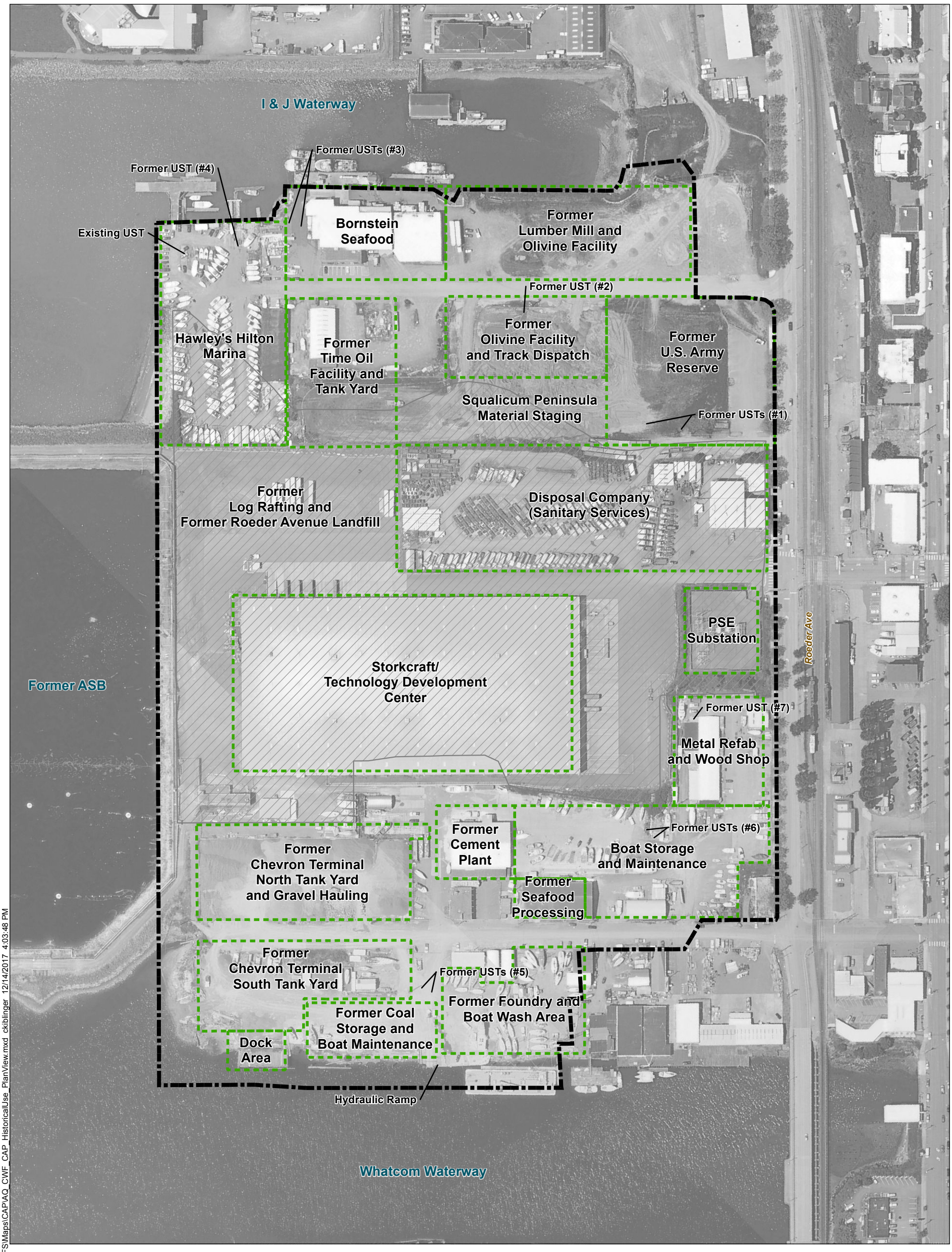

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Figure 2-1
Historical Site Operations and Land Use
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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State of Washington

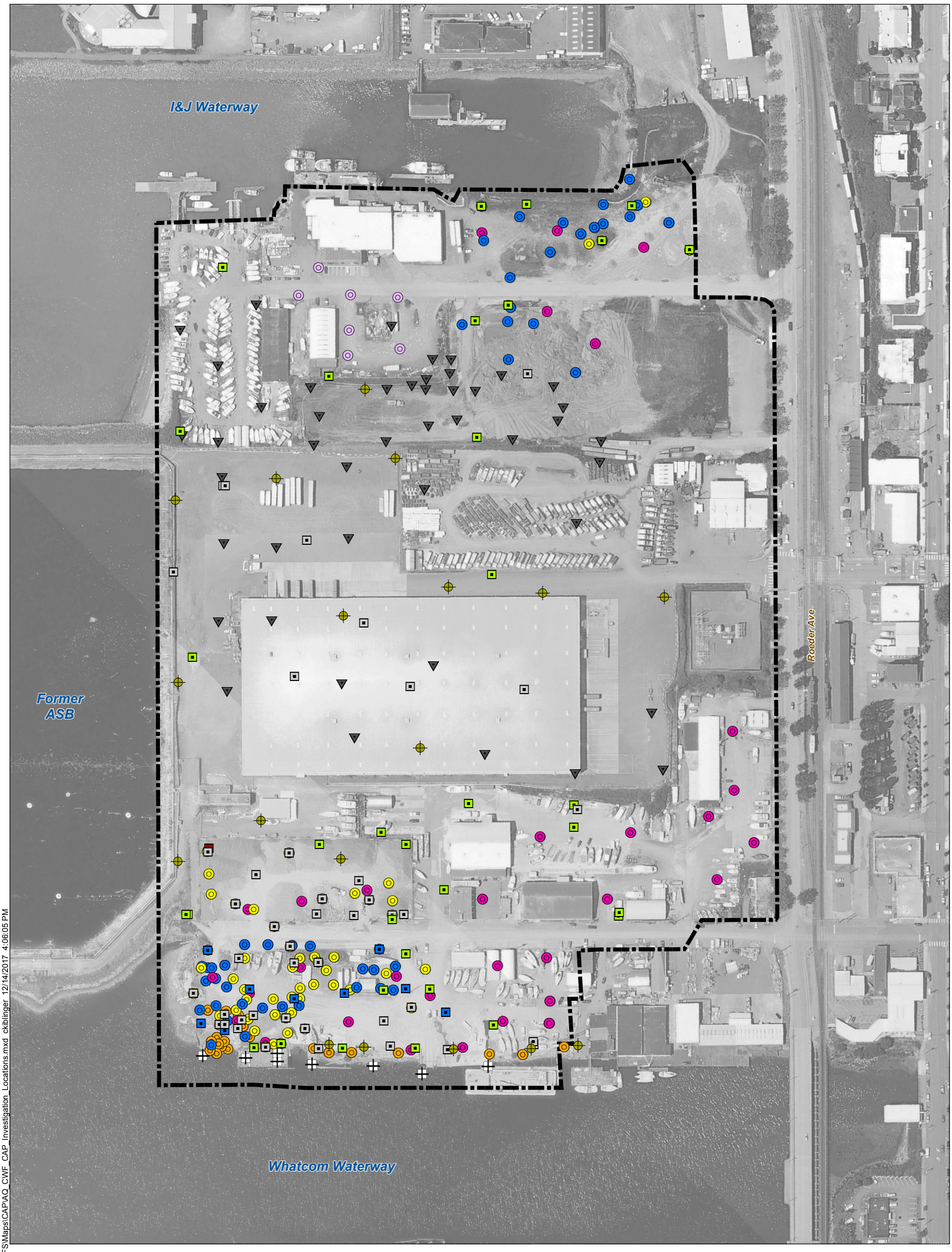

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Figure 2-2
Central Waterfront Site Investigation Locations
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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SOURCE: Figure prepared from Figure 1-1 of the Draft Waterfront District Sub-Area Plan, 2018

Figure 2-3
Proposed Planning Framework: Waterfront District Boundaries
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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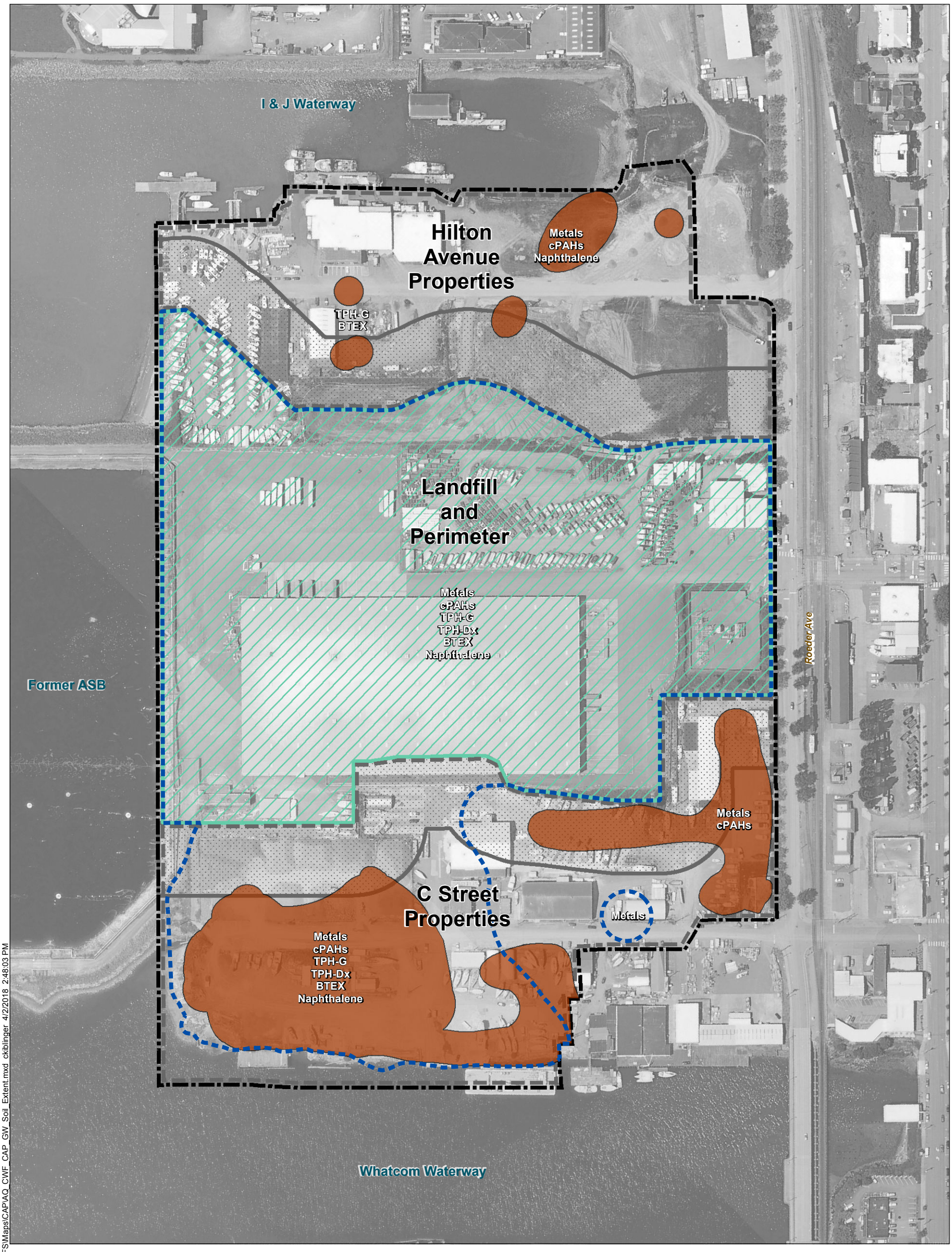
State of Washington



NOTES:
1. Areas within the landfill boundary are assumed to pose a threat to human health or the environment through direct contact or release to the environment
2. Landfill gas is limited to areas within the landfill perimeter and soil gas is limited to areas of soil and/or groundwater petroleum impacts in the C Street Properties subarea.
3. Areas addressed in the RI/FS are based on screening levels and the RI/FS evaluated a range of cleanup levels applicable to the Site.
4. Aerial by U.S. Geological Survey: July 2009.

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Figure 2-4
Extent of Groundwater and Soil Contamination
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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State of Washington

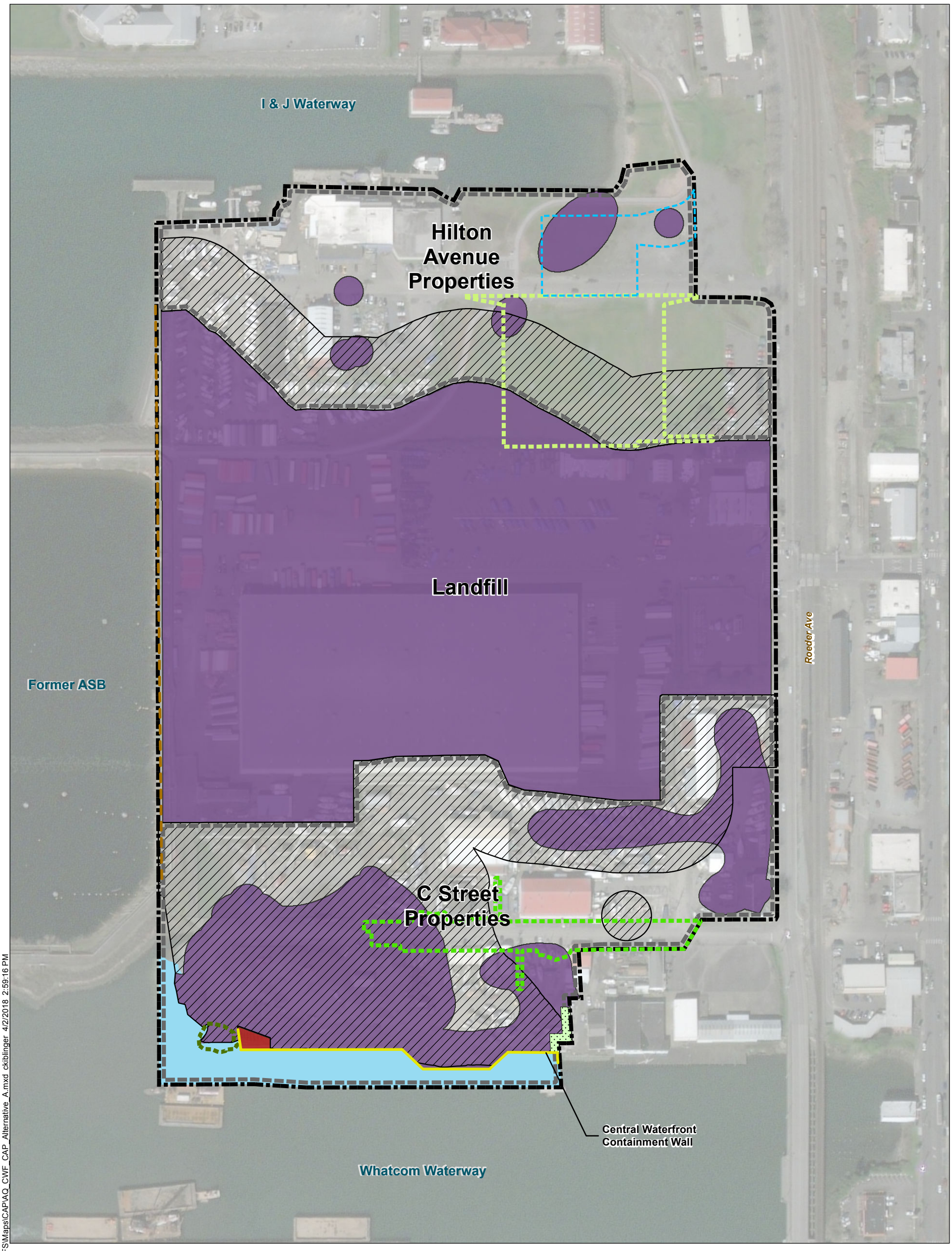

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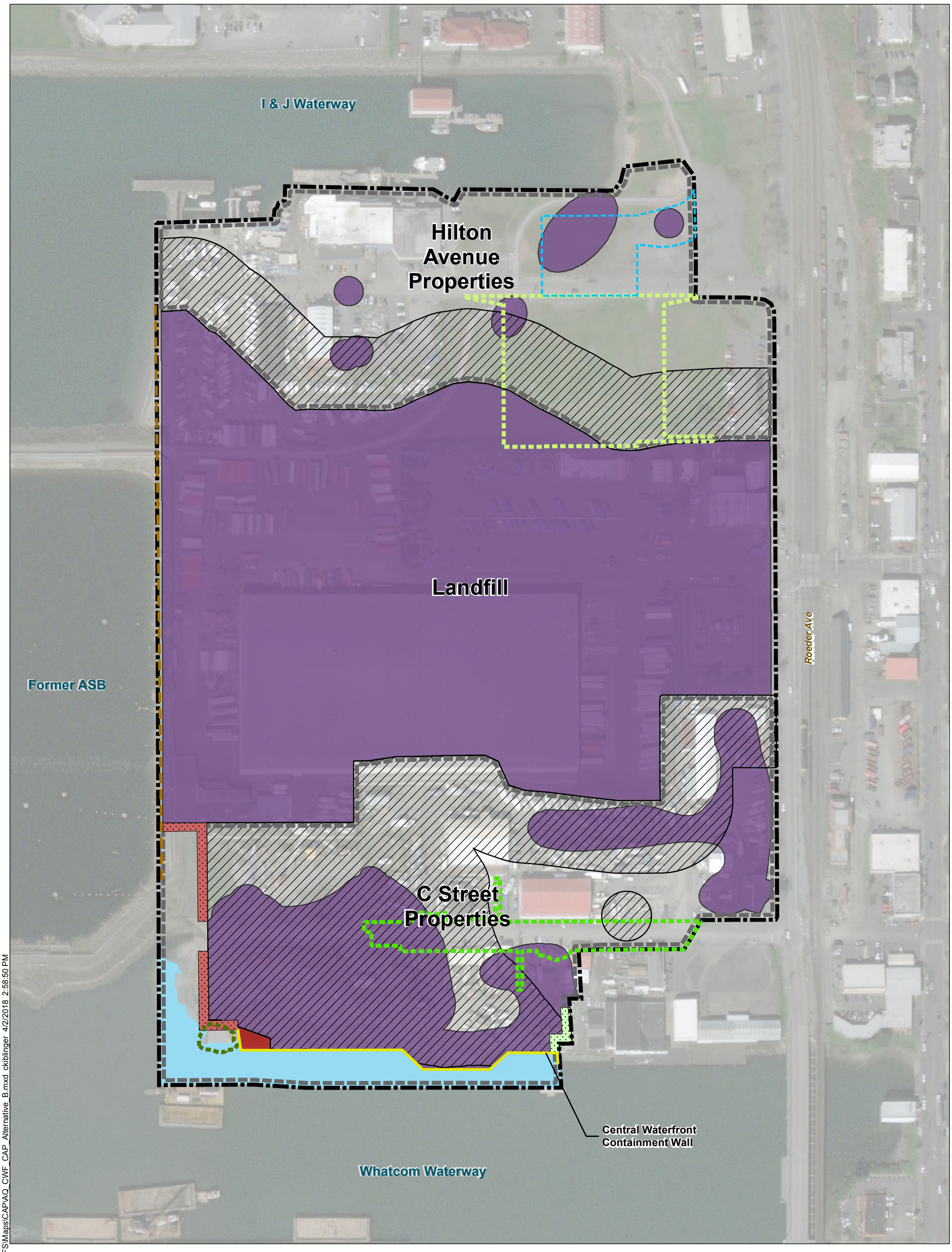
Figure 4-1
Alternative A
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA



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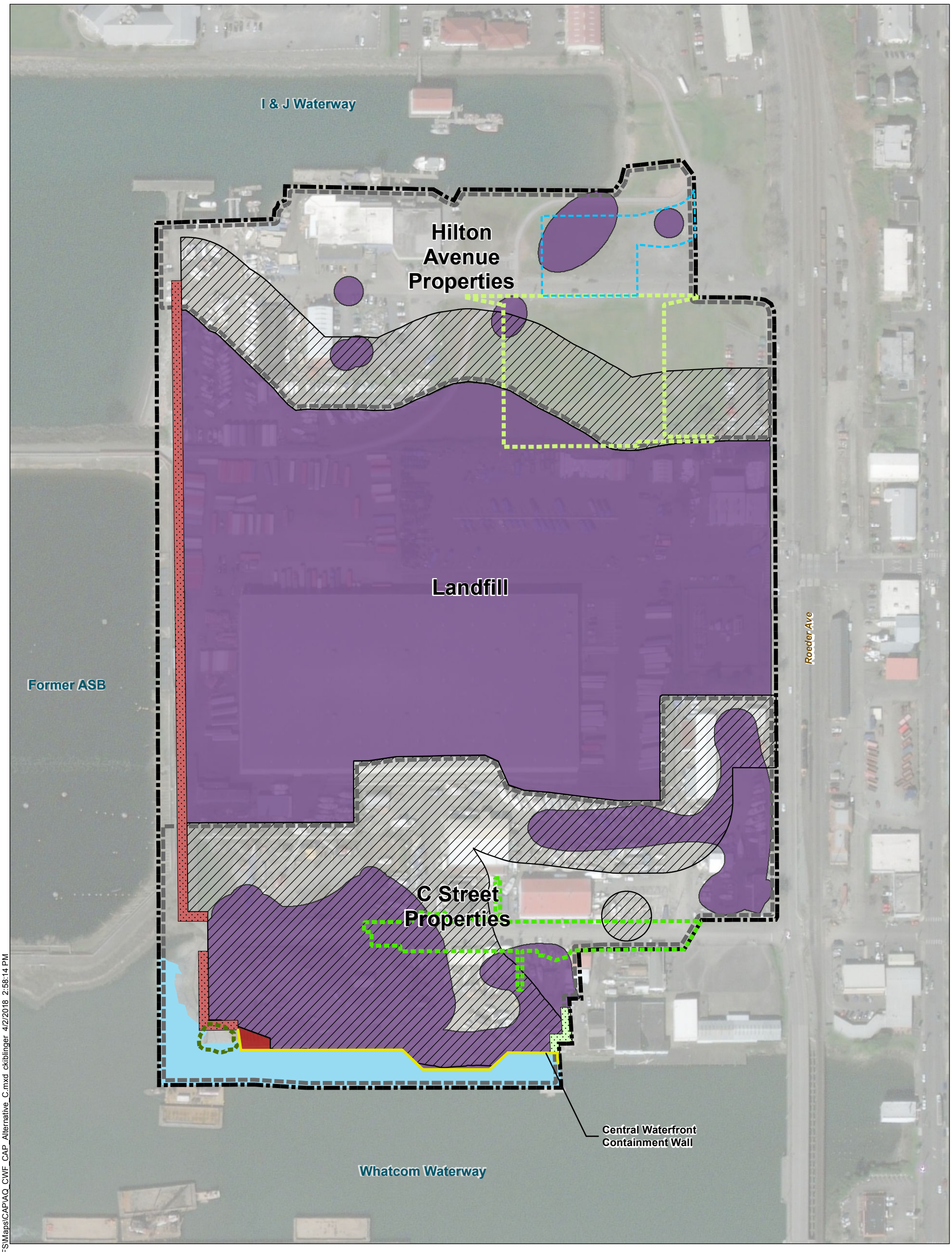
State of Washington

Figure 4-2
Alternative B
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA



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State of Washington

Figure 4-3
Alternative C
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

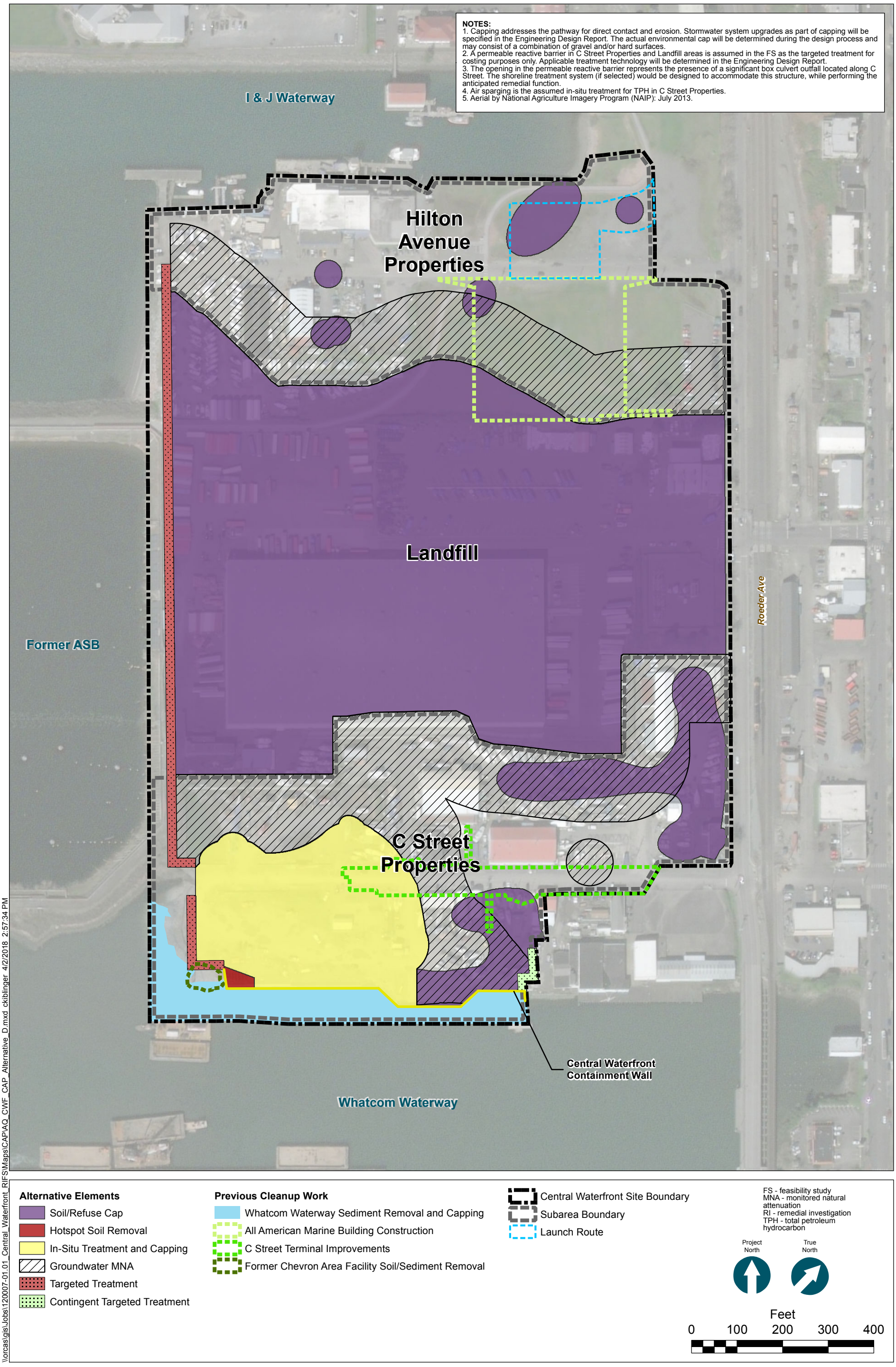

Figure 4-4
Alternative D
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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NOTES:
1. Capping addresses the pathway for direct contact and erosion. Stormwater system upgrades as part of capping will be specified in the Engineering Design Report. The actual environmental cap will be determined during the design process and may consist of a combination of gravel and/or hard surfaces.
2. A permeable reactive barrier in C Street Properties is assumed in the FS as the targeted treatment for costing purposes only. Applicable treatment technology will be determined in the Engineering Design Report.
3. The opening in the permeable reactive barrier represents the presence of a significant box culvert outfall located along C Street. The shoreline treatment system (if selected) would be designed to accommodate this structure, while performing the anticipated remedial function.
4. Air sparging is the assumed in-situ treatment for TPH in C Street Properties.
5. Barrier wall along the Landfill footprint may be a slurry wall or sheetpile wall to be determined in the Engineering Design Report.
6. Aerial by National Agriculture Imagery Program (NAIP): July 2013.

I & J Waterway

Hilton Avenue Properties

Landfill

Former ASB

Roeder Ave

C Street Properties

Central Waterfront Containment Wall

Whatcom Waterway

Alternative Elements
- Soil/Refuse Cap
- Hotspot Soil Removal
- In-Situ Treatment and Capping
- Barrier Wall
- Groundwater MNA
- Targeted Treatment
- Contingent Targeted Treatment
- Groundwater Extraction Well with Discharge to POTW

Previous Cleanup Work
- Whatcom Waterway Sediment Removal and Capping
- All American Marine Building Construction
- C Street Terminal Improvements
- Former Chevron Area Facility Soil/Sediment Removal

- Central Waterfront Site Boundary
- Subarea Boundary
- Launch Route

FS - feasibility study
MNA - monitored natural attenuation
POTW - Publicly Owned Treatment Works
RI - remedial investigation
TPH - total petroleum hydrocarbon

Project North / True North

Feet
0 100 200 300 400

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Figure 4-5
Alternative E
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

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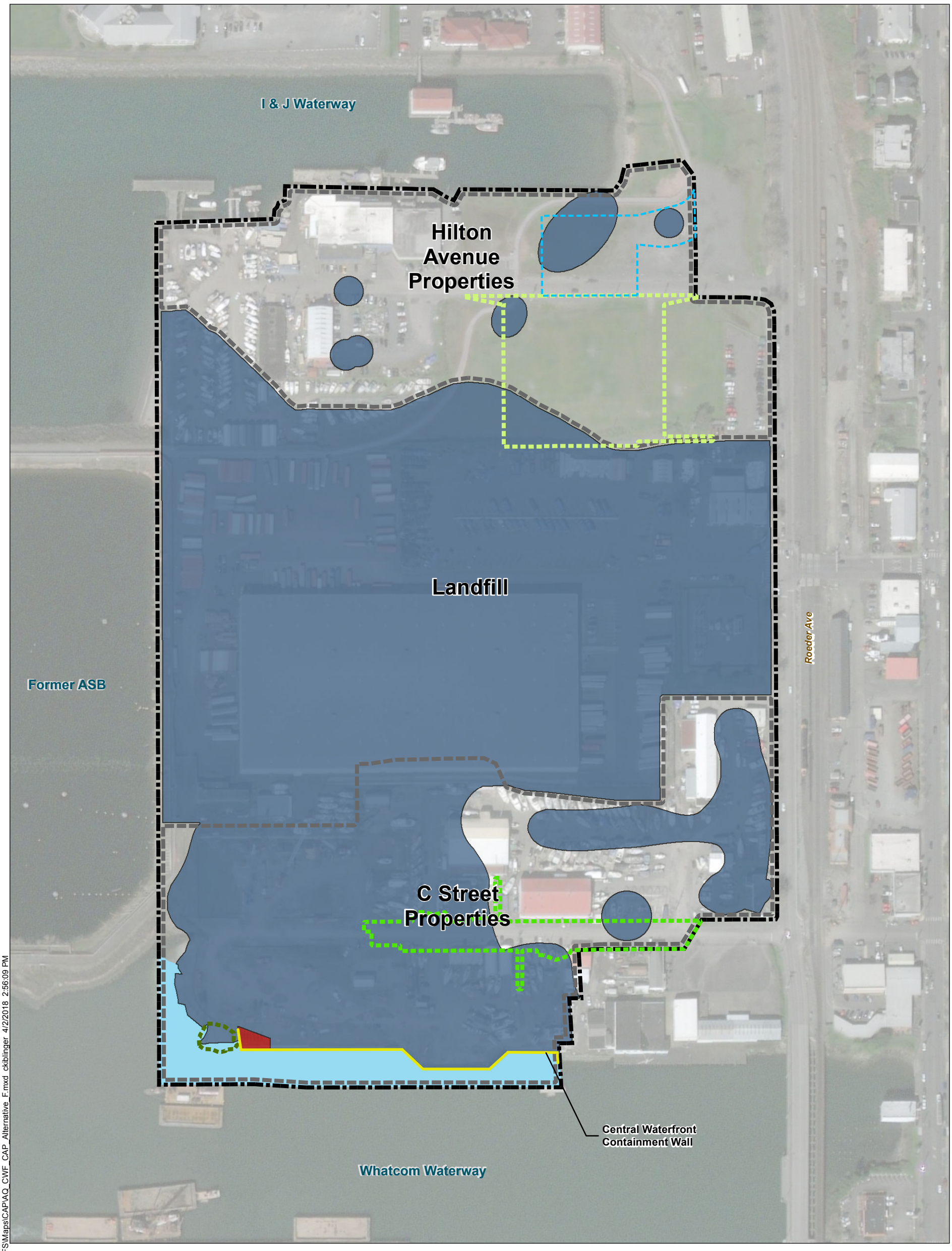
State of Washington



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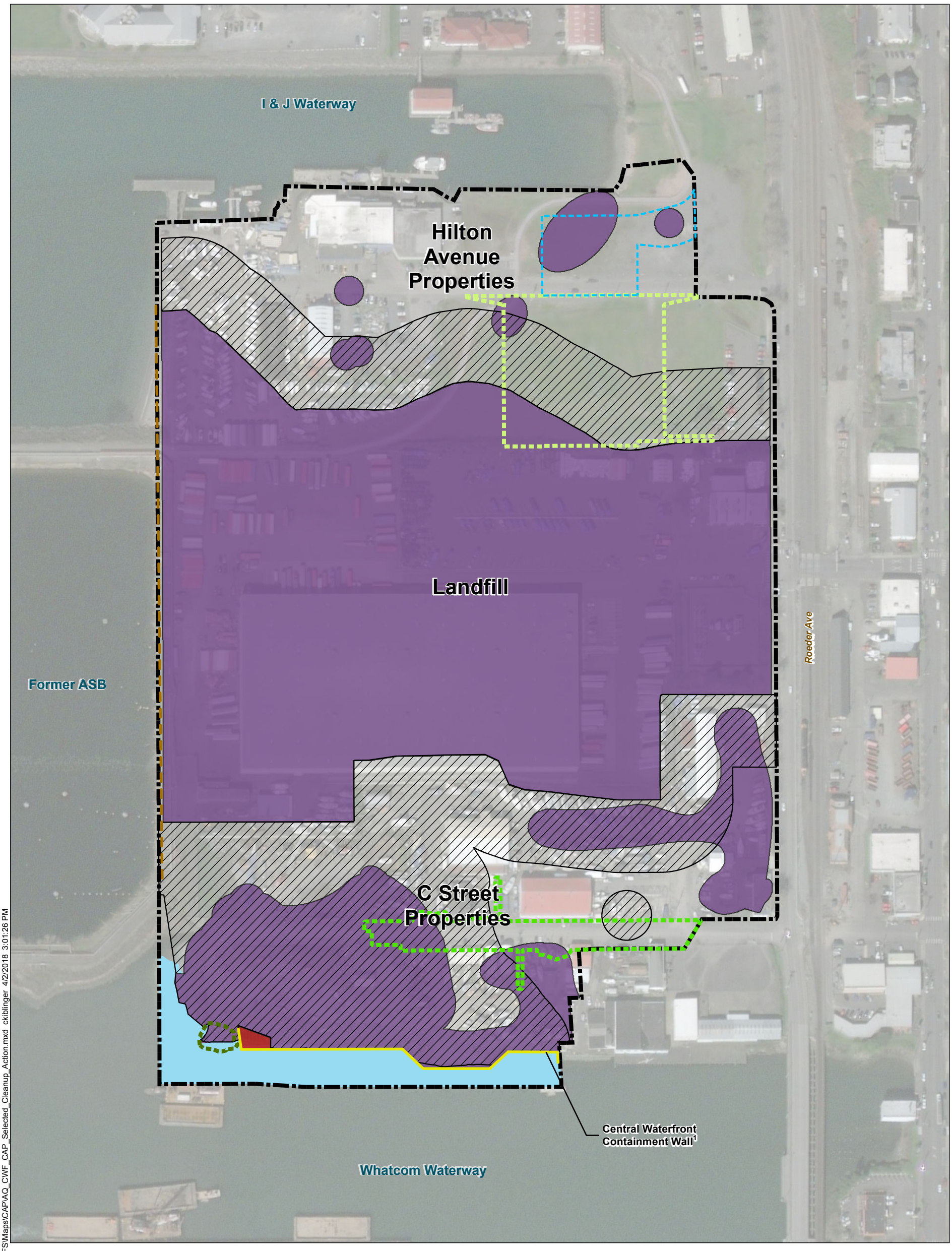
State of Washington

Figure 4-6
Alternative F
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA



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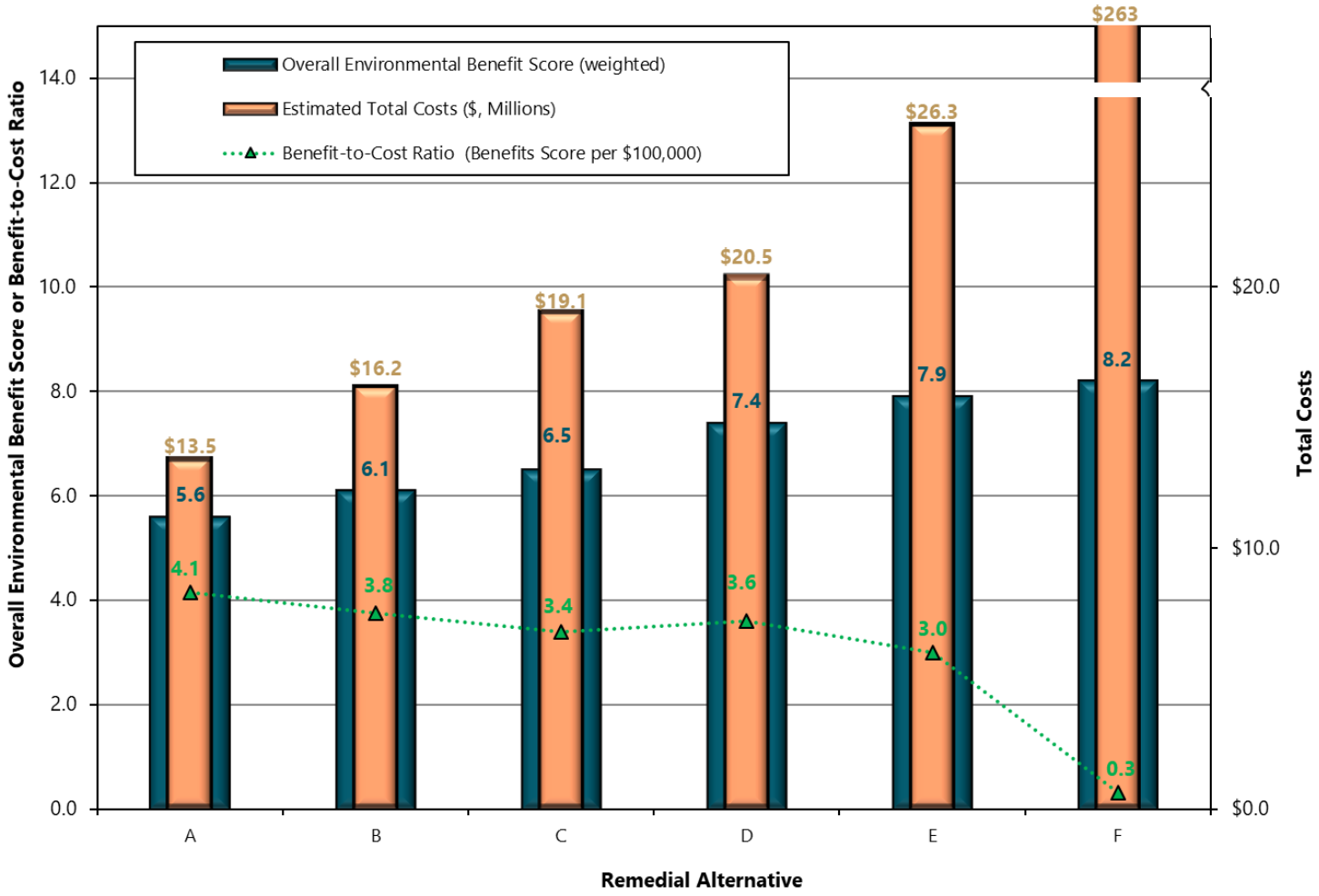
State of Washington

Figure 5-1
Selected Cleanup Action
Cleanup Action Plan
Central Waterfront Site
Bellingham, WA

Figure 5-2
Relationship Between Benefits and Costs



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State of Washington

Figure 5-2
Relationship Between Benefits and Costs
Cleanup Action Plan
Central Waterfront Site, Bellingham, WA

Appendix A
Pre-Design Compliance Monitoring Results

720 Olive Way, Suite 1900
Seattle, Washington 98101
206.287.9130

ANCHOR QEA

Memorandum

May 9, 2018

To: Brian Sato, Toxics Cleanup Program, Washington State Department of Ecology

From: Halah Voges and Sylian Rodriguez, Anchor QEA, LLC

cc: Ben Howard, Port of Bellingham
Julia Fitts and Bernadette Wright, Anchor QEA, LLC

Re: Central Waterfront Site – Agreed Order No. DE 3441 – Pre-Design Compliance Monitoring Results

This memorandum presents the results of the July 2017 Pre-Design Compliance Monitoring groundwater and porewater sampling at the Central Waterfront Site (Site) located in Bellingham, Washington. In accordance with the Washington State Department of Ecology (Ecology)-approved Pre-Design Compliance Monitoring Plan (Anchor QEA 2017) and Agreed Order No. DE 3441, focused Site groundwater and porewater sampling was conducted to evaluate the potential for seasonal variability on the presence/absence of metals (specifically copper) along the Site's southeastern shoreline. These samples were collected to evaluate whether the groundwater-to-surface-water pathway is complete, and to determine the need for an active remedial technology at the Site to address any residual groundwater contamination. The sampling methods, data quality assessment, analytical chemistry results, and conclusions are summarized in the following sections.

Purpose and Background

In June 2016, Ecology identified the need for supplemental compliance monitoring data to evaluate current groundwater, porewater, and seep quality in certain areas of the Site's western (nearshore area of the C Street Properties subarea) and southern shorelines (adjacent to containment wall structures that were installed as stabilization and source control measures for the Phase 1 Whatcom Waterway cleanup). Compliance monitoring was performed during two low tide sampling events in July 2016 and November 2016.

Compliance monitoring results were incorporated into the Remedial Investigation/Feasibility Study (RI/FS) (Anchor QEA 2018) to assist development and evaluation of remedial alternatives and selection of the Cleanup Action for the Site. Remedial alternatives A through E included a contingent targeted groundwater treatment element on the southeastern portion of the C Street Properties subarea to prevent metals-contaminated groundwater from migrating into surface water and sediment. This contingent action was based on dissolved copper concentrations exceeding screening levels in a groundwater sample from monitoring well CWF-CW-2 during the July 2016 sampling event. Groundwater was sampled again at CWF-CW-2 in November 2016 and porewater was sampled at a downgradient location (CWF-PW-4) situated in an armored riprap area along the Site

shoreline that is part of the recently completed Whatcom Waterway Phase 1 sediment cap. Dissolved copper levels in groundwater were below the screening levels during the November 2016 sampling event. The porewater sample downgradient of the groundwater sample had detection limits greater than screening levels. Detection limits for these samples were elevated due to sample dilutions that were necessary because of the elevated total dissolved solids and sodium content of the samples. Because the detection limits were elevated, it cannot be stated with certainty that actual concentrations of all analytes (including copper) were below the screening levels, even though copper was not detected in the sample.

At Ecology's request, an additional groundwater and porewater sampling event was conducted in July 2017 to further evaluate the potential for seasonal variability on the presence/absence of metals (specifically copper) along the Site's southeastern shoreline. During this low-tide sampling event, groundwater was resampled at CWF-CW-2 and porewater was resampled at downgradient location CWF-PW-4 (Figure 1). The results of the July 2017 sampling event are summarized below.

Investigation Methods

Groundwater and porewater sampling were conducted by Anchor QEA in accordance with the Ecology-approved Pre-Design Compliance Monitoring Plan (Anchor QEA 2017). Analytical Resources, Inc. (ARI) performed the chemical analysis and data validation was conducted by Anchor QEA. Field sampling logs are provided in Attachment 1. Laboratory analytical data reports and data validation reports are provided as Attachments 2 and 3, respectively.

Groundwater Sampling

Groundwater sampling was performed at existing monitoring well CWF-CW-2 (Figure 1), consistent with procedures described in the Draft Central Waterfront RI/FS Sampling and Analysis Plan (RETEC 2007). Groundwater depth and water quality parameters were measured and recorded prior to sampling. Groundwater was sampled from the approximate middle of the well screen interval using low-flow methodology (peristaltic pump with dedicated tubing). Prior to sampling, the monitoring well was purged and groundwater was allowed to re-equilibrate (i.e., recharge). Once water quality parameters stabilized, groundwater was sampled. Sampling was performed during low-tide conditions.

The groundwater sample from CWF-CW-2 was analyzed for total/dissolved metals (field filtered). Due to potential salinity interference from adjacent marine water, metals analyses were conducted using inductively coupled plasma mass spectrometry (ICP-MS) instrumentation with Universal Cell Technology (UCT).

Porewater Sampling

A porewater sample was collected downgradient of monitoring well CWF-CW-2 (station CWF-PW-4; Figure 1) using a stainless-steel drive point piezometer with a 6-centimeter-long screen. The drive point piezometer was manually driven into the cap until the screen was fully submerged into the filter cap material, approximately 24 inches below the sediment-surface water interface. Once installed, porewater was extracted using a peristaltic pump and dedicated sample tubing. Porewater quality parameters were continuously monitored; sampling proceeded after parameters stabilized. Sampling was performed during low tide conditions.

The porewater sample from station CWF-PW-4 was analyzed for total/dissolved metals (field filtered). As with groundwater, porewater metals analyses were conducted using ICP-MS instrumentation in UCT to reduce potential salinity interference.

Data Quality Assessment

This section provides information about data quality, including field and laboratory quality control (QC) measures and data validation findings. The laboratory data reports are provided in Attachment 2. A detailed data validation report is provided in Attachment 3.

Field Data Quality

Field QC samples consisted of one porewater field duplicate sample collected from station CWF-PW-4. Each bottle for the field duplicate was collected sequentially after the initial sample and labeled with a unique sample identification. The field duplicate was analyzed for total/dissolved metals (field filtered), and metals analyses were conducted using ICP-MS instrumentation in UCT. The precision of the field samples was evaluated by calculating the relative percent difference (RPD) when results were above the reporting limit (RL), or the difference if the sample or field duplicate result was less than five times the RL. All RPDs or difference values were within control limits; therefore, no data were qualified.

Analytical Data Quality

Laboratory control evaluations consisted of the following:

- Method blanks were analyzed at the required frequencies and were free of target analytes.
- Accuracy was evaluated by analyzing laboratory control samples (LCS) and matrix spikes (MS) at the required frequencies. All LCS and MS recoveries were within laboratory control limits.
- Precision was evaluated by field and laboratory duplicate RPD values. Sample result values less than five times the RL may have exaggerated RPD values; therefore, if the sample or duplicate was less than five times the RL, then sample results were evaluated by the difference between them using the control limit of ± 1x RL. All duplicate RPD values and/or duplicate difference result values were within control limits.

The validation report determined that the laboratory followed the specified analytical methods and all requested sample analyses were conducted within holding times. Overall data quality objectives were met and all data are acceptable as reported.

Investigation Results

This section summarizes the analytical testing results for groundwater and porewater samples collected during the July 2017 compliance monitoring event. Table 1 presents the results of these analyses screened against the Site-specific Central Waterfront RI/FS (Anchor QEA 2018) groundwater screening levels (along with previous compliance monitoring events in 2016 for reference).

Chemical Screening

Dissolved metals concentrations in the July 2017 samples are non-detect and/or below the Site-specific screening levels (Table 1), with the exceptions discussed below for copper, nickel, mercury, and silver.

- Dissolved copper concentrations in porewater are non-detect (i.e., for both parent and field duplicate samples); however, the reporting limit for dissolved copper is elevated (and above the screening level) due to interferences associated with high salinity and total dissolved solids in these samples. The dissolved copper concentration in groundwater is below the screening level.
- Dissolved nickel concentrations in porewater slightly exceed the screening level. Nickel levels in groundwater are below the screening level.
- Dissolved mercury concentrations in both groundwater and porewater are non-detect with laboratory reporting limits above the screening level.
- Dissolved silver concentrations in porewater are non-detect with laboratory reporting limits above the groundwater screening level. Silver concentrations in groundwater are non-detect and below the screening level.

Conclusions

The results of the July 2017 Pre-Design Compliance Monitoring event confirm, together with results from the 2016 compliance monitoring events, that the seasonal variability of metals concentrations in groundwater and porewater at the monitoring stations is low, that groundwater contaminants are not migrating from upland areas of the Site to sediment (i.e., into porewater), and that the groundwater-to-surface-water pathway along the Site's southern shoreline is incomplete. As such, a contingent targeted treatment for groundwater (i.e., identified in Alternatives A through E of the RI/FS for the east portion of the C Street Properties subarea; Figure 1) is not warranted and therefore, is not retained in the Selected Cleanup Action described in the Cleanup Action Plan.

References

Anchor QEA, 2017. *Central Waterfront Site – Agreed Order No. DE 3441 – Pre-Design Compliance Monitoring Plan*. Prepared for Ecology on behalf of the Port of Bellingham by Anchor QEA. July 2017.

Anchor QEA, 2018. *Final Remedial Investigation and Feasibility Study Report, Central Waterfront Site, Bellingham, Washington*. Prepared for the Port of Bellingham by Anchor QEA. March 2018.

RETEC, 2007. *Draft Work Plan for Remedial Investigation & Feasibility Study, Central Waterfront Site, Bellingham, WA*. Prepared for the Port of Bellingham by The RETEC Group, Inc. and S.S. Papadopulos & Associates. March 9, 2007.

Table

Table 1
Pre-Design Compliance Monitoring Results
CWF-CW-2 and CWF-PW-4

	Location ID	CWF-CW-2			CWF-PW-4			
	Sample ID	CWF-CW-2-07202016	CWF-CW-2-111416	CWF-CW-02-20170724	CWF-PW-4-111416	CWF-PW-104-111416	CWF-PW-04-20170724	CWF-PW-104-20170724
	Sample Date	7/20/2016	11/14/2016	07/24/2017	11/14/2016	11/14/2016	07/24/2017	07/24/2017
	Matrix	Groundwater	Groundwater	Groundwater	Porewater	Porewater	Porewater	Porewater
	Sample Type	Normal	Normal	Normal	Normal	Field Duplicate	Normal	Field Duplicate
	Screening Level							
Metals, Total (µg/L)								
Antimony	--	**2.6**	**0.504**	**3.74**	**0.520 J**	4 U	4 U	4 U
Arsenic	5.0	**0.9**	**1.45**	**1.4**	**3.42 J**	**2.18 J**	**3.3 J**	**2.36 J**
Barium	--	**67**	**102**	**86.5**	**48.6**	**36**	**143**	**150**
Beryllium	--	0.4 U	2 U	1 U	4 U	4 U	4 U	4 U
Cadmium	8.8	0.2 U	0.1 U	0.5 U	2 U	**0.74 J**	2 U	2 U
Chromium	260	**16**	**14.2**	**13.5**	**7.96 J**	**8.44 J**	**17.2**	**15.2**
Chromium VI	50	10 UJ	13 U	13 U	13 U	13 U	13 U	13 U
Copper	3.1	**14**	**7.3***	**7.73**	4 U*	4 U*	4 U*	4 U*
Lead	8.1	**1.2**	**0.806**	**1.05**	**1.48 J**	**1.44 J**	2 U	2 U
Mercury	0.059	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	8.2	**4**	**3.79**	**2.96**	**4.84 J**	**2.88 J**	**10.3**	**11.5**
Selenium	71	2.5 U	**0.811**	2.5 U	10 U	10 U	10 U	10 U
Silver	1.9	0.4 U	2 U*	1 U	2 U*	2 U*	6 U*	6 U*
Thallium	--	0.4 U	0.2 U	1 U	4 U	4 U	4 U	4 U
Zinc	81	**13 J**	40 U*	**29.4**	40 U*	**20.8 J***	**22.3 J**	**25.8 J**
Metals, Dissolved (µg/L)								
Antimony	--	**3**	4 U	**3.64**	4 U	4 U	4 U	4 U
Arsenic	5.0	**0.8 J**	**1.06 J**	**1.12**	**1.40 J**	**2.06 J**	**3.34 J**	**2.92 J**
Barium	--	**69**	**97.4**	**84.5**	**48.7**	**27.1**	**142**	**140**
Beryllium	--	1 U	4 U	1 U	4 U	4 U	4 U	4 U
Cadmium	8.8	0.5 U	2 U	0.5 U	2 U	2 U	2 U	2 U
Chromium	260	**16**	**12.4**	**7.41**	**7.14 J**	**7.48 J**	**13.5**	**13.1**
Copper	3.1	**10**	**0.8 J***	**2.33 J**	4 U*	4 U*	4 U*	4 U*
Lead	8.1	**0.7**	2 U	0.5 U	2 U	2 U	2 U	2 U
Mercury	0.059	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	8.2	**5**	**4.02 J**	**2.58**	**2.44 J**	**2.00 J**	**10.9**	**11.6**
Selenium	71	3 U	10 U	2.5 U	10 U	10 U	10 U	10 U
Silver	1.9	1 U	2 U*	1 U	2 U*	2 U*	6 U*	6 U*
Thallium	--	1 U	4 U	1 U	4 U	4 U	4 U	4 U
Zinc	81	**14.2 J**	40 U*	**20.8**	40 U*	**21.9 J***	**22.6 J**	**22.9 J**

Notes:

Detected concentration is greater than Central Waterfront FS Groundwater screening level

Nondetected concentration is greater than Central Waterfront FS Groundwater screening level

* Result of sample re-analysis

Bold: Detected result

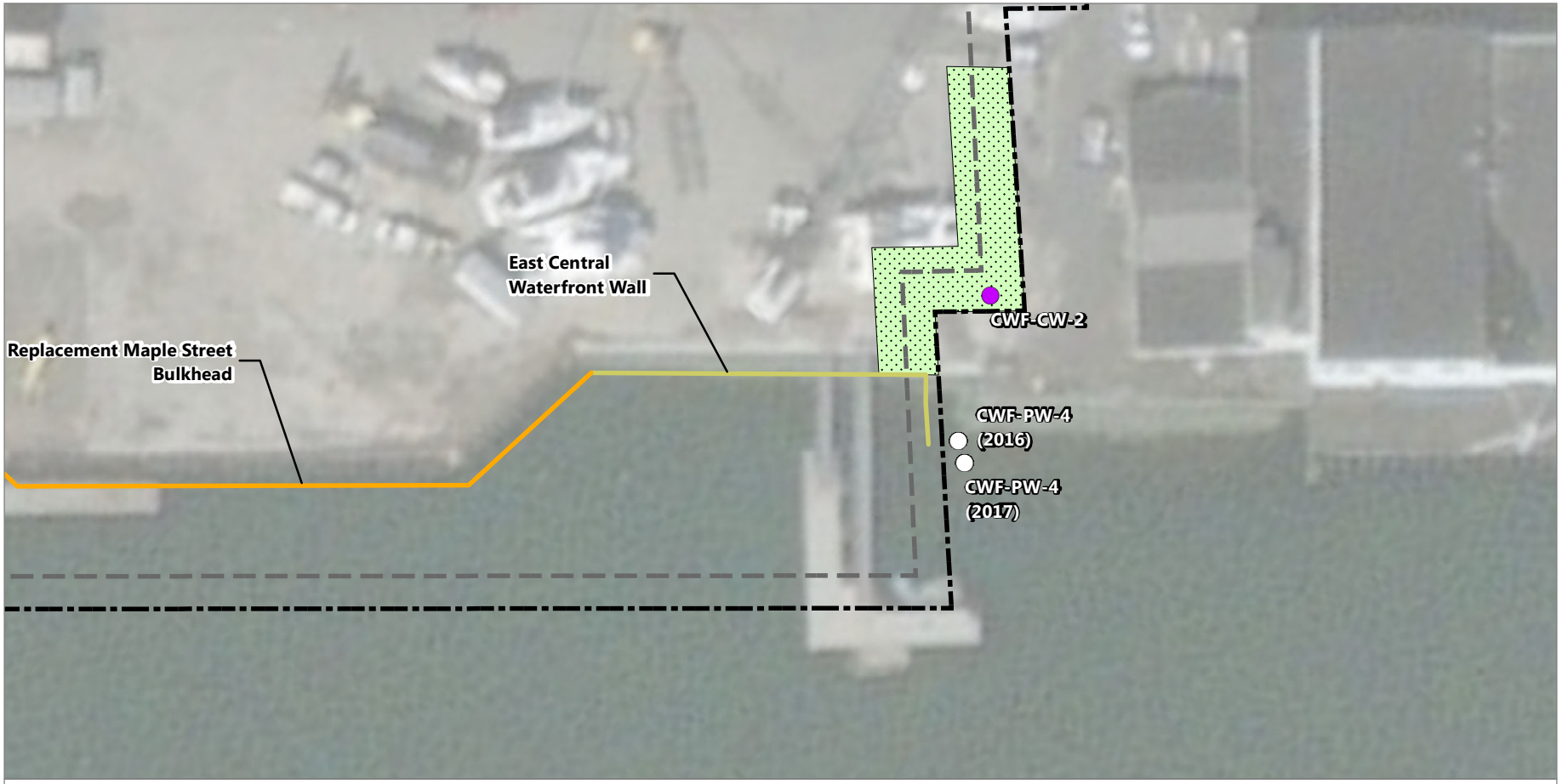
J: Estimated value

U: Compound analyzed, but not detected above detection limit

UJ: Compound analyzed, but not detected above estimated detection limit

µg/L: micrograms per liter

Figure



LEGEND:

- Groundwater Sampling Location
- Porewater Sampling Location
- Contingent Targeted Treatment
- Central Waterfront Site Boundary
- RI Subarea Boundary

NOTE:
1. Extent of Contingent Targeted Treatment derived in the Central Waterfront Final Remedial Investigation and Feasibility Study Report (Anchor QEA 2018).
2. Aerial photo: esri 2016.

Project North / True North

0 50

Feet

Publish Date: 2018/04/24, 11:34 AM | User: ckiblinger
Filepath: \\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\CAP\AppxA\AQ_CWF_CAP_AppxA_PreDesign_Compliance_Monitoring.mxd

ANCHOR QEA

Figure 1
Sample Locations
Pre-Design Compliance Monitoring Results
Central Waterfront Site
Port of Bellingham, WA

Attachment 1
Field Sampling Logs

ANCHOR QEA

DATE: 7/24/2017

PROJECT NAME: Pre-design Compliance Mont

PROJECT NO: 120007-01.04, Task 15

DAILY SAFETY BRIEFING

PERSON CONDUCTING MEETING: JA

HEALTH & SAFETY OFFICER: JA

PROJECT MANAGER: HV

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/MSDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Near Miss Reporting Procedures
- ☑ Lifting Techniques
- ☑ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☑ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking
- ☐ Reviewed Prior Lessons Learned
- ☐ Other: Over head equipment

WEATHER CONDITIONS: Sunny, some wind (SE)

DAILY WORK SCOPE: Groundwater & pore-water

SITE-SPECIFIC HAZARDS: Slips, trips, falls (rip-rap), overhead crane

SAFETY COMMENTS:

ATTENDEES

PRINTED NAME	SIGNATURE
Bernadette Wright	
Jennifer Allen	

Daily Log

ANCHOR QEA

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

PROJECT NAME: CWF Compliance Monitoring **DATE:** 7/24/2017

SITE ADDRESS: C - Street, Bellingham WA **PERSONNEL:** JA, BW

WEATHER: **WIND FROM:** N | NE | E | SE | S | SW | W | NW

SUNNY | CLOUDY | RAIN | ?

LIGHT | MEDIUM | HEAVY

TEMPERATURE: °F 70 . °C [Circle appropriate units]

TIME	COMMENTS
0830	Arrived onsite at Landings at Colony Wharf to collect samples from CWF-PW-4 & CWF-MW-2. Boat staged over CWF-MW-2.
0835	Coordinated with Colony Wharf regarding boat stationing (they indicated that the vessel staged over MW-2 would be launched at approximately 9:30 AM
0945	Colony Wharf launched boat.
0948	Using a pribar, Anchor QEA prepped a pathway for the piezometer at CWF-PW-04. Material below rip-rap felt sandy. Black, silty material was suspended into the water column during this activity. Pizometer was then driven through the rip-rap to the sandy layer (approximately 4'-feet BSG).
1040	Attempted to pump porewater. Some water was extracted but the line was not continuously charged.
1051	Call N.S. to confirm flushing procedure.
10:55	Attempted first flush. Approximately 250 mL D.I. was pushed into the well, 250 mL was subsequently extracted. Porewater did not appear present.
11:00	Attempted second flush. 500 mL DI pumped into well. 300 mL extracted.
11:05	Attempted third flush. 500 mL DI pumped into well. 300 mL extracted. (clear extract). Next 300 mL contained black particulates. We continued flushing.
11:48	Collected CWF-PW-4-20170724.
1153	Collected CWF-PW-104-20170724.
1220	Broke down sampling equipment at CWF-PW-4 in preparation for sampling at CWF-MW-2.
1225	Break to allow Colony Wharf to launch vessel.

Signature: _____

Daily Log

ANCHOR QEA

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

PROJECT NAME: CWF Compliance Monitoring **DATE:** 7/24/2017

SITE ADDRESS: C-Street, Bellingham WA **PERSONNEL:** JA, BW

WEATHER: **WIND FROM:** N NE E SE S SW W NW

SUNNY CLOUDY RAIN ?

LIGHT MEDIUM HEAVY

TEMPERATURE: °F 70 . °C

[Circle appropriate units]

TIME	COMMENTS
12:30	Set up sampling equipment at station CWF-MW-2.
12:48	Initiated purge at CWF-MW-2. Continued purging until meter parameter equalized
1354	Collected groundwater sample at CWF-MW-2-20170724.
1420	Initiated breakdown of sampling equipment at CWF-MW-02.
1500	Checked out of site at Colony Wharf office. Went back to office to prepare samples for shipping.

Signature:

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Ave.
Bellingham, Washington 98225
(360) 733-4311

PROJECT NAME: CWF- **WELL ID:** CWF-PW-04

SITE ADDRESS: 1000 C St. **SAMPLE ID:** CWF-PW-04-07242017@1148

DUP ID: CWF-PW-104-07242017@1153

WIND FROM: N | NE | E | SE | S | SW | W | NW — (LIGHT) | MEDIUM | HEAVY

WEATHER: (SUNNY) | PRTLY CLOUDY | CLOUDY | RAIN **TEMPERATURE:** (°F) 70. °C [Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

[Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
/ /	:	.	---	~~8.82~~ Pore water	---		X 1	.
/ /	:	.	---	.	---	BW	~~X 3~~	.

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) (Peristaltic Pump) (C) Disposable Bailer

Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA

Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
500 mL HDPE	7/24/17	11:46	B	2	500 HNO3	(YES)	(NO)		total metals
500 mL HDPE	7/24/17	11:48	B	2	500 —	(YES)	(YES)		diss. metals
500 mL AG	7/24/17	11:46	B	2	500 —	(YES)	(NO)		Hex Chrom
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:			BW	YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		

Total Bottles (include duplicate count): 6

Analysis Allowed per Bottle Type

BOTTLE TYPE	ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
500 mL HDPE	Total and Dissolved Metals: (Ag) (As) (Be) (Cd) (Cr) (Cu) (Hg) (Ni) (Pb) (Sb) (Se) (Tl) (Zn) (Ba)
500 mL AG	(SVOCs) (PAHs) (TBT) (Pesticides) Hex Chrom
40 mL vial	(VOCs) (BTEX) (TPH-G)
Lg OJ HDPE	(TDS) (TSS)
Sm OJ HDPE	(Alkalinity) (Ammonia) (Dissolved Sulfide) (Chloride) (Nitrate) (Sulfate) (Chromium VI)
1L AG	(PCBs) (TPH-Dx) (Dioxins/Furans)

WATER QUALITY DATA

Purge Start Time: 11:10 30.12 mS/cm Depth of tubing (ft btoc): 80 ft

Meas.	Time	Cum. Volume	DTW (ft bTOC)	pH	E Cond (µS/cm)	Temp °C	DO (mg/L)	ORP mV	Water Quality (Color, Clarity)	TPS / turbidity (NTU)
1	11:20	1.5 L	.	7.13	~~30.01~~	23.1	1.64	164	clear, black particles	7.43
2	11:23	1.95 L	.	6.69	30.522	22.8	0.87	163.7	clear, slightly yellow	5.62
3	11:26	2.40 L	.	6.88	30.669	22.8	0.86	146.0	clear	3.69
4	11:29	2.85 L	.	6.94	30.772	22.9	0.78	135.2	clear	2.93
5	11:32	3.30 L	.	6.99	30.761	22.8	0.72	127.9	clear	2.55
6	11:35	3.75 L	.	6.99	30.693	22.9	0.72	122.7	clear	2.37
7	11:38	4.20 L	.	7.00	30.690	22.8	0.63	117.0	clear	1.99
8	11:41	4.65 L	.	6.97	30.562	22.7	0.57	112.0	"	1.73
9	11:44	5.10 L	.	6.95	30.536	22.8	0.52	108.4	"	1.76
10	11:47	5.55 L	.	6.96	30.486	22.8	0.53	106.1	"	1.57
11	:		.	.		.				
12	:		.	.		.				

[gallons or liters]

Conductivity measured in mS/cm, multiply by 1000 to get uS/cm

Turbidity before sample collection (NTU): **Turbidity after sample collection (NTU):**

Comments: pumping @ 150 mL/min, 0.45L/3min. Sampled @ 11:46

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Ave.
Bellingham, Washington 98225
(360) 733-4311

PROJECT NAME: CWF — **WELL ID:** CWF-CW-02
SITE ADDRESS: 1000 C ST — **SAMPLE ID:** CWF-CW-02-07242017
DUP ID: NA

WIND FROM: N, ~~NE~~, E, SE, S, SW, W, NW — LIGHT, MEDIUM, HEAVY
WEATHER: SUNNY, PRTLY CLOUDY, CLOUDY, RAIN — **TEMPERATURE:** (°F) 70 . °C
[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
/ /	12 :32	15.4	---	5.8	---	9.6	X 1	1 . ~~63~~ 56
/ /	:	.	---	.	---	.	X 3	4 . ~~89~~ 69

Gal/ft = (dia./2)² x 0.163: 1" = 0.041; (2" = 0.163); 3" = 0.367; 4" = 0.653; 6" = 1.469; 10" = 4.080; 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer — Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA — Sample Depth: — [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	√
500mL HDPE	7/24/17	13:54	B	1	500	HNO3	YES	NO		total met
500mL HDPE	7/24/17	13:54	B	1	500		YES	YES		diss met
Lg OJ HDPE	7/24/17	13:54	B	1	500		YES	NO		hex chrom
Sm	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:					YES	NO		

Total Bottles (include duplicate count): 3

Analysis Allowed per Bottle Type

BOTTLE TYPE	ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
500 mL HDPE	Total and Dissolved Metals: (Ag) (As) (Be) (Cd) (Cr) (Cu) (Hg) (Ni) (Pb) (Sb) (Se) (Tl) (Zn) (Ba)
500 mL AG	(SVOCs) (PAHs) (TBT) (Pesticides)
40 mL vial	(VOCs) (BTEX) (TPH-G)
Lg OJ HDPE	(TDS) (TSS) ~~Hexavalent Chromium~~ BW
Sm OJ HDPE	(Alkalinity) (Ammonia) (Dissolved Sulfide) (Chloride) (Nitrate) (Sulfate) (Chromium VI)
1L AG	(PCBs) (TPH-Dx) (Dioxins/Furans)

WATER QUALITY DATA — Purge Start Time: 12:48 — Depth of tubing (ft btoc): 10 ft

Meas.	Time	Cum. Volume (L)	DTW (ft bTOC)	pH	E Cond (mS/cm)	Temp °C	DO (mg/L)	ORP (mV)	Water Quality (Color, Clarity)	Turbidity (NTU)
1	12:56	2.0	5.85	7.73	6.835	18.8	0.75	-39.4	clear, black particles	3.63
2	13:01	2.6	5.85	6.84	6.998	18.5	0.43	-51.3	"	3.12
3	13:04	3.2	5.85	6.84	7.307	18.3	0.38	-56.8	"	2.06
4	13:07	3.8	5.80	6.77	7.454	18.2	0.35	-58.9	"	1.79
5	13:10	4.4	5.83	6.72	7.538	18.3	0.32	-61.7	"	1.99
6	13:13	5.0	5.82	6.73	7.701	18.3	0.30	-62.6	"	1.79
7	13:16	5.6	5.82	6.74	7.879	18.5	0.29	-64.0	"	1.60
8	13:19	6.2	5.87	6.73	8.065	18.4	0.27	-64.9	"	1.52
9	13:22	6.8	5.88	6.75	8.032	18.3	0.27	-66.2	"	1.17
10	13:25	7.4	5.86	6.74	8.133	18.3	0.25	-67.2	"	1.63
11	13:28	8.0	5.86	6.75	8.221	18.3	0.24	-68.9	"	1.41
12	13:31	8.6	5.88	6.76	8.231	18.2	0.26	-68.7	"	1.45

[gallons or liters]

Turbidity before sample collection (NTU): **Turbidity after sa**

Conductivity measured in mS/cm, multiply by 1000 to get uS/cm

Comments: pumping @ 200 ml/min

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA
1605 Cornwall Avenue
Bellingham, WA 98225
(360) 733-4311

PROJECT NAME: CWF
WELL ID: CWF-CW-02
SITE ADDRESS: 1050 C St. SAMPLE
~~BLIND~~ ID: CWF-CW-02-07242017
PROJECT NUMBER:
DUP ID: NA

WATER QUALITY DATA (L) | Purge Start Time: : | Method: Low Flow Peristaltic Pump | Pump/Bailer Inlet Depth:

Time	DTW (ft)	Purge ~~(gal)~~	pH	E Cond (µS)	°F Temp °C	DO (mg/L)	ORP	TDS	Salinity	Turbidity	Water Quality
1334	5.89	9.2	6.73	8.385	18.2	0.26	-68.9			0.96	clear
1337	5.87	9.8	6.75	8.323	18.3	0.26	-70.1			0.85	"
1340	5.88	10.4	6.77	8.338	18.3	0.26	-70.9			0.92	"
1343	5.89	11.0	6.74	8.339	18.2	0.24	-71.6			0.77	"
1347	5.88	11.6	6.73	8.508	18.2	0.25	-720			0.77	"
1350	5.87	12.2	6.73	8.520	18.2	0.25	-72.4			0.76	"
1353	5.89	12.8	6.74	8.508	18.3	0.24	-72.9			0.91	"

Conductivity measured in mS/cm, multiply by 1000 to get uS/cm

(Cummulative Totals) (circle units) (Clarity, Color)

Notes: Sampled @ 1354 CWF-CW-02-07242017

Sampler: Bernadette Wright
(Printed Name)

(Signature)

Attachment 2
Laboratory Analytical Data Reports

(Provided under separate cover)

Attachment 3
Data Validation Reports

720 Olive Way, Suite 1900
Seattle, Washington 98101
206.287.9130

ANCHOR QEA

Data Validation Report – EPA Stage 2A

August 29, 2017

Project: Central Waterfront Site RI/FS/Interim Compliance Monitoring

Project Number: 120007-01.01

This report summarizes the review of analytical results for two water samples and one field duplicate sample collected on July 24, 2017. The samples were collected by Anchor QEA, LLC, and submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. The following analytical parameter results were reviewed in this report:

- Total and dissolved metals by U.S. Environmental Protection Agency (USEPA) methods 200.8, 6010C, and 7470A
- Hexavalent chromium (Cr+6) by USEPA method 7196A

Sample IDs, associated sample delivery groups (SDGs), matrices, and analyses are presented in Table 1.

Table 1
Sample IDs, Matrices, Analyses, and SDGs

Sample ID	Lab SDG	Lab Sample ID	Matrix	Analyses
CWF-PW-04-20170724	17G0267	17G0267-01 / 17G0267-02	Water	Metals, Cr+6
CWF-PW-104-20170724	17G0267	17G0267-03 / 17G0267-04	Water	Metals, Cr+6
CWF-CW-02-20170724	17G0267	17G0267-05 / 17G0267-06	Water	Metals, Cr+6

Notes:
SDG: sample delivery group

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QA/QC) guidelines outlined in the analytical procedures. Laboratory results were reviewed using the laboratory control limits and the following guidelines:

- Central Waterfront Site – Agreed Order No. DE3441 – Pre-Design Compliance Monitoring Plan (Anchor QEA 2017)
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition (USEPA 1986)
- National Functional Guidelines for Inorganic Superfund Data Review (USEPA 2017)

Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody forms were signed by ARI at the time of sample receipt. Samples were received in good condition and within the recommended temperature range.

Holding Times and Sample Preservation and Analytical Methods

Samples were appropriately preserved and analyzed within holding times.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes.

Field Quality Control

Field Duplicates

One field duplicate was collected in association with this sample set. Detected results are summarized in Table 2.

Table 2
Field Duplicate Summary

Analyte	CWF-PW-04-20170724	CWF-PW-104-20170732	RPD	Difference	RL
Total arsenic	3.3 µg/L	2.36 µg/L	--	0.94 µg/L	4 µg/L
Total barium	143 µg/L	150 µg/L	4.8%	--	--
Total chromium	17.2 µg/L	15.2 µg/L	--	2 µg/L	10 µg/L
Total nickel	10.3 µg/L	11.5 µg/L	--	1.2 µg/L	10 µg/L
Total zinc	22.3 µg/L	25.8 µg/L	--	3.5 µg/L	80 µg/L
Dissolved arsenic	3.34 µg/L	2.92 µg/L	--	0.42 µg/L	4 µg/L
Dissolved barium	142 µg/L	140 µg/L	1.4%	--	--
Dissolved chromium	13.5 µg/L	13.1 µg/L	--	0.4 µg/L	10 µg/L
Dissolved nickel	10.9 µg/L	11.6 µg/L	--	0.7 µg/L	10 µg/L
Dissolved zinc	22.6 µg/L	22.9 µg/L	--	0.3 µg/L	80 µg/L

Notes:
µg/L: microgram per liter
RL: reporting limit
RPD: relative percent difference

Result values less than five times the reporting limit (RL) may have exaggerated relative percent difference (RPD) values; therefore, if the sample or field duplicate result was less than five times the RL, the sample result is evaluated by the difference between them. All RPDs or difference values were within control limits; therefore, no data were qualified.

Laboratory Control Samples

Laboratory control samples (LCS) and were analyzed at the required frequency. All LCS recoveries were within laboratory control limits.

Matrix Spike and Matrix Spike Duplicate Samples

Matrix spike (MS) samples were analyzed at the required frequency and laboratory duplicates were analyzed in place of matrix spike duplicate (MSD) samples. All MS recoveries were within laboratory control limits.

Laboratory Duplicates

Laboratory duplicates were analyzed at the required frequency or in place of MSD samples. Parent and/or duplicate results that were less than five times the RL were evaluated by the difference between the results using the control limit of ± 1x RL. Duplicate RPDs and/or difference results were within control limits.

Method Reporting Limits and Analyte List

Reporting limits were acceptable as reported. All values were reported using the laboratory reporting limits. Values were reported as undiluted or, when diluted, the reporting limit reflects the dilution factor. Copper and silver reporting limits were elevated due to matrix interferences. Project action limits were not met for these compounds.

Overall Assessment

As was determined by this evaluation, the laboratory followed the specified analytical methods and all requested sample analyses were completed. Accuracy was acceptable as demonstrated by the LCS and MS recovery values. Precision was acceptable as demonstrated by the laboratory and field duplicate RPD values or difference values. All data are acceptable as reported.

References

Anchor QEA, 2017. Central Waterfront Site – Agreed Order No. DE3441 – Pre-Design Compliance Monitoring Plan. July 2017.

USEPA (U.S. Environmental Protection Agency), 1986. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. EPA-530/SW-846.

USEPA, 2017. National Functional Guidelines for Inorganic Superfund Data Review. Office of Superfund Remediation and Technology Innovation. United States Environmental Protection Agency. EPA-540-R-2017-001. January 2017.

Appendix B
Northeast Bank Solids Sampling Memorandum

720 Olive Way, Suite 1900
Seattle, Washington 98101
206.287.9130

ANCHOR QEA

Memorandum

May 9, 2018

To: Brian Sato, Toxics Cleanup Program, Washington State Department of Ecology

From: Halah Voges and Sylian Rodriguez, Anchor QEA, LLC

cc: Ben Howard, Port of Bellingham

Re: Central Waterfront Site – Agreed Order No. DE 3441 – Northeast Bank Solids Sampling

This memorandum presents the results of the March 15, 2018, northeast bank solids sampling at the Central Waterfront Site (Site) located in Bellingham, Washington. At the request of the Washington State Department of Ecology (Ecology) and Agreed Order No. DE 3441, focused sampling of the white sandy, fine-grained material found in surface soils along the southeast bank of the I&J Waterway shoreline (within the Hilton Avenue Properties subarea), was conducted to evaluate material chemical characteristics and associated potential impacts to adjacent sediments.

The white sandy, fine-grained material was thought to be potential "olivine sands" associated with former Olivine operations). The material was exposed in the upper 1 foot of the I&J Waterway shoreline, due to bank erosion at the end of the east bulkhead adjacent to the former Olivine Uplands area. Soil samples were collected to assess whether the material is contaminated and whether an active remedial technology (targeted removal and/or capping) is necessary at the Site to address any potential residual soil contamination. The sampling methods, data quality assessment, analytical chemistry results, and conclusions are summarized in the following sections.

Investigation Methods

The Port of Bellingham conducted soil sampling, Analytical Resources, Inc. (ARI) performed the chemical analysis, and Anchor QEA conducted data validation. Laboratory analytical data reports and data validation reports are provided as Attachments 1 and 2, respectively.

Two soil samples (HA-01 and HA-02) were collected from surface soils (0 to 1 feet below ground surface) at the top of bank along the I&J Waterway shoreline, at the end of the east bulkhead adjacent to the former Olivine Upland area (Figure 1). Samples were collected using a shovel because the white sandy, fine-grained material was already exposed.

The two soil samples were analyzed for metals and polycyclic aromatic hydrocarbons (PAHs).

Data Quality Assessment

This section provides information about data quality, including laboratory quality control (QC) measures and data validation findings. The laboratory data reports are provided in Attachment 1. A detailed data validation report is provided in Attachment 2.

Analytical Data Quality

Laboratory control evaluations consisted of the following:

- Method blanks were analyzed at the required frequencies and were free of target analytes.
- Accuracy was evaluated by analyzing laboratory control samples (LCS) and matrix spikes (MS) at the required frequencies. All LCS and MS recoveries were within laboratory control limits.
- Precision was evaluated for laboratory duplicate relative percent difference (RPD) values. Sample result values less than five times the RL may have exaggerated RPD values; therefore, if the sample or duplicate was less than five times the RL, then sample results were evaluated by the difference between them using the control limit of ± 1x RL. All duplicate RPD values and/or duplicate difference result values were within control limits.

The validation report determined that the laboratory followed the specified analytical methods and all requested sample analyses were conducted within holding times. Overall data quality objectives were met and all data are acceptable as reported.

Investigation Results

This section summarizes the analytical testing results for the soil samples collected on March 15, 2018. Table 1 presents the results of these analyses screened against the Central Waterfront RI/FS (Anchor QEA 2018) soil cleanup levels for the Hilton Avenue Properties subarea.

Metal concentrations in the March 2018 soil samples are non-detect and/or below the Hilton Avenue Properties subarea cleanup levels (Table 1), with the exception of arsenic. Although arsenic concentrations in both samples are non-detect, the reporting limits were elevated (2 to 4 times above the cleanup level).

Naphthalene and carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentrations in the March 2018 soil samples are non-detect and/or below the Hilton Avenue Properties subarea cleanup levels (Table 1).

Conclusions

The results of the March 2018 sampling of white sandy, fine-grained material demonstrate that this material is not contaminated and is not impacting adjacent sediments. The need for its potential targeted removal or capping is not warranted and, therefore, it is not retained in the Selected Cleanup Action described in the Cleanup Action Plan.

References

Anchor QEA, 2018. *Final Remedial Investigation and Feasibility Study Report, Central Waterfront Site, Bellingham, Washington*. Prepared for the Port of Bellingham by Anchor QEA. March 2018.

Table

Table 1
Northeast Bank Solids Sampling Results

	Location ID	HA-01_1803	HA-02_1803
	Sample ID	HA-01_20180315	HA-02_20180315
	Sample Date	3/15/2018	3/15/2018
	Depth	0-1 ft	0-1 ft
	Sample Type	N	N
	Matrix	SO	SO
	HiltonSoilCUL		
Metals (mg/kg)			
Arsenic	20	80.3 U	44.7 U
Barium	--	**9.79**	2.68 U
Cadmium	80	**2.05 J**	1.79 U
Chromium	--	**4.05 J**	4.47 U
Copper	3200	3.21 U	1.79 U
Lead	250	32.1 U	**6.2 J**
Mercury	24	0.0418 U	0.0361 U
Nickel	1600	**6.3 J**	**22.5**
Selenium	400	**31.7 J**	**22 J**
Silver	400	4.82 U	**0.53 J**
Zinc	24000	**5.47 J**	**9.81**
Polycyclic Aromatic Hydrocarbons (µg/kg)			
1-Methylnaphthalene	--	4.84 U	4.82 U
2-Methylnaphthalene	--	4.84 U	**2.59 J**
Acenaphthene	--	4.84 U	4.82 U
Acenaphthylene	--	4.84 U	4.82 U
Anthracene	--	4.84 U	4.82 U
Benzo(a)anthracene	--	**3.86 J**	4.82 U
Benzo(a)pyrene	--	4.84 U	4.82 U
Benzo(b)fluoranthene	--	**8.2**	4.82 U
Benzo(b,j,k)fluoranthenes	--	**15.8**	9.64 U
Benzo(g,h,i)perylene	--	4.84 U	4.82 U
Benzo(j)fluoranthene	--	**3.58 J**	4.82 U
Benzo(k)fluoranthene	--	**3.78 J**	4.82 U
Chrysene	--	**16.7**	4.82 U
Dibenzo(a,h)anthracene	--	4.84 U	4.82 U
Dibenzofuran	--	4.84 U	**8.2**
Fluoranthene	--	**35.7**	**25**
Fluorene	--	4.84 U	**14.1**
Indeno(1,2,3-c,d)pyrene	--	4.84 U	4.82 U
Naphthalene	1600000	4.84 U	4.82 U
Phenanthrene	--	**10.7**	**84.6**
Pyrene	--	**26.1**	**9.95**
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)	140	**6.235 J**	4.82 U

Notes:

Detected concentration is greater than the soil cleanup level for the Hilton Avenue Properties subarea

Nondetected concentration is greater than the soil cleanup level for the Hilton Avenue Properties subarea

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

mg/kg: milligrams per kilogram

µg/kg: micrograms per kilogram

TEQ: toxic equivalent

Figure

LEGEND:

- Location of Bank Solids Sampling
- Extent of Landfill Refuse
- Landfill Perimeter
- Subarea Boundary
- Central Waterfront Site Boundary

Project North
True North
0
200
Feet

Publish Date: 2018/07/16, 11:08 AM | User: ckiblinger
Filepath: \\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\CAP\AppxB\AQ_CWF_CAP_AppxB_Olivine_Sands_Sampling.mxd

ANCHOR QEA

Figure 1
Sample Locations
Northeast Bank Solids Sampling
Central Waterfront Site
Port of Bellingham, WA

Attachment 1
Laboratory Analytical Data Reports

Analytical Resources, Incorporated
Analytical Chemists and Consultants

02 April 2018

Ben Howard
Port of Bellingham
1801 Roeder Ave
Bellingham, WA 98225

RE: Hilton

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)	Associated SDG ID(s)
18C0288	N/A

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

4611 S. 134th Place, Suite 100 • Tukwila, WA 98168 • Ph: (206) 695-6200 • Fax: (206) 695-6202

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 180288	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: Port of Bellingham	Phone: 360-676-2500	Date: 3/15/18	Ice Present?
Client Contact: Ben Howard		No. of Coolers:	Cooler Temps:
Client Project Name: Hilton			
Client Project #: Central Waterfront	Samplers: BH		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)
www.arilabs.com

Sample ID	Date	Time	Matrix	No. Containers	PAHs (SIM)	Metals ①							Notes/Comments
HA-01	3/15/18	1140	Soil	2	X	X							① Metals include: Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc
HA-02	↓	1147	↓	2	X	X							

Analysis Requested

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Ben Howard	Printed Name: Brandon Fisk	Printed Name:	Printed Name:
	Company: Port of Bellingham	Company: ARI	Company:	Company:
	Date & Time: 3/15/18 1605	Date & Time: 3/15/18 1015	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
HA-01	18C0288-01	Solid	15-Mar-2018 11:40	16-Mar-2018 10:15
HA-02	18C0288-02	Solid	15-Mar-2018 11:47	16-Mar-2018 10:15

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Case Narrative

Polynuclear Aromatic Hydrocarbons (PAH) - EPA Method SW8270D-SIM

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Total Metals - EPA Method 6010C

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Total Hg - EPA Method 7470/7471

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

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WORK ORDER

18C0288

Client: Port of Bellingham
Project: Hilton
Project Manager: Kelly Bottem
Project Number: Hilton-1

Report To:
Port of Bellingham
Ben Howard
1801 Roeder Ave
Bellingham, WA 98225
Phone: (360) 715-7365
Fax: -

Invoice To:
Port of Bellingham
Ben Howard
1801 Roeder Ave
Bellingham, WA 98225
Phone :(360) 715-7365
Fax: -

Date Due:	30-Mar-2018 18:00 (10 day TAT)		
Received By:	Brandon Fisk	Date Received:	16-Mar-2018 10:15
Logged In By:	Jacob Walter	Date Logged In:	16-Mar-2018 15:11

Samples Received at: **5.8°C**

Intact, properly signed and dated custody seals attached to outside of cooler(s)	No	Custody papers included with the cooler	Yes
Custody papers properly filled out (in, signed, analyses requested, etc)	Yes	Was a temperature blank included in the cooler	No
Was sufficient ice used (if appropriate)	Yes	All bottles sealed in individual plastic bags	No
All bottles arrived in good condition (unbroken)	Yes	All bottle labels complete and legible	Yes
Number of containers listed on COC match number received	Yes	Bottle labels and tags agree with COC	Yes
Correct bottles used for the requested analyses	Yes	All VOC vials free of air bubbles	No
Analyses/bottles require preservation (attach preservation sheet excluding VOC)	No	Sufficient amount of sample sent in each bottle	Yes
Sample split at ARI	No		

Analysis	Due	TAT	Expires	Comments

WORK ORDER

18C0288

Client: Port of Bellingham **Project Manager:** Kelly Bottem

Project: Hilton **Project Number:** Hilton-1

Analysis	Due	TAT	Expires	Comments
18C0288-01 HA-01 [Solid] Sampled 15-Mar-2018 11:40 (GMT-08:00) Pacific Time (US & Canada)				
A = Glass WM, Clear, 8 oz	*B = Glass WM, Clear, 4 oz*			
Met 7471B Hg	30-Mar-2018 15:00	10	12-Apr-2018 11:40	
Met 6010C - Ag	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - As	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Ba	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Cd	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Cr	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Cu	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Ni	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Pb	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Met 6010C - Se	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
Solids, Total, Dried at 103 -105 °C, Soli	30-Mar-2018 15:00	10	12-Apr-2018 11:40	
Solids, Total, Metals Correction	30-Mar-2018 15:00	10	12-Apr-2018 11:40	
8270D-SIM PAH (0.1 ug/L or 5 ug/kg)	30-Mar-2018 15:00	10	29-Mar-2018 11:40	
Met 6010C - Zn	30-Mar-2018 15:00	10	11-Sep-2018 11:40	
18C0288-02 HA-02 [Solid] Sampled 15-Mar-2018 11:47 (GMT-08:00) Pacific Time (US & Canada)				
A = Glass WM, Clear, 8 oz	*B = Glass WM, Clear, 4 oz*			
Solids, Total, Metals Correction	30-Mar-2018 15:00	10	12-Apr-2018 11:47	
Met 6010C - Ag	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - As	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Ba	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Cd	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Cr	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Cu	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Ni	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Pb	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Se	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 6010C - Zn	30-Mar-2018 15:00	10	11-Sep-2018 11:47	
Met 7471B Hg	30-Mar-2018 15:00	10	12-Apr-2018 11:47	
Solids, Total, Dried at 103 -105 °C, Soli	30-Mar-2018 15:00	10	12-Apr-2018 11:47	
8270D-SIM PAH (0.1 ug/L or 5 ug/kg)	30-Mar-2018 15:00	10	29-Mar-2018 11:47	

Reviewed By _____ Date _____

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Port of Bellingham Project Name: _____

COC No(s): _____ NA Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: 18C0288 Tracking No: 8662 6348 5926 NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc.)	(YES)	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 5.8

Time: 1015

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID#: DOC2565

Cooler Accepted by: BF Date: 3/16/18 Time: 1015

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used?	Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other:		
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		YES	(NO)
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES)	NO
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	(NA)	YES	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	(NA)		

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

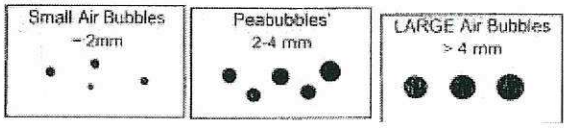
Samples Logged by: SBW Date: 03/16/18 Time: 1511

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:



Small → "sm" (< 2 mm)
Peabubbles → "pb" (2 to < 4 mm)
Large → "lg" (4 to < 6 mm)
Headspace → "hs" (> 6 mm)

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-01

18C0288-01 (Solid)

Semivolatile Organic Compounds - SIM

Method: EPA 8270D-SIM — Sampled: 03/15/2018 11:40

Instrument: NT8 — Analyzed: 27-Mar-2018 18:23

Sample Preparation:	Preparation Method: EPA 3546 (Microwave)		
	Preparation Batch: BGC0530	Sample Size: 18.2 g (wet)	Dry Weight:10.34 g
	Prepared: 21-Mar-2018	Final Volume: 0.5 mL	% Solids: 56.79
Sample Cleanup:	Cleanup Method: Silica Gel		
	Cleanup Batch: CGC0160	Initial Volume: 0.5 mL	
	Cleaned: 27-Mar-2018	Final Volume: 0.5 mL	
Sample Cleanup:	Cleanup Method: Sulfur		
	Cleanup Batch: CGC0159	Initial Volume: 0.5 mL	
	Cleaned: 27-Mar-2018	Final Volume: 0.5 mL	

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Naphthalene	91-20-3	1	1.23	4.84	ND	ug/kg	U
2-Methylnaphthalene	91-57-6	1	1.07	4.84	ND	ug/kg	U
1-Methylnaphthalene	90-12-0	1	0.39	4.84	ND	ug/kg	U
Acenaphthylene	208-96-8	1	1.05	4.84	ND	ug/kg	U
Acenaphthene	83-32-9	1	0.55	4.84	ND	ug/kg	U
Dibenzofuran	132-64-9	1	1.33	4.84	ND	ug/kg	U
Fluorene	86-73-7	1	0.61	4.84	ND	ug/kg	U
Phenanthrene	85-01-8	1	0.69	4.84	**10.7**	ug/kg	
Anthracene	120-12-7	1	0.84	4.84	ND	ug/kg	U
Fluoranthene	206-44-0	1	0.45	4.84	**35.7**	ug/kg	
Pyrene	129-00-0	1	0.61	4.84	**26.1**	ug/kg	
Benzo(a)anthracene	56-55-3	1	0.80	4.84	**3.86**	ug/kg	J
Chrysene	218-01-9	1	1.02	4.84	**16.7**	ug/kg	
Benzo(b)fluoranthene	205-99-2	1	1.33	4.84	**8.20**	ug/kg	
Benzo(k)fluoranthene	207-08-9	1	0.74	4.84	**3.78**	ug/kg	J
Benzo(j)fluoranthene	205-82-3	1	0.66	4.84	**3.58**	ug/kg	J
Benzofluoranthenes, Total		1	2.91	9.68	**15.8**	ug/kg	
Benzo(a)pyrene	50-32-8	1	0.59	4.84	ND	ug/kg	U
Indeno(1,2,3-cd)pyrene	193-39-5	1	1.02	4.84	ND	ug/kg	U
Dibenzo(a,h)anthracene	53-70-3	1	0.86	4.84	ND	ug/kg	U
Benzo(g,h,i)perylene	191-24-2	1	1.03	4.84	ND	ug/kg	U
Surrogate: 2-Methylnaphthalene-d10				*32-120 %*	*52.2*	*%*	
Surrogate: Dibenzo[a,h]anthracene-d14				*21-133 %*	*67.6*	*%*	
Surrogate: Fluoranthene-d10				*36-134 %*	*62.2*	*%*	

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-01

18C0288-01 (Solid)

Metals and Metallic Compounds

Method: EPA 6010C — Sampled: 03/15/2018 11:40

Instrument: ICP2 — Analyzed: 21-Mar-2018 16:55

Sample Preparation: Preparation Method: SWC EPA 3050B
Preparation Batch: BGC0506 — Sample Size: 1.084 g (wet) — Dry Weight:0.62 g
Prepared: 19-Mar-2018 — Final Volume: 50 mL — % Solids: 57.47

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Arsenic	7440-38-2	20	4.50	80.3	ND	mg/kg	U
Barium	7440-39-3	20	2.40	4.82	**9.79**	mg/kg	D
Cadmium	7440-43-9	20	0.199	3.21	**2.05**	mg/kg	J, D
Chromium	7440-47-3	20	0.756	8.03	**4.05**	mg/kg	J, D
Copper	7440-50-8	20	0.396	3.21	**3.07**	mg/kg	J, D
Lead	7439-92-1	20	2.09	32.1	ND	mg/kg	U
Nickel	7440-02-0	20	3.19	16.1	**6.30**	mg/kg	J, D
Selenium	7782-49-2	20	13.1	80.3	**31.7**	mg/kg	J, D
Silver	7440-22-4	20	0.704	4.82	ND	mg/kg	U
Zinc	7440-66-6	20	2.56	16.1	**5.47**	mg/kg	J, D

4611 S. 134th Place, Suite 100 • Tukwila, WA 98168 • Ph: (206) 695-6200 • Fax: (206) 695-6202

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-01

18C0288-01 (Solid)

Metals and Metallic Compounds

Method: EPA 7471B — Sampled: 03/15/2018 11:40

Instrument: CETAC — Analyzed: 30-Mar-2018 11:15

Sample Preparation: Preparation Method: SMM EPA 7471B
Preparation Batch: BGC0584 — Sample Size: 0.208 g (wet) — Dry Weight:0.12 g
Prepared: 23-Mar-2018 — Final Volume: 50 mL — % Solids: 57.47

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Mercury	7439-97-6	1	0.0418	ND	mg/kg	U

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-01

18C0288-01 (Solid)

Metals and Metallic Compounds

Method: SM 2540 G-97 — Sampled: 03/15/2018 11:40

Instrument: N/A — Analyzed: 20-Mar-2018 17:18

Sample Preparation: Preparation Method: No Prep-Metals
Preparation Batch: BGC0508 — Sample Size: 10 g (wet)
Prepared: 19-Mar-2018 — Final Volume: 10 g

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.04	**57.47**	%	

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-01

18C0288-01 (Solid)

Extractions

Method: PSEP 1986 — Sampled: 03/15/2018 11:40

Instrument: N/A — Analyzed: 19-Mar-2018 08:17

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BGC0492 — Sample Size: 1 g (wet)
Prepared: 19-Mar-2018 — Final Volume: 1 g

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.01	**56.79**	%	

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-02

18C0288-02 (Solid)

Semivolatile Organic Compounds - SIM

Method: EPA 8270D-SIM — Sampled: 03/15/2018 11:47

Instrument: NT8 — Analyzed: 27-Mar-2018 18:50

Sample Preparation:	Preparation Method: EPA 3546 (Microwave)		
	Preparation Batch: BGC0530	Sample Size: 14.11 g (wet)	Dry Weight:10.38 g
	Prepared: 21-Mar-2018	Final Volume: 0.5 mL	% Solids: 73.54
Sample Cleanup:	Cleanup Method: Silica Gel		
	Cleanup Batch: CGC0160	Initial Volume: 0.5 mL	
	Cleaned: 27-Mar-2018	Final Volume: 0.5 mL	
Sample Cleanup:	Cleanup Method: Sulfur		
	Cleanup Batch: CGC0159	Initial Volume: 0.5 mL	
	Cleaned: 27-Mar-2018	Final Volume: 0.5 mL	

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Naphthalene	91-20-3	1	1.23	4.82	ND	ug/kg	U
2-Methylnaphthalene	91-57-6	1	1.06	4.82	**2.59**	ug/kg	J
1-Methylnaphthalene	90-12-0	1	0.39	4.82	ND	ug/kg	U
Acenaphthylene	208-96-8	1	1.04	4.82	ND	ug/kg	U
Acenaphthene	83-32-9	1	0.55	4.82	ND	ug/kg	U
Dibenzofuran	132-64-9	1	1.33	4.82	**8.20**	ug/kg	
Fluorene	86-73-7	1	0.61	4.82	**14.1**	ug/kg	
Phenanthrene	85-01-8	1	0.69	4.82	**84.6**	ug/kg	
Anthracene	120-12-7	1	0.84	4.82	ND	ug/kg	U
Fluoranthene	206-44-0	1	0.45	4.82	**25.0**	ug/kg	
Pyrene	129-00-0	1	0.60	4.82	**9.95**	ug/kg	
Benzo(a)anthracene	56-55-3	1	0.79	4.82	ND	ug/kg	U
Chrysene	218-01-9	1	1.01	4.82	ND	ug/kg	U
Benzo(b)fluoranthene	205-99-2	1	1.32	4.82	ND	ug/kg	U
Benzo(k)fluoranthene	207-08-9	1	0.73	4.82	ND	ug/kg	U
Benzo(j)fluoranthene	205-82-3	1	0.66	4.82	ND	ug/kg	U
Benzofluoranthenes, Total		1	2.90	9.64	ND	ug/kg	U
Benzo(a)pyrene	50-32-8	1	0.59	4.82	ND	ug/kg	U
Indeno(1,2,3-cd)pyrene	193-39-5	1	1.01	4.82	ND	ug/kg	U
Dibenzo(a,h)anthracene	53-70-3	1	0.86	4.82	ND	ug/kg	U
Benzo(g,h,i)perylene	191-24-2	1	1.03	4.82	ND	ug/kg	U
Surrogate: 2-Methylnaphthalene-d10				*32-120 %*	*48.1*	*%*	
Surrogate: Dibenzo[a,h]anthracene-d14				*21-133 %*	*71.1*	*%*	
Surrogate: Fluoranthene-d10				*36-134 %*	*59.7*	*%*	

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-02

18C0288-02 (Solid)

Metals and Metallic Compounds

Method: EPA 6010C — Sampled: 03/15/2018 11:47

Instrument: ICP2 — Analyzed: 29-Mar-2018 15:13

Sample Preparation: Preparation Method: SWC EPA 3050B
Preparation Batch: BGC0506 — Sample Size: 1.026 g (wet) — Dry Weight:0.56 g
Prepared: 19-Mar-2018 — Final Volume: 50 mL — % Solids: 54.57

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Arsenic	7440-38-2	10	2.50	44.7	ND	mg/kg	U
Barium	7440-39-3	10	1.33	2.68	ND	mg/kg	U
Cadmium	7440-43-9	10	0.111	1.79	**1.01**	mg/kg	J, D
Chromium	7440-47-3	10	0.420	4.47	ND	mg/kg	U
Copper	7440-50-8	10	0.220	1.79	**1.14**	mg/kg	J, D
Lead	7439-92-1	10	1.16	17.9	**6.20**	mg/kg	J, D
Nickel	7440-02-0	10	1.77	8.93	**22.5**	mg/kg	D
Selenium	7782-49-2	10	7.29	44.7	**22.0**	mg/kg	J, D
Silver	7440-22-4	10	0.392	2.68	**0.530**	mg/kg	J, D
Zinc	7440-66-6	10	1.42	8.93	**9.81**	mg/kg	D

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-02

18C0288-02 (Solid)

Metals and Metallic Compounds

Method: EPA 7471B — Sampled: 03/15/2018 11:47

Instrument: CETAC — Analyzed: 30-Mar-2018 11:16

Sample Preparation: Preparation Method: SMM EPA 7471B
Preparation Batch: BGC0584 — Sample Size: 0.254 g (wet) — Dry Weight:0.14 g
Prepared: 23-Mar-2018 — Final Volume: 50 mL — % Solids: 54.57

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Mercury	7439-97-6	1	0.0361	ND	mg/kg	U

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-02

18C0288-02 (Solid)

Metals and Metallic Compounds

Method: SM 2540 G-97 — Sampled: 03/15/2018 11:47

Instrument: N/A — Analyzed: 20-Mar-2018 17:18

Sample Preparation: Preparation Method: No Prep-Metals
Preparation Batch: BGC0508 — Sample Size: 10 g (wet)
Prepared: 19-Mar-2018 — Final Volume: 10 g

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.04	**54.57**	%	

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

HA-02

18C0288-02 (Solid)

Extractions

Method: PSEP 1986 — Sampled: 03/15/2018 11:47

Instrument: N/A — Analyzed: 19-Mar-2018 08:17

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BGC0492 — Sample Size: 1 g (wet)
Prepared: 19-Mar-2018 — Final Volume: 1 g

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Total Solids		1	0.01	**73.54**	%	

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Semivolatile Organic Compounds - SIM - Quality Control

Batch BGC0530 - EPA 3546 (Microwave)

Instrument: NT8 Analyst: JZ

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BGC0530-BLK1)				Prepared: 21-Mar-2018 Analyzed: 27-Mar-2018 16:36							
Naphthalene	ND	1.28	5.00	ug/kg							U
2-Methylnaphthalene	ND	1.10	5.00	ug/kg							U
1-Methylnaphthalene	ND	0.40	5.00	ug/kg							U
Acenaphthylene	ND	1.08	5.00	ug/kg							U
Acenaphthene	ND	0.57	5.00	ug/kg							U
Dibenzofuran	ND	1.38	5.00	ug/kg							U
Fluorene	ND	0.63	5.00	ug/kg							U
Phenanthrene	ND	0.72	5.00	ug/kg							U
Anthracene	ND	0.87	5.00	ug/kg							U
Fluoranthene	ND	0.47	5.00	ug/kg							U
Pyrene	ND	0.63	5.00	ug/kg							U
Benzo(a)anthracene	ND	0.82	5.00	ug/kg							U
Chrysene	ND	1.05	5.00	ug/kg							U
Benzo(b)fluoranthene	ND	1.37	5.00	ug/kg							U
Benzo(k)fluoranthene	ND	0.76	5.00	ug/kg							U
Benzo(j)fluoranthene	ND	0.68	5.00	ug/kg							U
Benzofluoranthenes, Total	ND	3.01	10.0	ug/kg							U
Benzo(a)pyrene	ND	0.61	5.00	ug/kg							U
Indeno(1,2,3-cd)pyrene	ND	1.05	5.00	ug/kg							U
Dibenzo(a,h)anthracene	ND	0.89	5.00	ug/kg							U
Benzo(g,h,i)perylene	ND	1.07	5.00	ug/kg							U
Surrogate: 2-Methylnaphthalene-d10	86.8			ug/kg	*150*		*57.9*	*32-120*			
Surrogate: Dibenzo[a,h]anthracene-d14	130			ug/kg	*150*		*86.4*	*21-133*			
Surrogate: Fluoranthene-d10	111			ug/kg	*150*		*74.1*	*36-134*			
LCS (BGC0530-BS1)				Prepared: 21-Mar-2018 Analyzed: 27-Mar-2018 17:03							
Naphthalene	85.9	1.28	5.00	ug/kg	150		57.3	36-120			
2-Methylnaphthalene	83.9	1.10	5.00	ug/kg	150		56.0	35-120			
1-Methylnaphthalene	82.6	0.40	5.00	ug/kg	150		55.0	39-120			
Acenaphthylene	87.9	1.08	5.00	ug/kg	150		58.6	35-120			
Acenaphthene	86.3	0.57	5.00	ug/kg	150		57.5	39-120			
Dibenzofuran	89.7	1.38	5.00	ug/kg	150		59.8	38-120			
Fluorene	98.7	0.63	5.00	ug/kg	150		65.8	41-120			
Phenanthrene	107	0.72	5.00	ug/kg	150		71.1	46-120			
Anthracene	110	0.87	5.00	ug/kg	150		73.0	36-120			

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Semivolatile Organic Compounds - SIM - Quality Control

Batch BGC0530 - EPA 3546 (Microwave)

Instrument: NT8 Analyst: JZ

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
LCS (BGC0530-BS1)				Prepared: 21-Mar-2018 Analyzed: 27-Mar-2018 17:03							
Fluoranthene	118	0.47	5.00	ug/kg	150		78.5	46-120			
Pyrene	127	0.63	5.00	ug/kg	150		84.9	49-120			
Benzo(a)anthracene	126	0.82	5.00	ug/kg	150		84.1	42-120			
Chrysene	121	1.05	5.00	ug/kg	150		80.7	48-120			
Benzo(b)fluoranthene	124	1.37	5.00	ug/kg	150		82.4	35-127			
Benzo(k)fluoranthene	120	0.76	5.00	ug/kg	150		79.9	37-129			
Benzo(j)fluoranthene	108	0.68	5.00	ug/kg	150		72.1	40-120			
Benzofluoranthenes, Total	357	3.01	10.0	ug/kg	450		79.2	46-120			
Benzo(a)pyrene	118	0.61	5.00	ug/kg	150		78.6	36-120			
Indeno(1,2,3-cd)pyrene	130	1.05	5.00	ug/kg	150		86.9	40-120			
Dibenzo(a,h)anthracene	135	0.89	5.00	ug/kg	150		90.3	38-120			
Benzo(g,h,i)perylene	132	1.07	5.00	ug/kg	150		87.8	38-120			
Surrogate: 2-Methylnaphthalene-d10	81.0			ug/kg	*150*		*54.0*	*32-120*			
Surrogate: Dibenzo[a,h]anthracene-d14	132			ug/kg	*150*		*87.9*	*21-133*			
Surrogate: Fluoranthene-d10	110			ug/kg	*150*		*73.4*	*36-134*			

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Metals and Metallic Compounds - Quality Control

Batch BGC0506 - SWC EPA 3050B

Instrument: ICP2 Analyst: TCH

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BGC0506-BLK1)				Prepared: 19-Mar-2018 Analyzed: 21-Mar-2018 14:34							
Arsenic	ND	0.280	5.00	mg/kg							U
Barium	ND	0.149	0.300	mg/kg							U
Cadmium	0.0159	0.0124	0.200	mg/kg							J
Chromium	ND	0.0471	0.500	mg/kg							U
Copper	0.0443	0.0247	0.200	mg/kg							J
Lead	ND	0.130	2.00	mg/kg							U
Nickel	ND	0.199	1.00	mg/kg							U
Selenium	ND	0.816	5.00	mg/kg							U
Silver	ND	0.0439	0.300	mg/kg							U
Zinc	ND	0.160	1.00	mg/kg							U
LCS (BGC0506-BS1)				Prepared: 19-Mar-2018 Analyzed: 21-Mar-2018 15:13							
Arsenic	218	0.280	5.00	mg/kg	200		109	80-120			
Barium	213	0.149	0.300	mg/kg	200		107	80-120			
Cadmium	52.2	0.0124	0.200	mg/kg	50.0		104	80-120			
Chromium	53.4	0.0471	0.500	mg/kg	50.0		107	80-120			
Copper	50.8	0.0247	0.200	mg/kg	50.0		102	80-120			
Lead	215	0.130	2.00	mg/kg	200		107	80-120			
Nickel	51.2	0.199	1.00	mg/kg	50.0		102	80-120			
Selenium	217	0.816	5.00	mg/kg	200		108	80-120			
Silver	53.4	0.0439	0.300	mg/kg	50.0		107	80-120			
Zinc	50.6	0.160	1.00	mg/kg	50.0		101	80-120			
Duplicate (BGC0506-DUP1)		**Source: 18C0288-01**		Prepared: 19-Mar-2018 Analyzed: 21-Mar-2018 16:51							
Arsenic	ND	4.49	80.1	mg/kg		ND					U
Barium	12.1	2.39	4.81	mg/kg		9.79			21.30	20	L, D
Cadmium	2.03	0.198	3.20	mg/kg		2.05			0.83	20	J, D
Chromium	5.48	0.754	8.01	mg/kg		4.05			30.00	20	L, J, D
Copper	3.24	0.395	3.20	mg/kg		3.07			5.29	20	D
Lead	ND	2.09	32.0	mg/kg		ND					U
Nickel	5.54	3.18	16.0	mg/kg		6.30			12.90	20	J, D
Selenium	37.7	13.1	80.1	mg/kg		31.7			17.30	20	J, D
Silver	ND	0.703	4.81	mg/kg		ND					U
Zinc	8.05	2.56	16.0	mg/kg		5.47			38.20	20	L, J, D
Matrix Spike (BGC0506-MS1)		**Source: 18C0288-01**		Prepared: 19-Mar-2018 Analyzed: 21-Mar-2018 17:00							

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Metals and Metallic Compounds - Quality Control

Batch BGC0506 - SWC EPA 3050B

Instrument: ICP2 Analyst: TCH

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Matrix Spike (BGC0506-MS1)	**Source: 18C0288-01**			Prepared: 19-Mar-2018 Analyzed: 21-Mar-2018 17:00							
Arsenic	324	4.49	80.2	mg/kg	321	ND	101	75-125			D
Barium	347	2.40	4.81	mg/kg	321	9.79	105	75-125			D
Cadmium	85.0	0.199	3.21	mg/kg	80.2	2.05	103	75-125			D
Chromium	87.3	0.755	8.02	mg/kg	80.2	4.05	104	75-125			D
Copper	83.2	0.395	3.21	mg/kg	80.2	3.07	99.9	75-125			D
Lead	328	2.09	32.1	mg/kg	321	ND	102	75-125			D
Nickel	91.4	3.18	16.0	mg/kg	80.2	6.30	106	75-125			D
Selenium	365	13.1	80.2	mg/kg	321	31.7	104	75-125			D
Silver	84.4	0.703	4.81	mg/kg	80.2	ND	105	75-125			D
Zinc	85.7	2.56	16.0	mg/kg	80.2	5.47	100	75-125			D

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Metals and Metallic Compounds - Quality Control

Batch BGC0584 - SMM EPA 7471B

Instrument: CETAC Analyst: DP

QC Sample/Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BGC0584-BLK1)				Prepared: 23-Mar-2018 Analyzed: 30-Mar-2018 11:11						
Mercury	ND	0.0250	mg/kg							U
LCS (BGC0584-BS1)				Prepared: 23-Mar-2018 Analyzed: 30-Mar-2018 11:13						
Mercury	0.520	0.0250	mg/kg	0.500		104	80-120			

Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Certified Analyses included in this Report

Analyte	Certifications
EPA 6010C in Solid	
Silver	NELAP,WADOE,DoD-ELAP
Arsenic	NELAP,WADOE,DoD-ELAP,ADEC
Barium	NELAP,WADOE,ADEC,DoD-ELAP
Cadmium	NELAP,WADOE,DoD-ELAP,ADEC
Chromium	NELAP,WADOE,DoD-ELAP,ADEC
Copper	NELAP,WADOE,DoD-ELAP
Nickel	NELAP,WADOE,DoD-ELAP,ADEC
Lead	NELAP,WADOE,DoD-ELAP,ADEC
Selenium	NELAP,WADOE,DoD-ELAP
Zinc	NELAP,WADOE,DoD-ELAP
EPA 7471B in Solid	
Mercury	WADOE,NELAP,DoD-ELAP,CALAP
EPA 8270D-SIM in Solid	
Naphthalene	ADEC,DoD-ELAP,NELAP,WADOE
2-Methylnaphthalene	ADEC,DoD-ELAP,NELAP
1-Methylnaphthalene	ADEC,DoD-ELAP,NELAP,WADOE
Biphenyl	ADEC,DoD-ELAP,NELAP
2,6-Dimethylnaphthalene	ADEC,WADOE
Acenaphthylene	ADEC,DoD-ELAP,NELAP,WADOE
Acenaphthene	ADEC,DoD-ELAP,NELAP,WADOE
Dibenzofuran	ADEC,DoD-ELAP,NELAP
Fluorene	ADEC,DoD-ELAP,NELAP,WADOE
Phenanthrene	ADEC,DoD-ELAP,NELAP,WADOE
Anthracene	ADEC,DoD-ELAP,NELAP,WADOE
Carbazole	ADEC,DoD-ELAP,NELAP
1-Methylphenanthrene	ADEC
Fluoranthene	ADEC,DoD-ELAP,NELAP,WADOE
Pyrene	ADEC,DoD-ELAP,NELAP,WADOE
Benzo(a)anthracene	ADEC,DoD-ELAP,NELAP,WADOE
Chrysene	ADEC,DoD-ELAP,NELAP,WADOE
Benzo(b)fluoranthene	ADEC,DoD-ELAP,NELAP,WADOE
Benzo(k)fluoranthene	ADEC,DoD-ELAP,NELAP,WADOE
Benzo(j)fluoranthene	ADEC,DoD-ELAP,NELAP,WADOE
Benzo(e)pyrene	ADEC,NELAP
Benzo(a)pyrene	ADEC,DoD-ELAP,NELAP,WADOE

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Perylene	ADEC,NELAP
Indeno(1,2,3-cd)pyrene	ADEC,DoD-ELAP,NELAP,WADOE
Dibenzo(a,h)anthracene	ADEC,DoD-ELAP
Benzo(g,h,i)perylene	ADEC,DoD-ELAP,NELAP,WADOE

Code	Description	Number	Expires
ADEC	Alaska Dept of Environmental Conservation	UST-033	05/11/2018
CALAP	California Department of Public Health CAELAP	2748	06/30/2018
DoD-ELAP	DoD-Environmental Laboratory Accreditation Program	66169	02/07/2019
NELAP	ORELAP - Oregon Laboratory Accreditation Program	WA100006	05/11/2018
WADOE	WA Dept of Ecology	C558	06/30/2018
WA-DW	Ecology - Drinking Water	C558	06/30/2018

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Port of Bellingham	Project: Hilton	
1801 Roeder Ave	Project Number: Hilton-1	**Reported:**
Bellingham WA, 98225	Project Manager: Ben Howard	02-Apr-2018 12:01

Notes and Definitions

U	This analyte is not detected above the applicable reporting or detection limit.
L	Analyte concentration is <=5 times the reporting limit and the replicate control limit defaults to +/- RL instead of 20% RPD
J	Estimated concentration value detected below the reporting limit.
D	The reported value is from a dilution
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
[2C]	Indicates this result was quantified on the second column on a dual column analysis.

Attachment 2
Data Validation Reports

720 Olive Way, Suite 1900
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206.287.9130

ANCHOR QEA

Data Validation Report – EPA Stage 2A

May 9, 2018

Project: Central Waterfront, Olivine Sands Soil Sampling

Project Number: 120007-01.01

This report summarizes the review of analytical results for two soil samples collected on March 15, 2018. The samples were collected by the Port of Bellingham and submitted to Analytical Resources, Inc (ARI). The following analytical parameters were reviewed in this report:

- Total solids (TS) by Standard Method (SM) 2540 G
- Polycyclic aromatic hydrocarbons (PAHs) by U.S. Environmental Protection Agency (USEPA) 8270D in selective ion mode
- Mercury (Hg) by USEPA method 7471B
- Metals by USEPA method 6010C

ARI sample data group (SDG) 18C0288 was reviewed in this report. Sample IDs, matrices, and analyses are presented in Table 1.

Table 1
Sample IDs, Matrices, and Analyses

Sample ID	Lab Sample ID	Matrix	Analyses
HA-01	18C0288-01	Soil	TS, PAHs, Hg, metals
HA-02	18C0288-02	Soil	TS, PAHs, Hg, metals

Notes:
Hg: mercury
PAH: polycyclic aromatic hydrocarbon
TS: total solids

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QC) guidelines outlined in the analytical procedures. Laboratory results were reviewed using the laboratory control limits and the following guidelines:

- *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (SW-846, Third Edition; USEPA 1986)
- *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA 2017a)
- *National Functional Guidelines for Organic Superfund Methods Data Review* (USEPA 2017b)

Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody form was signed by ARI at the time of sample receipt. Samples were received in good condition and within the recommended temperature range.

Holding Times and Sample Preservation

Samples were appropriately preserved and analyzed within holding times.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes, with two exceptions. Cadmium and copper were detected in the method blank at concentrations between the method detection limit and the reporting limit. Due to dilution, associated sample concentrations were not significantly higher than the concentrations in the blank, so results were elevated to the reporting limit and qualified as not detected.

Field Quality Control

No field QC samples were required with this sample set.

Surrogate Recoveries

Surrogate recoveries were within the laboratory control limits for all samples.

Laboratory Control Samples

Laboratory control samples (LCSs) were analyzed at the required frequency. All LCS analyses resulted in recoveries within laboratory control limits.

Matrix Spike

A matrix spike (MS) sample was analyzed for metals and all percent recoveries were within laboratory control limits.

Laboratory Duplicates

A laboratory duplicate was analyzed for metals. Results were within laboratory control limits, except for barium, chromium and zinc. Detected concentrations were within five times the reporting limits, so no data were qualified.

Method Reporting Limits

Reporting limits were acceptable as reported. All values were reported using the laboratory reporting limit. Values were reported as undiluted, or when diluted, the reporting limit reflects the dilution factor.

Overall Assessment

As was determined by this evaluation, the laboratory followed the specified analytical methods and all requested sample analyses were completed. Accuracy was acceptable as demonstrated by the surrogate, LCS/LCSD, and MS/MSD recovery values. Precision was acceptable as demonstrated by the LCS/LCSD, MS/MSD, and laboratory duplicate relative percent difference (RPD) values. Most data are acceptable as reported; all other data are acceptable as qualifier. Table 2 summarizes the qualifiers applied to the sample results reviewed in this report.

Table 2
Data Qualification Summary

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
HA-01	Metals	Copper	3.07J mg/kg	3.21U mg/kg	Method blank contamination
HA-02	Metals	Cadmium	1.01J mg/kg	1.79U mg/kg	Method blank contamination
		Copper	1.14J mg/kg	1.79U mg/kg	

Notes:
J: Indicates an estimated value
U: Indicates the compound or analyte was analyzed for but not detected at or above the specified limit
µg/L: microgram per liter
%R: percent recovery
mg/kg: milligram per kilogram

References

USEPA (U.S. Environmental Protection Agency), 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. Office of Solid Waste and Emergency Response. EPA-530/SW-846.

USEPA, 2017a. *National Functional Guidelines for Inorganic Superfund Methods Data Review*. Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-001. January 2017.

USEPA, 2017b. *National Functional Guidelines for Organic Superfund Methods Data Review*. Office of Superfund Remediation and Technology Innovation. EPA 540 R 2017-002. January 2017.