# DRAFT
# Remedial Investigation/Feasibility Study Report

Dakota Creek Industries
Anacortes, Washington
Ecology Agreed Order No. DE-07TCPHQ-5080

*for*
**Washington State Department of Ecology on Behalf of Port of Anacortes**

April 27, 2020

GeoEngineers

2101 4th Avenue, Suite 950
Seattle, Washington 98121
206.728.2674

# Remedial Investigation/Feasibility Study Report

# Dakota Creek Industries
# Anacortes, Washington
# Ecology Agreed Order No. DE-07TCPHQ-5080

**File No. 5147-006-13**

**April 27, 2020**

Prepared for:

Washington State Department of Ecology
PO Box 47600
Olympia, Washington 98503

Attn: Arianne Fernandez

On Behalf of:

Port of Anacortes
PO Box 297
Anacortes, Washington 98504-7600

Prepared by:

GeoEngineers, Inc.
2101 4th Avenue, Suite 950
Seattle, Washington 98121
206.728.2674

Robert S. Trahan, LG
Senior Environmental Scientist

John M. Herzog, PhD, LG
Senior Principal

RST:JMH:ch

# Table of Contents

**LIST OF TABLES**

**LIST OF FIGURES**

**APPENDICES**

## LIST OF ACRONYMS AND ABBREVIATIONS

| Acronym/ Abbreviation | Description |
|---|---|
| AET | Apparent Effects Threshold |
| Agreed Order | Agreed Order No. DE-07TCPHQ-5080 |
| ARARs | Applicable Regulatory Requirements |
| ARI | Analytical Resources, Inc. |
| ASTM | ASTM International |
| ASTs | above ground storage tanks |
| bgs | below ground surface |
| bcy | in-place cubic yards |
| BETX | benzene, ethylbenzene, toluene and total xylenes |
| BMPs | best management practices |
| BSAFs | biota-sediment accumulation factor |
| cm | centimeter |
| CAO | Cleanup Action Objective |
| CAP | Cleanup Action Plan |
| CCI | CCI Analytical |
| City | City of Anacortes |
| COC | Contaminant of Concern |
| COPC | Contaminant of Potential Concern |
| cPAH | carcinogenic polycyclic aromatic hydrocarbons |
| CSL | Cleanup Screening Level |
| CSO | Combined Sewer Outfall |
| CSM | Conceptual Site Model |
| DAHP | Washington State Department of Archaeology and Historic Preservation |
| DCA | disproportionate cost analysis |
| DCAP | Draft Cleanup Action Plan |
| DCI | Dakota Creek Industries |

| | |
|---|---|
| DEA | David Evans and Associates |
| DMMP | Dredged Material Management Program |
| DMMU | Dredged Material Management Unit |
| DNR | Department of Natural Resources |
| DP | direct push |
| DPS | Distinct Population Segment |
| DUA | Decision Unit Area |
| Ecology | Washington State Department of Ecology |
| EDB | dibromoethane, 1-2 |
| EDC | dichloroethane, 1-2 |
| EIM | Ecology's Environmental Information Management System |
| ELCO | electrocoagulation |
| EPA | United States Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESU | evolutionarily significant unit |
| FS | Feasibility Study |
| FSID | Facility Site Identification |
| ft/day | feet per day |
| $F_{oc}$ | fraction organic carbon |
| GeoEngineers | GeoEngineers, Inc. |
| GPS | global positioning system |
| H:V | horizontal to vertical |
| $H_w$ | Head in the well above the equilibrium level at time zero |
| $H_o$ | Initial change in head in the well due to an injection of a volume (V) at time zero |
| HPAH | high molecular weight polycyclic aromatic hydrocarbons |
| HA | hand auger |
| HSA | hollow stem auger |
| ISGP | Industrial Stormwater General Permits |
| $K_{oc}$ | organic carbon partition coefficient |
| L/kg | liters per kilogram |
| LPAH | low molecular weight polycyclic aromatic hydrocarbons |

| | |
|---|---|
| µg/kg | micrograms per kilogram |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MHHW | mean higher high water |
| MLLW | mean lower low water |
| MS | Manufacturing/Shipping (Anacortes Zone Code) |
| MTBE | methyl tertiary-butyl ether |
| MTCA | Model Toxics Control Act |
| ng/kg | nanograms per kilograms |
| NMFS | National Marine Fisheries Service (now NOAA Fisheries) |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollution Discharge Elimination System |
| OHW | Ordinary High Water |
| OnSite | OnSite Environmental, Inc. |
| PAHs | polycyclic aromatic hydrocarbons |
| PCBs | polychlorinated biphenyls |
| PCUL | preliminary cleanup level |
| Pier 1 | Port of Anacortes Pier 1 Marine Terminal |
| Pier 2 | Port of Anacortes Pier 2 Marine Terminal |
| Port | Port of Anacortes |
| PQL | practical quantitation limit |
| PSEP | Puget Sound Estuary Program |
| PVC | polyvinyl chloride |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| SAIC | Science Applications International Corporation |
| SCO | Sediment Cleanup Objective |
| SCUM II | Sediment Cleanup Users' Manual II |
| Site | Dakota Creek Industries |
| SM | Standard Method |

| | |
|---|---|
| SMS | Sediment Management Standard |
| SPI | sediment profile imaging |
| SQS | sediment quality standards |
| SVOC | semi-volatile organic compound |
| SWPPP | Stormwater Pollution Prevention Plan |
| TBT | tributyltin |
| TDS | total dissolved solids |
| TEE | terrestrial ecological evaluation |
| TEF | toxicity equivalency factor |
| TEQ | toxicity equivalency quotients (refers to concentration basis) |
| TOC | total organic carbon |
| TS | total solids |
| TVS | total volatile solids |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| USTs | Underground Storage Tanks |
| UTL | upper tolerance limit |
| VCP | Voluntary Cleanup Program |
| VOCs | volatile organic compound |
| WAC | Washington Administrative Code |

## EXECUTIVE SUMMARY

On behalf of the Port of Anacortes (Port), and in accordance with Agreed Order No. DE-07TCPHQ-5080 (Agreed Order; Ecology 2007), GeoEngineers, Inc. (GeoEngineers) has prepared this Remedial Investigation (RI)/Feasibility Study (FS) Report for the "Anacortes Port of Dakota Creek" site (Site) located along the shoreline of Guemes Channel at the northern terminus of Q Avenue in Anacortes, Washington. The RI/FS was completed using environmental investigation data collected by the Port in general accordance with the Ecology-approved Remedial Investigation/Feasibility Study (RI/FS) Work Plan (GeoEngineers 2008a). Environmental data from previous soil, groundwater and sediment characterization studies completed at the Site were used to identify contaminants of potential concern (COPCs) for evaluation in the RI. The purpose of the RI was to define nature and extent of contamination in affected Site media and to identify and evaluate cleanup actions to address the identified contamination. The purpose of the FS was to develop Cleanup Action Objectives (CAOs), screen potential remedial technologies, develop cleanup action alternatives to address contaminated media of concern, evaluate the cleanup action alternatives relative to the Model Toxics Control Act (MTCA) threshold requirements and identify the cleanup action alternative that achieves the highest level of environmental benefit with a cost that is not disproportionate to the other cleanup action alternatives evaluated. This RI/FS report was prepared under the direction of the Washington State Department of Ecology (Ecology) in accordance with the Agreed Order.

### Site Description and Historical Land Use

The Site, located at 115 Q Avenue in Anacortes, Washington, is an active shipyard used for new vessel construction and repair. The Site is comprised of both upland and marine areas and is bounded by the Port of Anacortes Pier 1 to the west and Pier 2 to the east, 3rd Street on the south, and the Guemes Channel to the north. The Site is located in the northwest quadrant of Section 18, Township 35 North, and Range 2 East, has the coordinates of latitude N48.520606° and longitude W122.610640°. Dakota Creek Industries (DCI) currently leases the Site from the Port for vessel construction and maintenance operations. The Site includes a portion of the Port's Pier 1 Marine Terminal (Pier 1), a centrally located outfitting dock (Central Pier), a synchrolift, upland fabrication areas, shops, a sandblast grit storage shed, warehouses and storage areas. The northern portion of Pier 1 (which is a deep-water moorage terminal) is used by DCI to support dry dock operations.

The marine portion of the Site (Marine Area) is located between the Port's Pier 1 and Pier 2 Marine Terminals and has a navigation depth of approximately -35 feet Mean Lower Low Water (MLLW) to support shipyard operations. To the west and south, the Marine Area is separated from the uplands by vertical sheet pile bulkheads. To the east, the Marine Area is bound by the Port's Pier 2 Marine Terminal which is an earth fill structure and a pile supported wharf. The slope of the earth fill is armored with riprap.

The upland portion of the Site (Upland Area) is relatively flat with a ground surface elevation ranging between approximately 13 and 15 feet MLLW. Most of the Upland Area is paved with asphalt or concrete. Limited portions of the Upland Area are unpaved and consist of a crushed gravel working surface for fabrication layout and heavy equipment use. Currently, public access to the shipyard facility and the Port's Pier 1 and Pier 2 facilities is restricted with fencing, signage and security guards.

Since approximately 1879, the Site has been used for shipping, shipbuilding, ship repairs and other maritime-related industrial purposes and has contained various above ground storage tanks (ASTs), a rail spur, and associated buildings including machine shops, welding shops and equipment sheds to support

industrial operations. Prior to 2008, the Marine Area contained multiple piers, docks and two marine railway boat lifts. The west marine railway, located between the East Pier and Pier 1, was removed in the early 1990s. The east marine railway located between the East Pier and Pier 2 was removed in 2008 as part of the Project Pier 1 redevelopment activities. The Project Pier 1 redevelopment activities also included the removal of the L and East Docks and associated marine structures, dredging of approximately 170,000 cubic yards of sediment to achieve the current navigational depth of the Marine Area, installation of 670 linear feet of sheet pile bulkhead to reconfigure the southern shoreline, placement of 250 linear feet of riprap along the basin's east boundary and construction of the Central Pier. Concurrent with the 2008 redevelopment activities, an interim action cleanup was completed in accordance with the Ecology-approved RI/FS Work Plan and Interim Action Work Plan Addendum (GeoEngineers 2008b) to remove approximately 26,000 cubic yards of contaminated sediment from the southern half of the Marine Area and contaminated soil from the Upland Area during excavation activities to install new subsurface utility infrastructure.

## Site Characterization

### Previous Site Characterization and Cleanup Actions

Multiple environmental studies have been completed at the Site since 1991 to characterize Site conditions. These studies have identified that historical uses including vessel moorage, bulk fuel and oil storage, and shipbuilding activities have resulted in the release of contaminants to soil, groundwater and sediment. Cleanup actions previously completed at the Site include:

- **1991 UST Cleanup Action** – In 1991, two underground storage tanks (USTs) located near the south end of L dock were removed from the Site for permanent closure. During the removal of these tanks, approximately 20 cubic yards of petroleum impacted soil was removed from this area and transferred from the Site for landfill disposal. Verification samples at the final excavation limits were obtained to confirm the removal of the petroleum impacted soil observed during tank removal activities.
- **2001 Hydraulic Winch Cleanup Action** – In 2001, a hydraulic winch and its timber frame located near the south end of the east marine railway were removed from the Site. During removal of this structure and associate components, approximately 30 cubic yards of petroleum impacted soil were excavated and transferred from the Site for landfill disposal. Verification samples at the final excavation limits were obtained to confirm the removal of the petroleum impacted soil observed during removal of the hydraulic winch and associated timber frame.
- **2002 Petroleum and Marine Railway Cleanup Actions** – In 2002, the Port completed cleanup actions to address known soil contamination in the Petroleum Cleanup Action Area extending from the aluminum shop (building formerly identified as the equipment maintenance shed) to the former bulk fuel storage ASTs; and the Marine Railway Cleanup Action Area located near the eastern marine railway structure. Cleanup actions to remove soil contamination (approximately 1,650 cubic yards) in these areas were completed under Ecology's Voluntary Cleanup Program (VCP). Upon completion of the remedial excavation activities, discrete confirmation samples from the excavation sidewalls and base were collected to verify the removal of soil contamination. The previously identified contamination in these areas was successfully removed from the Site as indicated by verification sampling and the excavation areas were backfilled to the original grade with clean imported soil. Although the cleanup actions confirmed the removal of soil contamination in these areas, the work was never finalized under the VCP.

### Agreed Order Site Characterization

On December 12, 2007, the Port entered Agreed Order No. DE-07TCPHQ-5080 with Ecology. Under the Agreed Order, the Port is required to complete an interim cleanup action in the marine area, evaluate the nature and extent of contamination in affected media on a Site-wide basis and develop and evaluate cleanup alternatives for addressing the identified contamination. In accordance with the Agreed Order, an RI was completed to further evaluate sediment, groundwater and soil conditions at the Site to define the nature and extent of contamination. RI activities included collection of new environmental data to evaluate the nature and extent of COPCs identified by the previous environmental studies completed at the Site.

#### *Sediment Remedial Investigation*

Sediment investigation activities were completed in general accordance with the Ecology-approved RI/FS Work Plan to characterize the vertical extent of sediment contamination in areas previously identified as exceeding the Sediment Management Standard (SMS) criteria, and to evaluate sediment in areas of the basin where no data previously existed.

In October 2008, RI sediment samples were collected from seven locations (G-1 through G-7) within the Marine Area. Sediment samples at locations G1, G2 and G7 were collected using a vibracore deployed from a research vessel. Sediment samples at locations G3 through G6 were collected from the upland area using a limited access direct-push drill rig during low tide. Surface and subsurface sediment samples were collected from sediment cores advanced to depths ranging from approximately 4 to 7 feet below the mudline surface to evaluate sediment quality in areas of the basin where no data previously existed.

#### *Groundwater Remedial Investigation*

Groundwater investigation activities were completed in general accordance with the Ecology-approved RI/FS Work Plan to characterize groundwater conditions at the shoreline where groundwater discharges to surface water, evaluate groundwater conditions in the vicinity of the 1991 UST, 2001 Hydraulic Winch and 2002 Petroleum and Marine Railway Cleanup Action Areas, to estimate the hydraulic conductivity of the shallow aquifer, and to evaluate tidal influence on the shallow aquifer.

Initial monitoring activities were completed in June 2008 to evaluate groundwater conditions. Following completion of the 2008 Interim Action and reconfiguration of the DCI shoreline, Ecology required that four additional rounds of quarterly groundwater monitoring be completed to further evaluate groundwater conditions. Quarterly groundwater monitoring events were completed in May 2012, August 2012, November 2012 and February 2013. Due to inconclusive evidence linking contaminant exceedances identified in soil to contaminant exceedances in groundwater, Ecology required that four additional rounds of groundwater monitoring be completed on a semi-annual basis to further evaluate the potential source of soil contamination to groundwater. In addition, Ecology determined that the location of monitoring well MW-1 was not an appropriate location for monitoring the conditional point of compliance and that a new well (MW-8) be installed north of MW-1 to serve that purpose.

#### *Soil Remedial Investigation*

Soil investigation activities were completed in general accordance with the Ecology-approved RI/FS Work Plan to characterize soil conditions in the upland portion of the Site to characterize the Site for the purpose of developing and evaluating cleanup action alternatives. Soil investigation included the collection of samples using a combination of hollow stem auger (HSA), direct push (DP), test pit (TP) and hand auger (HA) exploration technologies to evaluate soil conditions. In June 2008, subsurface soil samples were collected from 11 HSA explorations, 10 test pit explorations and three hand auger explorations to meet the

objectives of the RI/FS Work Plan. In 2014, a supplemental soil investigation was completed to further characterize the nature and extent of these contaminants in soil. During this supplemental soil investigation, 43 DP explorations were completed to further evaluate soil conditions. At the request of Ecology, three additional DP explorations were completed in July 2018 to evaluate soil conditions adjacent to and upgradient from monitoring well MW-8 based on the detected concentrations of arsenic and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) in groundwater near this location.

***Evaluation of Site Outfalls and Catch Basins***

During development of the RI/FS Work Plan, Ecology identified sediment in DCI catch basins as a potential source of contamination to the Marine Area sediments due to the configuration of the Site stormwater system at the time. However, the Site stormwater system has been significantly modified since preparation of the RI/FS Work Plan. Most of the Site surfaces have been paved over-time and a new system was installed as part of the Port's Project Pier 1 redevelopment to capture the stormwater and wastewater from the Site for treatment prior to discharge. Stormwater and wastewater captured at the Site is treated prior to discharge to the City's sanitary sewer or to Guemes Channel under National Pollution Discharge Elimination System (NPDES) General Permit WAR045711. DCI performs regular monitoring of the water collection systems to ensure compliance with the discharge requirements of the NPDES permit.

As a result of the ongoing treatment and monitoring activities for stormwater and wastewater from the Site, discharges from the DCI stormwater/wastewater collection systems are no-longer a potential source of contamination to the Marine Area portion of the Site. Potential historical contaminant discharges to the Marine Area prior to the stormwater system upgrade activities have been addressed as part of the 2008 Interim Action, where the known contaminated sediments and underlying clean native sediments were removed from the Site as discussed below.

## Interim Action

Interim action dredging and excavation activities as discussed above were completed between July and November 2008 in general accordance with the Ecology-approved RI/FS Work Plan and Interim Action Work Plan Addendum to remove identified contamination in the Marine Area for upland landfill disposal and to remove portions of the known soil contamination in the Upland Area. During the 2008 Interim Action, approximately 26,000 cubic yards (approximately 38,000 tons) of contaminated sediment was removed from the Marine Area and an additional 580 cubic yards (approximate) of contaminated soil was removed from the Upland Area. Contaminated sediment and soil were transported by truck from the Site for upland landfill disposal.

Following verification of the contaminated sediment removal, an additional 230,000 cubic yards of clean sediment (approximate) determined to be suitable for open-water disposal by the Dredged Material Management Program (DMMP) was then dredged from the Marine Area and transported by barge to the Rosario Strait dispersive site to meet the Project Pier 1 redevelopment design grade of -35 feet MLLW.

Sediment samples collected from the base of the interim action dredge surface confirmed removal of contaminated sediments from the Marine Area and were used by the regulatory agencies to confirm that further dredging (beyond the limits of contamination) was in clean materials.

## Nature and Extent of Contamination

Based on a review of the Upland and Marine Area RI results, the following COCs were identified for sediment, groundwater and soil at the Site:

- **Sediment** – Metals including arsenic copper, lead, mercury and zinc, tributyltin (TBT), low molecular weight PAHs (LPAHs), high molecular weight PAHs (HPAHs), cPAHs, polychlorinated biphenyls (PCBs), dioxin and furans were identified as COCs for Marine Area sediment. However, interim action dredging in the Marine Area in 2008 resulted in the complete removal of sediment contamination at the Site. As a result, sediment is no longer considered a media of concern.
- **Groundwater** – Metals including arsenic and nickel, and cPAHs were identified as groundwater COCs for the Upland Area.
- **Soil** – Metals including arsenic and nickel, and cPAHs were identified as soil COCs for the Upland Area. In addition, results of previous environmental studies identified concentrations of gasoline-, diesel- and/or heavy oil-range petroleum hydrocarbons exceeding PCULs. As indicated above, the Port completed independent cleanup actions (i.e., 1991 UST, 2001 Hydraulic Winch and 2002 Petroleum and Marine Railway Cleanup Actions) to remove the previously identified petroleum contamination from the Site. Confirmation sample results obtained from the limits of these excavations indicated that the petroleum contamination was successfully removed from the Site. However, confirmation soil sample results for these areas could not be independently validated. Therefore, petroleum hydrocarbons within the footprints of the previously completed cleanup action areas are unverified until subsequent sampling result confirm their removal.

### Marine Area

As discussed above, interim action dredging and excavation activities completed between July and November 2008 in general accordance with the Ecology-approved RI/FS Work Plan and Interim Action Work Plan Addendum removed the identified sediment COCs exceeding preliminary cleanup level (PCULs) from the Marine Area. Sediment samples collected from the base of the interim action dredge prism and sediment sample results from previous environmental studies within the Marine Area provide the basis for sediment not being considered a media of concern for the Site.

### Upland Area

In the Upland area, COCs including arsenic, nickel and cPAHs were detected at concentrations exceeding PCULs in soil throughout the Site. In the eastern portion of the Site, arsenic and nickel exceeded PCULs in fill deposits from the ground surface to a depth of approximately 8 feet below ground surface (bgs). In the north central portion of the Site, arsenic and nickel exceeded PCULs in fill deposits from the ground surface to a depth of approximately 10 feet bgs. In the southwestern portion of the Site, arsenic, nickel and cPAHs exceeded the PCUL in fill deposits from the ground surface to a depth of approximately 13 feet bgs. Results of soil/sediment samples collected at the Site from the underlying native surface show that the Upland Area PCUL exceedances are limited to the overlying fill soil and do not extend to the underlying native surface.

In addition, results of previous environmental studies identified concentrations of gasoline-, diesel- and/or heavy oil-range petroleum hydrocarbons exceeding preliminary cleanup levels (PCULs) in historical fill deposits from the ground surface to a depth of approximately 8 feet bgs in the central and eastern portions of the Site. Between 1991 and 2002, the Port completed independent cleanup actions in these areas to

remove the previously identified petroleum contamination from the Site. These cleanup actions also likely resulted in the removal of arsenic, nickel and cPAH contamination from the Upland Area further limiting their nature and extent. Confirmation sample results obtained from the limits of these excavations indicated that the petroleum contamination was successfully removed from the Site. However, confirmation soil sample results for these areas could not be independently validated. A supplemental soil investigation is proposed as a pre-remedial design activity for the Site to verify the completeness of the previous remedial actions and would be reported in the Cleanup Action Plan (CAP). Sampling and analysis for this investigation will be completed under an Ecology-approved addendum to the RI/FS Work Plan in support of the selected preferred cleanup action alternative (discussed below) to address Site contamination.

Between 2015 and 2016, DCI replaced a significant portion of their gravel working surface with asphalt pavement which acts to prevent stormwater infiltration through the soil column. RI Groundwater monitoring results show that the paved surfaces are limiting the infiltration, leaching and subsequent migration of contaminants through the soil column to groundwater. In addition, this data show that contaminants that remain in place in saturated zone soils have stabilized and are not migrating downgradient toward the Guemes Channel since paving was completed.

At shoreline monitoring well locations, the following COCs were detected at concentrations greater than the groundwater PCUL since completion of the Upland Area paving activities:

- Dissolved nickel detected at a concentration of 8.3 micrograms per liter (µg/L) marginally exceeded the groundwater PCUL of 8.2 µg/L at shoreline monitoring well location MW-2B during the February 2017 monitoring event. However, total nickel at this location was not detected at a concentration exceeding the groundwater PCUL during this event and dissolved nickel did not exceed the PCUL in subsequent monitoring events at this location.
- Total cPAH toxicity equivalency (TEQ) concentrations and/or dissolved arsenic exceeded the groundwater PCUL at shoreline monitoring well location MW-8 during one or more semi-annual monitoring events between February 2016 and August 2017. However, cPAHs and arsenic concentrations at monitoring well location MW-1 (upgradient monitoring well location) were less than the PCUL for each of these monitoring events. Supplemental soil sampling and analysis to further evaluate soil conditions in the vicinity of MW-8 did not identify potential source materials for cPAHs or arsenic in saturated soil adjacent to or upgradient of this location.

At upgradient monitoring well locations, PCUL exceedances were only observed at monitoring well location MW-7. At location MW-7, total and dissolved arsenic and nickel were detected at concentrations exceeding groundwater PCULs during one or more semi-annual monitoring events. However, at downgradient monitoring well locations MW-3A and MW-6, total and dissolved arsenic and nickel either were not previously detected or were detected at concentration less than the groundwater PCUL for the last four semi-annual groundwater monitoring events.

### Preferred Cleanup Action Alternative Selection

Potentially applicable response actions and associated remediation technologies were identified and screened for the development of cleanup action alternatives to address COCs in soil and groundwater discussed above. The screening process determined the most appropriate technologies and process options based on their expected implementability, reliability, effectiveness, and relative cost. Screening also considered modifying criteria associated with current and future land uses, consideration of potential

historical and archaeological remains, and impacts to existing habitat resources. Cleanup action alternatives were then developed by combining technologies retained through the screening process to meet the Site cleanup standards. The design parameters used to develop the alternatives were based on both engineering judgment and the current knowledge of Site conditions and are conceptual-level designs for the implementation of the individual technologies. In accordance with the requirements of WAC 173-340-350 and WAC 173-340-360, cleanup action alternatives were evaluated against the following criterion:

- Compliance with cleanup standards and applicable laws;
- Provision for a reasonable restoration time frame; and
- Use of permanent solutions to the maximum extent practicable by comparison of the following:
    - Protectiveness;
    - Permanence;
    - Cost;
    - Effectiveness over the long term;
    - Short-term risk management;
    - Net environmental benefit;
    - Technical and administrative implementability; and,
    - Consideration of public concerns.

A MTCA disproportionate cost analysis (DCA) was then completed to determine which cleanup action alternative that otherwise meets the threshold requirements achieves the highest level of environmental benefit while not being disproportionate in cost relative to the other alternatives. As a result of this evaluation, Cleanup Action Alternative 2 emerged as the preferred alternative which meets the minimum threshold requirements, achieves a high level of environmental benefit and is not disproportionate in cost relative to the other alternatives evaluated. Implementation of Cleanup Action Alternative 2 will result in contaminant mass reduction in the southeast portion of the Site and will be used in conjunction with containment technologies and institutional controls to prevent direct human contact and reduce the potential for leaching and migration of residual COCs contained within the fill soil within a reasonable restoration time frame.

# 1.0 INTRODUCTION

This report presents the results of the Remedial Investigation (RI) and Feasibility Study (FS) completed for the Port of Anacortes (Port) Dakota Creek Industries (DCI) shipyard facility (Site) located along the southern shoreline of Guemes Channel at the northern terminus of Q Avenue in Anacortes, Washington (Figure 1). The RI/FS was completed pursuant to the Washington State Department of Ecology (Ecology) Agreed Order DE-07TCPHQ-5080 (Agreed Order; Ecology 2007) and in accordance with the Washington State Model Toxics Control Act (MTCA) cleanup regulations (Chapter 173-340 Washington Administrative Code [WAC]). The Site is listed in the Washington State Department of Ecology (Ecology) Cleanup Site Database as Facility Site Identification (FSID) No. 2670 and Cleanup Site Identification No. 5174 and is formally referred to as Anacortes Port Dakota Creek. Ecology is managing the Site under the Puget Sound Initiative as part of their regional cleanup efforts on Fidalgo Island.

This RI/FS presents:

- The results of the investigation to define the nature and extent of contamination in media of concern at the Site and provides the data needed to complete an evaluation of cleanup actions to address the identified contamination; and
- The development and evaluation of cleanup action alternatives for addressing contamination identified at the Site and to select a preferred cleanup action alternative utilizing information gathered during the RI and previous environmental studies.

This RI/FS was completed in accordance with the requirements of the MTCA Cleanup Regulation, Chapter 173-340 WAC and the Sediment Management Standards (SMS), Chapter 173-204 WAC.

## 1.1. General Site Information

### 1.1.1. Site Description

The Site is located at 115 Q Avenue in Anacortes, Washington (Figure 1) and is an active shipyard used for new vessel construction and repair. The Site is comprised of both upland and marine areas and is bounded by the Port's Pier 1 Marine Terminal to the west and Pier 2 Marine Terminal to the east, 3rd Street on the south, and the Guemes Channel to the north. The Site is located in the northwest quadrant of Section 18, Township 35 North, and Range 2 East and has the coordinates of latitude N48.520606° and longitude W122.610640°.

DCI currently operates a shipyard at the Site and leases the property from the Port. DCI uses the facility for vessel construction and maintenance activities. The Site includes a portion of the Port's Pier 1 Marine Terminal, a centrally located outfitting dock (Central Pier), a synchrolift, upland fabrication areas, shops, a sandblast grit storage shed, warehouses and storage areas. The northern portion of Pier 1 (which is a deep-water moorage terminal) is used by DCI to support dry dock operations. Features of the Site and surrounding area are shown on Figure 2.

The offshore area of the Site (henceforth referred to as the Marine Area) is located between the Port's Pier 1 and Pier 2 Marine Terminals (Pier 1 and Pier 2) and is maintained with a navigation depth of approximately -35 feet Mean Lower Low Water (MLLW) to support shipyard operations. To the west and south, the Marine Area is separated from the uplands by vertical sheet pile bulkheads. To the east, the

Marine Area is bound by Pier 2 which is an earth fill structure and a pile supported wharf along the northern most part of the facility. The slope of the earth fill is armored with large rock (riprap).

The parts of the Site above Ordinary High Water (OHW) or upland area portion of the Site (henceforth referred to as the Upland Area) is relatively flat with a ground surface elevation of approximately 15 feet MLLW. Most of the upland area is paved with asphalt or concrete. The limited unpaved parts of the Upland Area consist of a crushed gravel working surface that is maintained for fabrication layout and heavy equipment. Currently, public access to the shipyard facility and the Port's Pier 1 and Pier 2 facilities is restricted with fencing, signage and security guards.

### 1.1.2. Legal Description

Tax parcel numbers and legal descriptions containing the Site are summarized in the following table. Tax parcel boundaries are shown on Figure 2.

| Tax Parcel Number | Legal Description |
|---|---|
| P32866 | Anacortes Tide Lands Tracks 2 and 3, Plate 9 Together with a Portion of Adjacent Vacated Q Avenue (Ord No. 1728) (1.3 acre). |
| P32867 | Tracks 4 and 16, Plate 9 Including Vacated Portions of 2nd and Broadway Street Adjacent and West 15 feet of Vacated R Street Together with East Half Vacated Q Avenue Adjacent to Track 4 (Ord No. 1707, AF No. 862268) Less Following Described Track on East Line of R Avenue 40 Feet North of North Line 3rd Street Then East 10 Feet Then North 150 Feet Then West 10 Feet to East Line R Avenue Then South 150 Feet to Point of Beginning (2.1 acre). |
| P32903 | Anacortes Tide Lands Tax 24A Beginning at the Intersection of North Line 3rd Street with East Line R Avenue Then North Along East Line R Avenue 190 Feet Then West 65 Feet Then North to Inner Harbor Line Then East Along Said Line 165 Feet Then South to North Line 3rd Street Then West 100 Feet to True Point of Beginning Less Portion Tax 24B and Easement to City Less Roll Tract 0-041-01 (0.41 acre). |
| P32904 | Portion Block 296 City of Anacortes Together with Portion Plate 9 Tide and Shore lands Defined as Follows Beginning at a Point 25 Feet West Centerline R Avenue and 190 Feet North of North Line 3rd Street Then North Parallel to Centerline R Avenue to Intersection West Inner Harbor Line Then East Along Said Line to a Point 100 Feet East of East Line R Avenue Then South to a Point Which Lies 190 Feet North of North Line 3rd Street Then West to Point of Beginning (1.08 acre). |
| P32905 | Anacortes Tide Lands Tax 24B Beginning on East Line R Avenue 40 Feet North of North Line 3rd Street Then East 10 Feet Then North Parallel to East Line R Avenue 150 Feet Then West 10 Feet to East Line R Avenue Then South Along R Avenue 105 Feet to Point of Beginning (0.03 acre). |
| P32906 | Anacortes Tide Lands Tax 25 then Portion West Half R Avenue Lying Between a Line 40 Feet North of and Parallel to North Line 3rd Street and a line 190 Feet North of and Parallel to North Line of 3rd Street (0.03 acre). |
| P32907 | Anacortes Tide Lands Tax 26 Then Portion East Half Vacated R Avenue Lying Between a Line 40 Feet North of and Parallel to North Line 3rd Street and a Line 190 Feet North and Parallel to North line 3rd Street (0.13 acre). |
| P54924 | Anacortes Block 3 Together with Vacated Alley through Block (Ord No. 1775) (0.74 acre). |
| P55030 | Anacortes All Block 26 Together with Vacated Alley through Said Block (Ord No. 1708, AF No. 862269) (1.39 acre). |

| Tax Parcel Number | Legal Description |
|---|---|
| P55031 | Anacortes Block 27 and Portion Northerly Extended Through Block 27 Along Vacated Alley of Block 27 Except Any Portion Lying within Tract 3, Plate 9 of Anacortes Tide Lands (1.21 acre). |
| P56539 | Anacortes Lot 13 Block 296 11 to 13 (0.1 acre). |

### 1.2. Historical Operations and Use

The Site has been used for shipping, shipbuilding, ship repairs and other maritime-related industrial purposes since approximately 1879. Historically, various above ground storage tanks (ASTs), a rail spur, and associated buildings including machine shops, welding shops and equipment sheds were located at the Site to support maritime operations. The historical features are shown on Figure 3. Aerial photographs presented in Appendix A show historical operations and development of the Site and surrounding area since the early 1900s.

Sanborn maps show that a bulk oil storage and distribution facility with at least six ASTs was in operation in the central upland portion of the Site. Historical records indicate that Pacific Tow Boat leased this portion of the Site to Standard Oil in late 1946 who operated the bulk oil storage and distribution facility until 1969 after which it was sold to the Dillingham Corporation. By the time that the Site was purchased by the Port in 1975, all structures associated with the bulk oil storage and distribution facility had been removed. The location of these tanks is visible on circa 1946 and 1960s aerial photographs (Appendix A).

The southwest portion of the Site was historically used for residential purposes from the early 1900s until the late 1960s based on a review of historical Sanborn maps and aerial photographs. The ground surface in this area was historically lower that the surrounding areas by several feet and that following the purchase of this area by the Port in 1975, the grade was raised to match the surrounding area using dredged sediments from Guemes Channel. In about 1976, DCI began to lease the Site from the Port and has continued to operate the shipyard since this time.

Prior to 2008, the Marine Area contained multiple piers and docks and two marine railway boat lifts (Figure 3). The west marine railway, located between the East Pier and Pier 1, was removed in the early 1990s. The east marine railway located between the East Pier and Pier 2 was removed in 2008 as part of the Project Pier 1 redevelopment activities. The Project Pier 1 redevelopment activities also included the removal of L and East Docks, the east marine railway and associated marine structures, dredging of approximately 170,000 cubic yards of sediment to achieve the current navigational depth of the Marine Area, installation of 670 linear feet of sheet pile bulkhead (open cell bulkhead) to reconfigure the southern shoreline, placement of 250 linear feet of riprap along the Marine Area's east boundary and construction of the Central Pier. The layout of the shipyard facility following redevelopment activities is shown on Figure 4. Concurrent with the redevelopment activities, an interim action cleanup was completed in accordance with the Ecology-approved RI/FS Work Plan (GeoEngineers 2008a) and Interim Action Work Plan Addendum (GeoEngineers 2008b) to remove approximately 26,000 cubic yards of contaminated sediment from the southern portion of the Marine Area and the removal of approximately 580 cubic yards of contaminated soil from the Upland Area to install new subsurface utility infrastructure. The Interim Action activities are further discussed in Section 4.0.

## 1.3. Current and Future Use

The Site and adjacent area are zoned by the City of Anacortes (City) for industrial use (Manufacturing/Shipping [MS]) and is characterized by marine shipping, warehousing, bulk material storage, transportation, and other industrial uses. The Port currently leases the Site to DCI who operates a shipyard for vessel construction and maintenance activities as described above. Public access to the Site (including the Port's adjacent Pier facilities) is restricted with by fencing, signage and guards.

Although the specific future uses of the Site will depend on the operations of the Port's lessees, the anticipated future use of the Site and surrounding area will continue to be for industrial purposes including shipbuilding, ship repairs and other maritime-related industrial business. The property is currently leased to DCI for an additional 37 years.

## 1.4. Environmental Setting

Key elements of the environmental setting of the Site, including physical conditions, geologic setting, natural resources and cultural resources are summarized in the following sections.

### 1.4.1. Climate

Anacortes temperatures are relatively mild. Summer daytime mean temperatures are in the 70s with night-time temperatures in the 50s. Maximum temperatures reach 80 to 85 degrees, with a few 90- to 100-degree days recorded. The highest temperatures and lowest relative humidity are recorded during periods of easterly winds. December and January are the coldest months, with average minimum temperatures in the upper 30s.

The prevailing wind direction is from the southeast in winter and southwest in summer. During late spring and summer, a prevailing westerly and northwesterly flow of air into Puget Sound brings a dry season beginning in May which reaches a peak in July. In late fall and winter, a prevailing southwesterly and westerly air flow from the Pacific Ocean results in a wet season beginning in October which lasts until the beginning of the dry season in May. During winter, the combined influence of low-pressure systems off the Pacific Ocean and cold air from the Fraser River Canyon produce strong northeasterly winds. Although it is not uncommon to have 30- to 40-knot winds under these conditions, the short fetch in the Anacortes area usually limits wind generated wave heights to no more than six feet. Wind gusts up to 73 miles per hour and sustained westerly velocities up to 54 miles per hour have been recorded.

Mean annual precipitation for Anacortes is 26.2 inches, most of which falls as rain. Average monthly precipitation varies from a low of 0.93 inch in July to a high of 3.79 inches in December.

### 1.4.2. Sea Level Rise

Since the time of the last glacial maximum about 20,000 years ago, sea level has been on the rise at varying rates. Global sea level has been rising over the past century, and the rate has increased in recent decades. In 2014, global sea level was 2.6 inches above the 1993 average and continues to rise at a rate of about $^{1}/_{8}$ of an inch per year (NOS 2019).

Global warming is thought to cause the two main mechanisms contributing to sea level rise which include: 1) thermal expansion (ocean water expands as it warms); and 2) melting stores of ice sheets and glaciers. Local application of global projections of sea level rise are complicated by multiple factors such as

atmospheric circulation patterns and tectonic movement. Considering these variables, the National Research Council has made projections of anticipated sea level rise for California, Oregon, and Washington. For the coast of Washington, the projected rise is up to 9 inches by 2030, up to 19 inches by 2050, an up to 56 inches by 2100 (NAP 2012).

To evaluate extreme high tide levels that are currently anticipated, graphs provided by the National Oceanic and Atmospheric Administration (NOAA) compare 10 percent and 1 percent exceedance probability levels, which correspond to tide levels that would be exceeded ten times and one time per century (i.e., the probability of an extreme tide level occurring on a 10-year interval and the probability of an extreme tide level occurring on a 100-year interval). Extreme levels are a combination of the astronomical tide, storm surge, and limited wave setup caused by breaking waves. NOAA has developed tide projections for Anacortes based on the Port Townsend tide gauge corrected for Anacortes. Currently, mean higher high water (MHHW) for Anacortes is 8.2 feet. NOAA tide predictions for a 10-year tidal level exceedance is 2.8 feet and 3.2 feet for a 100-year tidal level exceedance.

### 1.4.3. Topography and Bathymetry

The Site is located along the southern shoreline of Guemes Channel (Figure 1) and includes the Marine and adjacent Upland Area to the south (Figure 2). The Upland area is generally flat with elevations ranging from approximately +13 to +15 feet MLLW. Prior to 2008, the working surface of the Upland Area primarily consisted of crushed gravel. Following redevelopment of the shoreline in 2008, DCI began to pave the Upland Area with up to 6 inches of asphalt. Currently, most of the Upland Area is paved with asphalt while limited unpaved parts of the Upland Area consisting of a crushed gravel working surface are being maintained for fabrication layout and equipment storage. The extent of the gravel working surface prior to 2008 is shown on Figure 3. The current approximate extent of asphalt pavement in the Upland Area is shown on Figure 4.

The eastern bank of the Marine Area is armored with riprap which extends at an approximate 2H:1V slope to approximate elevation of -35 feet MLLW. To the south and west, sheet pile bulkheads separate the Upland and Marine Areas which extend vertically from approximately +15 feet to -35 feet MLLW. In the Marine Area, the navigation area is approximately -35 feet MLLW. Near the outer harbor line, the mudline surface rapidly drops off toward Guemes Channel.

Recent topographic and bathymetric contours at the Site are shown on Figure 4 and are referenced from a June 2014 bathymetric survey completed by David Evans and Associates (DEA) and Lidar imagery for Anacortes completed in May 2009.

### 1.4.4. Surface Water Bodies

The Site is located on the southern shoreline of Guemes Channel. The western end of Guemes Channel connects to the Rosario Strait. Fidalgo Bay is connected to the eastern end of Guemes Channel and is adjacent to Padilla Bay. March Point separates the southern part of Fidalgo Bay and Padilla Bay east of the Site.

There are no significant freshwater streams that flow into Guemes Channel or the Fidalgo Bay area (Antrim et al. 2000). In the Guemes Channel area, the average difference in height between mean higher high water (MHHW) and MLLW is 8.2 feet. Currents in Guemes Channel are relatively strong (averaging 0.9 and 2.1 knots on flood and ebb tides respectively; Antrim et al. 2000). Tidal currents are affected to some

extent by winds. Much of the Site is protected from prevailing currents through Guemes Channel, and from northerly wind and waves by Pier 1 and 2, and Guemes Island located to the north.

### 1.4.5. Shoreline Features

The Port's Pier 1 facility located west of the Marine Area was originally constructed in the early 1900s and extends north from the historical shoreline (see historical aerial photographs presented in Appendix A). The northern portion of the Pier 1 facility is a pile supported wharf which operates as a deep-water berth. From the existing shoreline, the eastern portion of Pier 1 was infilled between the 1960s and 1970 to create the present-day marine terminal structure. Over-time, Pier 1 has undergone general improvements including paving, utility upgrades and the construction of warehouses that are utilized by Port, DCI and other tenants for marine-related operations.

The synchrolift system used by DCI to raise vessels for out of water hull maintenance is located in the western part of the Marine Area and was installed in the early 1980s. During installation, sediment was dredged to a depth of approximately -35 feet MLLW directly below the synchrolift and -15 feet MLLW in the area immediately east of the lift (Figure 3). To maintain the structural integrity of Pier 1, a sheet pile bulkhead was installed along the western side of the synchrolift berth area.

Along the southern shoreline, redevelopment activities were completed in 2008 to increase the capacity and efficiency of the DCI operations. The Project Pier 1 redevelopment project included the installation of a new bulkhead (i.e., Open Cell Bulkhead), pier and dredging of the Marine Area to approximately -35 MLLW to allow for more efficient dock-side work and dry-dock operations. Clean structural fill was placed in the area south (shoreward) of the new bulkhead alignment and the pre-existing marine railway structures along with some of the existing upland buildings were removed in order to allow for more efficient use of the Upland Area. The new bulkhead extends across the southern portion of the Site separating the Marine and Upland Areas. In addition, a new pier (Central Pier) was constructed as part of the redevelopment project. The Central Pier extends north from the new bulkhead bisecting the Marine Area of the Site. This structure is paved and is supported by concrete piling.

Pier 2 located east of the Upland and Marine Areas is an earthen fill pier with a pile supported wharf at the northern portion of the facility. Pier 2 operates as a deep-water berth and is primarily used for bulk product exports. Based on a review of aerial photographs, this facility was initially constructed in the early 1900 to support marine-related industry operating in this area.

The historical configuration of the shoreline and layout of the Site prior to redevelopment activities in 2008 is shown on Figure 3. The current configuration of the shoreline and layout of the Site is shown on Figure 4.

### 1.4.6. Stormwater/Wastewater Outfalls

The former Scott Paper Mill outfall historically discharged near the outer part of the Marine Area between 1963 and 1973 (Figure 3). After 1973, discharge from the former Scott Paper Mill was through a new outfall pipe that was constructed to take advantage of the dispersive effects and physical characteristics of the current in Guemes Channel by extending the discharge point 680 feet beyond the outer harbor line. Discharge continued until 1978 when the former Scott Paper Mill was closed.

Following the purchase of the Site by the Port in 1975, DCI's stormwater/wastewater was discharged under Western Washington Phase II Municipal Stormwater National Pollution Discharge Elimination System

(NPDES) General Permit WAR045711. Prior to the Project Pier 1 redevelopment in 2008, stormwater/wastewater at the Site either infiltrated into the ground (at this time, DCI maintained a compact gravel working surface for facility operations), sheet flowed into Guemes Channel, or passed through oil separating catch basins before joining the City's storm drain system. Currently, stormwater/wastewater collected from the Site is collected from one of three outfall locations (Outfall 001 through Outfall 003; Figure 5) and treated before being discharged.

In addition to DCI's stormwater system, the City maintains two outfalls in the vicinity of the Marine Area. Treated wastewater from the City's wastewater treatment plant located at intersection of 5th Street and T Avenue is discharged to Guemes Channel from an outfall (R Avenue Outfall) located at the northwest corner of the Port's Pier 2 Facility (Figure 5). The City also maintains a combined sewer outfall (CSO) that discharges into the Marine Area (Q Avenue Outfall; Figure 5) to manage the throughput of stormwater to the City's wastewater treatment plant. Stormwater and wastewater collected from the Port's Pier 2 facility is captured by a large detention pond located east of the Site. Collected stormwater/wastewater is recycled for use in their truck wash station. Excess water from this system is discharged to the City's sanitary sewer system (P20 003; Figure 5).

The current stormwater collection, treatment and discharge for the Marine Area and surrounding area is shown on Figure 5 and further discussed in the following sections.

#### *1.4.6.1. Outfall 001 – DCI Shipyard*

In 2008, new storm drains were installed throughout the Site as part of the Project Pier 1 redevelopment to collect stormwater for treatment prior to discharge to Guemes Channel. Stormwater in the shipyard is collected from a network of catch basins and storm drainpipes and conveyed to an Aquip StormwateRx treatment system. The treatment system consists of a stormwater storage tank and enhanced media filtration tank with a buffering pre-treatment chamber and an inert and sorptive filtration media chamber. The treatment system is designed to reduce suspended solids, turbidity, heavy metals (including dissolved metals), and organics prior to discharge through a 36" diameter pipe into Guemes Channel at Outfall 001 (Figure 5).

The current system does not discharge bypass stormwater. Overflow from excessive storm events is routed back to an in-ground sump which then cycles back to the treatment system prior to discharge. DCI personnel conduct sampling of the stormwater/wastewater collection system in accordance with the DCI's Stormwater Pollution Prevention Plan (SWPPP; DCI 2017) to ensure compliance with the discharge requirements of the NPDES permit.

#### *1.4.6.2. Outfall 002 – Drydock Floodwater*

DCI uses a floating drydock that is moored at the northern end of Pier 1. The shipyard uses the drydock to clean and repair ships. Vessels hauled out periodically require pressure washing. Drydock floodwater is discharged when the drydock is flooded to dock or float a vessel onto or off the drydock floor (Outfall 002; Figure 5). To minimize the potential for pollutants to enter Guemes Channel when the drydock floor submerges, the drydock floor is cleaned of debris following vessel cleaning and repair activities. Prior to each lowering of the drydock, DCI personnel thoroughly sweep and clean the deck and stairwells to remove any visible debris. In addition, the surfaces of the drydock are pressure washed on an as needed basis to remove any oily substances that may be present. Pressure wash wastewater is collected in a trough located on the east side of the drydock which connects to a removable collection sump located on the southeast

corner of the drydock. The collection sump is removed and hoisted ashore prior to lowering of the drydock where it is routinely cleaned.

Before each lowering of the drydock, DCI inspects and photographs the cleanliness of the drydock deck. Sampling for Outfall 002 is completed from the catwalk above the southeast corner of the drydock in accordance with DCI's SWPPP to ensure compliance with the discharge requirements of the NPDES permit.

#### *1.4.6.3. Outfall 003 – Wastewater*

Pressure wash wastewater and other wastewater/liquids generated during vessel cleaning operations at the shipyard is collected by sumps that service the drydock, rails area and mechanics shop. Collected wastewater is transported by tanker truck to a wastewater treatment system where the wastewater is processed prior to discharge to the City's sanitary sewer system at Outfall 003 (Figure 5). Wastewater is processed using an Ultrasorb® and Electrocoagulation (ELCO) Treatment Systems prior to discharge. The Ultrasorb® System is comprised of an accumulation tank with oil skimmer, coalescers and filters to remove oil and volatile organic compounds from the wastewater. The ELCO System targets the removal of suspended solids and metals by inducing a charge in the partials causing them to bond together and fall out of solution.

DCI personnel conduct sampling of the wastewater treatment system in accordance with the DCI's SWPPP to ensure compliance with the discharge requirements of the NPDES permit.

#### *1.4.6.4. R Avenue Outfall*

The City's wastewater utility serves over 4,000 acres of residential and commercial customers within the City of Anacortes. The system is classified as a combined stormwater and wastewater system. The wastewater system is responsible for operating and maintaining 96.8 miles of gravity sewers, 23 pump stations, 9.4 miles of force mains ranging in size from 1.5 to 12 inches in diameter, and 175 septic tanks. The system collects and transports wastewater to the City's treatment plant for processing prior to discharge. Effluent discharge from the treatment plant to the Guemes Channel is through the R Avenue outfall (Figure 5).

#### *1.4.6.5. Q Avenue Outfall*

The Q Avenue CSO allows for the discharge of untreated wastewater to an outfall located beneath DCI's Syncrolift Pier (Figure 5). Overflow to this outfall is separated from the wastewater flows by a concrete overflow dam positioned in an upgradient manhole connected to the City's wastewater system. During elevated precipitation events, wastewater is allowed to overflow the dam and discharge directly to Guemes Channel to prevent capacity exceedance of the City's wastewater treatment plant. The City has permanent flow meters installed at each of the CSO structures to measure CSO activity. The flows are reported and discussed in annual CSO reports that are submitted to Ecology. The current average overflow rate per year for this CSO since 2000 is 0.42 overflow events per year (PARIS 2019).

#### *1.4.6.6. Pier 2 Stormwater Discharge*

Pier 2 is a 14-acre paved pier owned and operated by the Port. Prior to 2011, the facility operated under Industrial Stormwater General Permits (ISGP) WAR000849, WAR001004 and WA0020257. In the northern portion of the facility, collected stormwater was discharged directly to Guemes channel at outfall P20 001 under ISGP WAR000849 (Figure 3). In the central and southern portions of the facility, stormwater collected from the facility was conveyed to a settlement pond prior to discharge to the Marine Area at outfall P20 002 under ISGP WAR001004 (Figure 3). Wash water generated from a wheel wash station operating at the

facility during trucking operations is collected in a secondary settlement pond prior to discharge to the City's sanitary sewer system at outfall P20 003 under ISGP WA0020257 (Figure 5).

Following Pier 2 facility upgrades, stormwater and wash water is collected and discharged to the City's sanitary sewer system at outfall P20 003 under State Waste Discharge Permit ST0045500. Facility upgrades for Pier 2 included construction of a new settling pond as well as the installation of two 15,000-gallon water tanks used to store recycled water for wheel wash operations and new manholes, pumps and piping to connect the system. Collected stormwater and wash water for the facility trucking operations is recycled. Excess water generated by the system is discharged to the City's sanitary sewer system at outfall P20 003 for treatment prior to discharge to Guemes Channel (discussed above). The solid waste build-up in the facilities detention pond is removed on an annual basis for upland disposal to a permitted landfill.

Historical outfalls for the Port's Pier 2 facility are shown on Figure 3. Current outfalls for the Port's Pier 2 facility are shown on Figure 5.

### 1.4.7. Geological Setting

#### *1.4.7.1. Local Geology*

The United States Geological Survey (USGS) map of the Bellingham Quadrangle (Lapen 2000) was reviewed for geologic information in the vicinity of the Site. The geologic soil deposits in the vicinity of the Site are the result of both glacial and nonglacial processes that have occurred during the last 12,000 years.

Soil deposits at the Site consist of artificial fill overlying recessional marine (glaciomarine) drift from the Everson Interstade of the Fraser Glaciation. Artificial fill deposits are primarily characterized by silt, sand, and gravel that contain periodic wood debris, organic material, asphalt debris, concrete, and glass/tile debris resulting from historical land uses. Glacial marine deposits are primarily characterized by unsorted, unstratified silt and clay with varying amounts of sand, gravel, cobbles and occasional boulders deposited during the glacial advancement and retreat (melting). This material may contain shells, wood, and large erratics (boulders) as a result of sea level fluctuation relative to the land surface and present-day sea level.

East of the Site, bedrock is mapped at the ground surface and is part of the Lummi Formation which consists of marine metasedimentary rock. The Lummi Formation is a metamorphosed pebble conglomerate, sandstone, and/or mudstone that were deposited during the early Cretaceous to late Jurassic age (140 to 150 million years before present).

#### *1.4.7.2. Geologic Hazards*

The Site is located within the Puget Sound region, which is seismically active. Seismicity in this region is attributed primarily to the interaction between the Pacific, Juan de Fuca and North American plates. The Juan de Fuca Plate is subducting beneath the North American Plate. It is thought that the resulting deformation and breakup of the Juan de Fuca Plate might account for the deep focus earthquakes in the region.

Research has concluded that historical large magnitude subduction-related earthquake activity has occurred along the Washington and Oregon coasts. Evidence suggests several large magnitude earthquakes (Richter magnitude 8 to 9) have occurred in the last 1,500 years, the most recent of which occurred about 300 years ago. No earthquakes of this magnitude have been documented during the recorded history of the Pacific Northwest.

A review of geologic maps has identified a small fault line that runs in a northwesterly direction between Guemes Channel and Cap Sante Marina. Based on review of USGS and Department of Natural Resources (DNR) maps, the fault does not appear to be connected to any named fault system.

Other geologic hazards for the region include liquefaction based on the presence of artificial fill. Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils and subsequent loss of strength. This can result in vertical oscillations and/or lateral spreading of the affected soils, with accompanying surface subsidence (sinking) and/or heaving. In general, soils that are susceptible to liquefaction include loose to medium dense clean to silty sands that are saturated (i.e., below the water table).

Based on the topography of the Site and surrounding area, geologic hazards from landslides were not identified.

### 1.4.8. Natural Resources

#### *1.4.8.1. Terrestrial Habitat*

Typical of industrialized waterfronts, sections of the shoreline adjacent to the Site are armored with riprap or are separated from the Marine Area with sheet pile bulkheads to prevent erosion. In the Upland Area, the ground surface is mostly paved with asphalt or concrete. In limited portions of the Upland Area, the ground surface consists of a crushed gravel working surface that is maintained for fabrication layout and equipment storage. As a result, the Site contains little to no vegetation that would serve as riparian or terrestrial habitat.

During development of the RI/FS Work Plan, Ecology requested that the Port complete a Terrestrial Ecological Evaluation (TEE) to determine if ecological based soil cleanup levels were applicable to the Site. The goal of the TEE process is the protection of terrestrial ecological receptors from exposure to contaminated soil with the potential to cause significant adverse effects. For species protected under the Endangered Species Act (ESA) or other applicable laws that extend protection to individuals of a species, a significant adverse effect means an impact that would significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding, or sheltering. For all other species, significant adverse effects are effects that impair reproduction, growth or survival.

In accordance with WAC 173-340-7491, a simplified TEE was completed for the Site. The results of the exposure analysis determined that the existing land surface (asphalt, concrete, compacted gravel, buildings, etc.) at the site and surrounding area make substantial wildlife exposure unlikely based on completion of Table 749-1. Ecology, during a visit in August 2008 to observe the condition of the Site confirmed that the working surface provided little to no habitat value. Additional paving of the previous gravel surfaces has occurred since that time, further reducing the potential for habitat at the Site.

The process specified under MTCA for identifying the requirements of a TEE (WAC 173-340-7491 and -7492) for the Site and results of the simplified TEE are presented in Appendix B.

#### *1.4.8.2. Groundwater Potability*

The City owns and operates a Class A water system which serves a much larger area than the sewer system boundary. The water system serves approximately 56,000 customers, with regional customers that include two refineries, the Skagit Public Utilities District, the town of La Conner, the Swinomish Tribal Community, and the City of Oak Harbor, including the Naval Air Station Whidbey Island. Because drinking water for the

Site and vicinity is supplied by the City, water supply wells are not known to exist at or near the Site, and groundwater beneath the Site is not used as drinking water. Groundwater at the Site is classified as non-potable.

Specific criteria used to evaluate groundwater potability (WAC 173-340-720(2)) and their applicability to the Site, are as follows:

1. *The ground water does not serve as a current source of drinking water – WAC 173-340-720(2)(a).*

   **Applicability:** Drinking water is currently supplied by the City. Water supply wells are not known to exist at or near the Site.

2. *The Department (Ecology) determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection [i.e., -720(2)], at concentrations which exceed ground water quality criteria published in Chapter 173-200 WAC – WAC 173-340-720(2)(c).*

   **Applicability**: Contaminated groundwater beneath the Site occurs in an unconfined shallow water-bearing zone contained within artificial fill. Shallow groundwater at the Site discharges directly to Guemes Channel and is not known to flow toward other aquifers that may be a current or potential future source of drinking water.

3. *Even if ground water is classified as a potential future source of drinking water, the Department recognizes that there may be sites where there is an extremely low probability that the ground water will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. An example of this situation would be shallow ground waters in close proximity to marine waters such as on Harbor Island in Seattle. At such sites, the Department may allow ground water to be classified as non-potable if each of the following conditions can be demonstrated. These determinations must be for reasons other than that the ground water or surface water has been contaminated by a release of a hazardous substance at the site – WAC 173-340-720(2)(d).*

   a. *There are known or projected points of entry of the ground water into the surface water – WAC 173-340-720(2)(d)(i).*

      **Applicability**: Groundwater at the Site is in close proximity to the Guemes Channel which is tidally influenced. This tidal influence results in the tidal exchange of saline surface water and upland groundwater within the Site as observed during groundwater monitoring activities (Section 5.3). Water quality parameters measured during monitoring activities show that total dissolved solids (TDS) in several wells located throughout the Site have elevated concentrations indicative of slightly saline (greater than 1,000 milligrams per liter [mg/L] TDS at wells MW-1 and MW-7) to highly saline (greater than 10,000 mg/L TDS at wells MW-2, MW-3 and MW-6).

   b. *The surface water is not classified as a suitable domestic water supply source under Chapter 173-201A WAC – WAC 173-340-720(2)(d)(ii).*

      **Applicability**: Guemes Channel is a marine surface water body and is not suitable as a domestic water supply under Chapter 173-201A WAC.

   c. *The ground water is sufficiently hydraulically connected to the surface water that the ground water is not practicable to use as a drinking water source – WAC 173-340-720(2)(d)(iii).*

**Applicability**: The shallow water-bearing zone at the Site is directly connected with and discharges into the Guemes Channel. It is not practicable to utilize the shallow aquifer for water supply due to the potential for drawing saline water into the aquifer (i.e., saltwater intrusion).

#### 1.4.9. Cultural Resources

Guemes Channel connects Rosario Strait with Fidalgo and Padilla Bays, which are high-priority, "early-action" cleanup areas under the Puget Sound Initiative. Ecology is working with stakeholders, including tribes, to keep them informed of the cleanup of contaminated sites and sediments in the vicinity of the Fidalgo/Padilla Bay areas. Tribes that are interested in engaging with Ecology under the Puget Sound Initiative at Fidalgo/Padilla Bays include the Swinomish, Samish, Upper Skagit, Suquamish, Skagit River System Cooperative, Tulalip and Lummi Tribes.

Cultural records (Lenz 2013) indicate that the Samish occupied the shoreline areas of Guemes Channel. Large historical middens representing winter villages and smaller sites related to camping and shellfish gathering are common in similar settings. Currently, no archaeological or culturally important sites are known to exist at the Site.

### 1.5. Ecological Setting

The Site is located on Fidalgo Island along the southern shoreline of Guemes Channel (Figure 1). Properties located to the west and south have industrial use and properties located to the east have commercial and residential uses. Guemes Channel to the north provides habitat for various marine fish, anadromous salmonids and invertebrate species of commercial and recreational value. The area also provides seasonal habitat for adult marine mammals, seabirds and other waterfowl.

The United States Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) report (USFWS 2019) includes a total of nine threatened, endangered, or candidate species and one critical habitat on the species list known to occur, or potentially occur, within an approximate 5-mile radius Site including:

- Mammals:
  - Grey Wolf (*Canis lupus*) – Proposed Endangered
  - North American Wolverine (*Gulo gulo luscus*) – Proposed Threatened
- Birds:
  - Marbled Murrelet (*Brachyramphus marmoratus*) – Threatened
  - Northern Spotted Owl (*Strix occidentalis caurina*) - Threatened
  - Streaked Horned Lark (*Eremophila alpestris strigata)* – Threatened
  - Yellow-billed Cuckoo (*Coccyzus americanus*) – Threatened
- Fishes:
  - Bull trout (*Salvelinus confluentus*) – Threatened
  - Dolly Varden (*Salvelinus malma*) – Proposed Similarity of Appearance (Threatened)
- Flowering Plants:
  - Golden paintbrush (*Castilleja levisecta*) – Threatened

- Critical Habitat:
    - Bull trout (*Salvelinus confluentus*) – Critical Habitat

The National Oceanic and Atmospheric Administration (NOAA) Fisheries Status of ESA Listings & Critical Habitat Designations for the West Coast region (NOAA 2019) includes a total of four threatened and three endangered species their critical habitat with potential to occur at the Site including:

- Puget Sound Steelhead (*Oncorhynchus mykiss*) – Threatened & Critical Habitat
- Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) – Threatened & Critical Habitat
- Southern Resident DPS orcas (*Orcinus orca*) – Endangered & Proposed Critical Habitat
- Western DPS Steller sea lion (*Eumetopias jubatus*) – Endangered & Critical Habitat
- Puget Sound/Georgia Basin DPS bocaccio (*Sebastes paucispinis*) – Endangered & Critical Habitat
- Puget Sound/Georgia Basin DPS yelloweye rockfish (*Sebastes ruberrimus*) – Threatened & Critical Habitat
- Puget Sound/Georgia Basin DPS canary rockfish (*Sebastes pinniger*) – Threatened & Critical

Within a mile of the assessment area, the Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) reports document surf smelt and Pacific herring breeding areas, Dungeness crab presence, cliffs/bluffs and a biodiversity area/corridor (Cap Sante Park; WDFW 2018).

## 1.6. Regulatory Framework

Environmental studies completed at the Site since approximately 1991 have identified that historical uses including vessel moorage, bulk fuel and oil storage, and shipbuilding activities have resulted in the release of contaminants to soil, groundwater and sediment. Partial cleanup of the Site has been completed as voluntary actions by the Port whereas, the final cleanup will be completed under a formal order with Ecology.

### 1.6.1. Voluntary Cleanup Action

The Port has completed the following voluntary cleanup actions to address known soil contamination:

- **1991 UST Cleanup Action** – In 1991, two underground storage tanks (USTs) located near the south end of L dock were removed from the Site for permanent closure. During the removal of these tanks, approximately 20 cubic yards of petroleum impacted soil was removed from this area and transferred from the Site for landfill disposal. Verification samples at the final excavation limits were obtained to confirm the removal of the petroleum impacted soil observed during tank removal activities.
- **2001 Hydraulic Winch Cleanup Action** – In 2001, a hydraulic winch and its timber frame located near the south end of the east marine railway were removed from the Site. During removal of this structure and associate components, approximately 30 cubic yards of petroleum impacted soil were excavated and transferred from the Site for landfill disposal. Verification samples at the final excavation limits were obtained to confirm the removal of the petroleum impacted soil observed during removal of the hydraulic winch and associated timber frame.
- **2002 Petroleum and Marine Railways Cleanup Actions** – In 2002, the Port completed a voluntary cleanup action to address known soil contamination in the Petroleum Cleanup Action Area extending

from the aluminum shop (building formerly identified as the equipment maintenance shed) to the former bulk fuel storage ASTs; and the Marine Railway Cleanup Action Area located near the eastern marine railway structure. Cleanup actions were completed under Ecology's Voluntary Cleanup Program (VCP) to remove soil with contaminant concentrations exceeding cleanup levels developed for the Site (Landau 2002a). The extent of the VCP cleanup actions is shown on Figure 6. Upon completion of the remedial excavation activities, discrete confirmation samples from the excavation sidewalls and base were collected to verify the removal of soil contamination in these areas. Based on the verification sample results, previously identified contamination in these areas was successfully removed from the Site and the excavation areas were backfilled to the original grade with clean imported soil (Landau 2002b). Although the cleanup actions confirmed the removal of soil contamination in these areas, the work was never finalized under the VCP.

### 1.6.2. Ecology Agreed Order

On December 12, 2007, the Port entered Agreed Order No. DE-07TCPHQ-5080 with Ecology. Under the Agreed Order, the Port is required to complete an interim cleanup action in the Marine Area, evaluate the nature and extent of contamination in affected media on a Site-wide basis and develop and evaluate cleanup alternatives for addressing the identified contamination including:

- Preparation of a RI/FS Work Plan (***completed***);
- Field data collection to fill data gaps identified in the Work Plan (***completed***);
- Completion of an interim remedial action to remove contaminated media from the Marine Area prior to redevelopment activities (***completed***);
- Preparation of RI/FS document to present the results of the field data collection and to identify and evaluate cleanup alternatives for contaminated media at the Site (***subject of this report***); and,
- Preparation of a Draft Cleanup Action Plan (DCAP) provides a proposed remedial action to address the contamination present on the Site (***future task***).

Completion of the RI/FS and DCAP documents will fulfill the remaining work requirements required by the Agreed Order. Field data collection in accordance with the Ecology-approved RI/FS Work Plan is summarized in Section 3.5. Interim Action activities completed in accordance with the Ecology-approved RI/FS Work Plan and Interim Action Work Plan Addendum to remove previously identified sediment contamination as part of the Port's Project Pier 1 redevelopment is summarized in Section 4.0.

The final cleanup action at the Site as determined by the Cleanup Action Plan (CAP) is anticipated to be completed under a Consent Decree between the Port and Ecology.

## 2.0 CLEANUP STANDARDS

Cleanup standards consist of: 1) cleanup levels that are protective of human health and the environment; 2) the point of compliance at which the cleanup levels must be met; and 3) additional regulatory requirements, specified in applicable state and federal laws, that apply to a cleanup action because of the type of action and/or the location of the Site.

Preliminary cleanup levels) for Site media of concern including sediment, groundwater and soil were developed during preparation of the RI/FS Work Plan. These preliminary cleanup levels have been updated (since development of the RI/FS Work Plan) to meet the current MTCA standards and are the proposed cleanup levels (PCULs) for defining the nature and extent of Site contamination, for developing cleanup action objectives, and developing remedial alternatives for the Site. Sediment PCULs for protection of benthic organisms and protection of human health and higher trophic level ecological receptors are presented in Tables 1 and 2, respectively. PCULs for groundwater and soil are presented in Tables 3 and 4, respectively. Sediment, groundwater and soil PCULs, and points of compliance for each of these media are discussed below.

## 2.1. Proposed Sediment Cleanup Levels

The RI/FS Work Plan included preliminary cleanup levels for sediment protective of benthic organisms using Sediment Quality Standards (SQS) and Cleanup Screening Level (CSL) criteria established under the Sediment Management Standard (SMS; WAC 173-204) available at the time. In December 2019, Ecology issued the revised Sediment Cleanup User's Manual II (SCUM II, Ecology 2019) as a guidance document for implementing the cleanup provisions of the SMS under WAC 173-204 that included development of cleanup levels protective of benthic organisms, and cleanup levels protective of human health and higher trophic level ecological receptors. Preliminary cleanup levels developed for the RI/FS Work Plan revised to meet current standards are the PCULs for sediment and are presented in Tables 1 and 2 and are further discussed in the following sections.

### 2.1.1. Proposed Sediment Cleanup Levels for the Protection of Benthic Organisms

Sediment PCULs for benthic invertebrate community health are the numeric Sediment Cleanup Objectives (SCO) from SMS that correspond to sediment quality that will result in no adverse effects to the benthic community (WAC 173-204-562). PCULs for protection of benthic organisms are presented in Table 1.

The SMS benthic community health-based sediment cleanup objective of WAC 173-204-562 provide numeric criteria for a broad range of chemicals. The benthic community health-based criteria for specific chemicals are based on either dry-weight or organic carbon-normalized concentrations. The analytical results for nonpolar organics are organic carbon normalized when the total organic carbon (TOC) concentration for a sample range from 0.5 to 3.5 percent (inclusive). The carbon normalized analytical results are then compared to the organic carbon-normalized SCO. Analytical results for nonpolar organics that include samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against Marine Sediment Apparent Effects Threshold (AET) values on a dry-weight basis (Table 8-1 of SCUM II). SMS and AET screening level criteria for benthic community health are presented in Table 1.

### 2.1.2. Proposed Sediment Cleanup Levels for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Sediment PCULs for protection of human health and protection of higher trophic level ecological receptors are presented in Table 2. PCULs for human health exposure to sediment via ingestion and dermal contact were developed utilizing equations and parameter values from Ecology's SCUM II guidance.

The sediment PCULs based on sediment ingestion and dermal contact shown in Table 2 represent the values for an adult exposed during net fishing (subsistence harvesting). Based on current Site conditions (i.e., deep-water berth with no accessible intertidal beach zone), the exposure scenario is expected to only

apply to subtidal sediments that are below -3 feet MLLW. Therefore, exposure to sediment by children during beach play and adults to sediment during clam digging in the intertidal zone above -3 feet MLLW is not applicable to the Marine Area.

Tissue data do not exist for the Site and site-specific biota-sediment accumulation factors (BSAFs) are not available to back-calculate risk-based sediment PCULs. Therefore, a simplified approach (Option 1 within SCUM II – Section 9.2) where the SCO and CSL are established at background (natural and regional, respectively) or the practical quantitation limit (PQL) was selected to develop sediment PCULs based on bioaccumulation exposure for human health and higher trophic level organisms. For bioaccumulative chemicals such as dioxins/furans, total polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), arsenic, cadmium, lead and mercury, sediment screening levels based on bioaccumulation are based on either the 90/90 Upper Tolerance Limit (UTL) on the mean natural background concentrations derived from the entire Bold Plus dataset (DMMP 2009; see SCUM II, Table 10-1), or the Ecology-accepted PQL, whichever is higher. Sediment PCULs for human health and higher trophic level ecological receptors were chosen from the lowest of bioaccumulative and direct contact pathways. The PCULs for subtidal areas include marine areas at elevations below -3 feet MLLW and the applicable direct contact pathway is net fishing.

Consistent with the SCUM II guidance, where the risk-based value is lower than natural background or PQL, the PCUL defaults to the higher of natural background or PQL. Table 2 presents the natural background, regional background, PQL and the PCUL level selected for each chemical.

#### 2.1.3. Point of Compliance in Sediment

In accordance with SMS requirements, the point of compliance for protection of benthic organisms and human health and higher trophic level species exposure in subtidal sediment is represented by the biologically active zone within the uppermost 10 centimeters (cm) below mudline.

### 2.2. Proposed Groundwater Cleanup Levels

The Site meets the definition of an industrial property under MTCA (WAC 173-340-200) as it is zoned for industrial use and has been and is being used for industrial purposes. The Site also meets the requirements for use of industrial cleanup levels for soil as hazardous substances remaining at the property do not pose a threat to human health and the environment in non-industrial areas (WAC 173-340-745[1][a][iii]). The Site is surrounded by properties that are also zoned for industrial land use. The location and use of the Site and land use in the surrounding area restricts access by the general public. Based on zoning, current and anticipated future land use, PCULs for groundwater were selected from the most conservative (lowest) published values from the following transport and exposure pathways:

- Acute and chronic effects to aquatic organisms resulting from exposure to contaminants in surface water and sediment where groundwater discharges to adjacent marine surface water;
- People consuming seafood exposed to contaminants in surface water and sediment where groundwater discharges to adjacent marine surface water; and
- People inhaling volatile organic compounds in enclosed spaces resulting from vapor intrusion.

As discussed in Section 1.4.8, groundwater at, or potentially affected by, the Site is not used for drinking water at this time and is not a reasonable future source of drinking water due to its proximity to marine

surface water and the availability of a municipal water supply. In accordance with WAC 173-340-720(2)(d), Site groundwater qualifies as a non-potable water source, therefore, people ingesting hazardous substances in groundwater is not a potential exposure pathway.

Groundwater PCULs that were selected are the lowest of the applicable numerical values from the regulatory criteria presented below. In accordance with WAC 173-340-705(6), the PCULs were adjusted as necessary based on Washington State groundwater background concentrations for metals (PTI 1989) and PQL to derive the groundwater PCULs such that groundwater PCULs for a given constituent shall not be set at a level below the natural background concentration or the PQL, whichever is higher. The PQLs were referenced from the Ecology-approved RI/FS Work Plan which were obtained from OnSite Environmental, Inc. (OnSite) of Redmond, Washington, a Washington-certified laboratory.

Groundwater PCULs for the Upland Area are presented in Table 3 and are further discussed in the following sections.

#### 2.2.1. Proposed Groundwater Cleanup Levels for the Protection of Surface Water

Groundwater PCULs were selected from available state and federal surface water criteria according to WAC 173-340-730(3). The most conservative (lowest) published values were selected from the following regulatory criteria:

- Water Quality Standards for Surface Waters of the State of Washington. These marine surface water criteria for protection of aquatic life (acute and chronic exposures) and human health (fish consumption) are published in Chapter 173-201A WAC.
- Federal Marine Water Quality Criteria for Washington State. These criteria are from United States Environmental Protection Agency's (EPA's) Final Revision of Federal Human Health Criteria Applicable to Washington from 40 CFR 131.45 (EPA 2016).
- Federal National Recommended Water Quality Criteria. These marine surface water criteria for protection of aquatic life (acute and chronic exposures) and human health (fish consumption) are established under Section 304 of the Clean Water Act.
- MTCA Method B standard formula values (for carcinogens and non-carcinogens) protective of human health (consumption of aquatic organisms) (WAC 173-340-730[3]).
    - Surface water criteria are not currently available for gasoline-, diesel, and oil-range petroleum hydrocarbons. Therefore, as recommended in WAC 173-340-730(3)(b)(iii)(C), the MTCA Method A groundwater cleanup levels for gasoline-, diesel, and oil-range petroleum hydrocarbons were used as the MTCA Method B surface water cleanup levels for these analytes.

#### 2.2.2. Proposed Groundwater Cleanup Levels for the Protection of Sediment

Groundwater concentrations protective of sediment were calculated assuming equilibrium partitioning between sediment and groundwater in sediment pore spaces. The following equation, from Ecology's Lower Duwamish Waterway Preliminary Cleanup Level Workbook Supplemental Information document dated December 2018, was used to calculate groundwater concentrations protective of dry weight SCO criteria:

Equation:

$C_w = SCO/(CF \times DF\ [K_d + \theta_w/\rho_b])$

*Where:*

$C_w$ = groundwater concentration protective of sediment (µg/L)
SCO = sediment cleanup objective (WAC 173-204-560[3]) (mg/kg dry weight)
CF = conversion factor (0.001 mg/µg)
DF = dilution factor (unitless) (default value of 1 for saturated sediment)
$K_d$ = soil-water distribution coefficient (L/kg). $K_d$ for organic chemicals is calculated per MTCA Equation 747-2 below.
$\theta_w$ = water-filled porosity (0.615 ml/ml)
$\rho_b$ = dry sediment bulk density (1.02 kg/L)

Equation:

$K_d = K_{oc} \times f_{oc}$

*Where:*

$K_{oc}$ = soil organic carbon-water partitioning coefficient (ml/g) (0.019 g/g)
$F_{oc}$ = sediment fraction organic carbon (g/g)

Values for $K_d$ and $K_{oc}$ are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2019.

#### 2.2.3. Proposed Groundwater Cleanup Levels for the Protection of Vapor Intrusion

PCULs were developed for the groundwater to indoor air or vapor intrusion transport pathway. The groundwater to vapor intrusion transport pathway used in this RI are based on values for industrial land use. As described above, the Site meets the definition of an industrial property under MTCA (WAC 173-340-200) as it is zoned for industrial use and is being used for industrial purposes now and for the foreseeable future.

#### 2.2.4. Point of Compliance for Groundwater

Groundwater at the Site does not meet the definition of potable water as outlined in WAC 173-340-720(2) based on the following factors: a) the groundwater does not serve as a current source of drinking water; and b) the groundwater is not a potential future source of drinking water given the Site's proximity to surface water that is not suitable as a domestic water supply (Section 1.4.8). Therefore, a conditional point of compliance located as close as technically possible to the point where groundwater discharges to surface water is proposed.

### 2.3. Proposed Soil Cleanup Levels

The Site meets the definition of an industrial property under MTCA (WAC 173-340-200) as it is zoned for industrial use and has been and is being used for industrial purposes (Section 1.1). The Site also meets the requirements for use of industrial cleanup levels for soil as hazardous substances remaining at the property do not pose a threat to human health and the environment in nearby non-industrial areas

(WAC 173-340-745[1][a][iii]). The Site is surrounded by properties that are also zoned for industrial land use. Residential areas are not located in proximity to the Site. The location and use of the Site and land use in the surrounding area restricts access to the Site by the general public. Based on zoning, current and anticipated future land use, soil PCULs were selected from the most conservative (lowest) published values from the following transport and exposure pathways:

- People ingesting soil through direct soil contact.
- Soil to groundwater transport pathway; including the protection of surface water via groundwater and protection of sediment via groundwater transport pathways.

As stated above (Section 1.4.8), groundwater at the Site is non-potable. Therefore, the soil PCULs used in this RI and discussed below include those derived for protection of non-potable groundwater. In addition, a TEE completed for the Site (Section 1.4.8) indicates that the Site is exempt under WAC 173-340-7491(1)(b) such that soil at the Site is covered by physical barriers (such as buildings or paved roads/working surfaces) that prevent exposure to plants and wildlife.

Soil PCULs that were selected are the lowest of the applicable numerical values from the regulatory criteria presented below. In accordance with WAC 173-340-705(6), the PCULs were adjusted as necessary based on background concentrations and PQLs to derive the soil PCULs such that soil PCULs for a given constituent shall not be set at a level below the natural background concentration or the PQL, whichever is higher. Natural background concentrations (except for arsenic) were referenced from Ecology Publication 94-115 "Natural Background Soil Metals Concentrations in Washington State" (Ecology 1994) using 90$^{th}$ percentile values published for the Puget Sound Basin. The arsenic background is established in regulation and published as the MTCA Method A value. The PQLs were obtained from OnSite of Redmond, Washington, a Washington-certified laboratory and presented in the Ecology-approved RI/FS Work Plan.

Soil PCULs for the Upland Area are presented in Table 4 are further discussed in the following sections.

### 2.3.1. Proposed Soil Cleanup Levels for the Protection of Human Health

Soil PCULs for the for protection of human health were identified from MTCA standard Method C soil cleanup levels for industrial land use – soil direct contact (WAC 173-340-745(5)(b)(iii)(B)). MTCA Method A soil cleanup levels for industrial land use (WAC 173-340-745[3]) are used for analytes without Method C soil cleanup levels, which include lead and petroleum hydrocarbons. Note that the Method A soil cleanup level for total PCBs is based on applicable federal law (40 CFR 761.61).

### 2.3.2. Proposed Soil Cleanup Levels for the Protection of Groundwater

Screening levels were developed for the soil to groundwater transport pathway using the MTCA fixed parameter three-phase partitioning model (WAC 173-340-747[4]). Default assumptions provided in WAC 173-340-747(4)(b) (Equation 747-1 and Equation 747-2) for saturated zone soils and Ecology default model input parameter values (soil organic carbon-water partition coefficient [$K_{oc}$] Henry's Law constants) were used in the calculations.

#### 2.3.3. Point of Compliance for Soil

Soil PCULs developed for the Site are based on the protection of surface water via groundwater and protection of sediment via groundwater transport pathways. Therefore, the point of compliance for the soil will be throughout the soil column in accordance with WAC 173-340-740(6)(b).

## 3.0 SITE CHARACTERIZATION STUDIES

### 3.1. Historical Sediment Characterization

Historical environmental studies completed to assess sediment quality in and near the Marine Area included the following:

- Phase 2 Environmental Assessment (Otten Engineering 1997)
- Marine Area Surface Dioxin Study (Floyd|Snider 2007)
- Fidalgo Bay Sediment Investigation (SAIC 2008)

The sediment characterization studies listed above resulted in the collection of surface samples ranging between 0 and 20 cm below the mudline at 20 locations. The sediment samples were submitted for a combination of analyses including TOC, total solids (TS), and grain size, SMS metals, semi-volatile organic compound (SVOCs), PAHs, volatile organic compound (VOCs), PCBs, pesticides, tributyltin (TBT), and dioxins and furans. The schedule of laboratory analysis for sediment samples as part of these studies are summarized in Table 5. Historical sediment sample locations within the Marine Area are shown on Figure 7. Historical sediment sample results are presented in Tables C-1 and 2 (Appendix C) and are summarized in the following sections.

#### 3.1.1. Phase 2 Environmental Assessment (1997)

In August 1997, Otten Engineering collected surface (0 to 10 cm) sediment samples at three locations (DC-SED-01 through DC-SED-03) from the intertidal portion of the Marine Area using hand tools during low tide. In addition, four surface sediment samples (DC-SED-05, DCI-SED-06, DCI-SED-08 and DC-SED-9) were collected from the subtidal portion of the Marine Area using a grab sampler deployed from a research vessel. Samples collected from these locations were submitted for a combination of metal, TOC, TS, TBT, PAH and PCB analysis.

The results of the chemical analysis identified detectable concentrations of metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc, TBT, low molecular weight PAHs (LPAHs), high molecular weight PAHs (HPAHs) and PCBs. Sediment sample results for this study are summarized in Tables C-1 and C-2 (Appendix C).

#### 3.1.2. Marine Area Surface Dioxin Study (2006)

In 2006, Floyd Snider collected surface (0 to 20 cm) sediment samples at locations DCI06-1 through DCI06-9 within the Marine Area for dioxin and furan analysis to further evaluate potential discharges from former Scott Paper Mill operations. Total dioxin and furan toxic equivalency quotients (TEQs) in sediment samples were less than the natural background level of 5 nanograms per kilogram (ng/kg), except for surface sediment at locations DC-106-4 through DC-106-8 collected in the vicinity of the east marine railway. Dioxin and furan results for this study are summarized in Tables C-1 and C-2 (Appendix C).

### 3.1.3. Fidalgo Bay Sediment Investigation (2007)

In 2007, Science Applications International Corporation (SAIC) completed a sediment investigation of the aquatic areas of Fidalgo Bay for Ecology. The objectives of this investigation were to conduct a multi-faceted, tiered sediment characterization in order to help define the nature and extent of the sediment contamination in Fidalgo Bay. Investigation activities included sediment profile imaging (SPI), surface sediment chemistry, and sediment toxicity testing.

Within the study's sub area located nearest the Marine Area (DUA 4, decision area encompassing the Site), a total of 36 SPI images were analyzed from 30 stations. At sample stations FB-4A-14, FB-4A-15 and FB-4A-17 located in close proximity to the Site, fine to medium sand with occasional gravel was identified as the prominent shallow (0 to 10 cm) substrate consistent with an intermediate energy environment. The results of the chemical analysis identified detectable concentrations of metals including arsenic, cadmium, chromium, copper, lead, mercury, silver and zinc, SVOCs including LPAHs and HPAHs, phthalates, miscellaneous extractables and phenols. Sediment sample result for sample stations FB-4A-14, FB-4A-15 and FB-4A-17 are summarized in Tables C-1 and C-2 (Appendix C).

### 3.1.4. DCI Basin Dredged Material Characterization and Recency Determination (2000 and 2004)

Between April 2000 and July 2004, surface and subsurface sediment samples were also collected from the Marine Area for the purpose of DMMP dredge material characterization and suitability determination (Hart Crowser 2000 and Anchor 2004). For the purposes of the dredge material characterization, the Marine Area was divided into two Dredge Material Management Units (DMMUs). DMMU-D1 encompassed the outer half of the Marine Area while DMMU-D2 encompassed the nearshore half of the Marine Area (Figure 7).

In April 2000, Hart Crowser completed an initial dredged material characterization. During this study, discrete samples from 0 to 10 cm were collected throughout DMMU-D1 and DMMU-D2 that were later composited for laboratory analysis of DMMP parameters to evaluate open-water disposal suitability. Based on the results of this initial study and previous environmental studies completed, the DMMP determined that surface and native subsurface (i.e., hard glacially compacted native sediments) sediment within DMMU-D1 was suitable for unconfined open-water disposal. The DMMP also determined that native sediment from DMMU-D2 was also suitable for unconfined open-water disposal. However, surficial fill material from DMMU-D2 was determined to not be suitable for open-water disposal.

To evaluate potential dioxin contamination from the former Scott Paper Mill outfall located in the vicinity of the proposed dredge prism, Anchor Environmental completed a supplemental dredged material characterization in July 2004 within the Marine Area and vicinity. As part of this study, subsurface sediment ranging in depth between 0 and 5 feet below the mudline were collected for laboratory analysis of dioxins and furans. Total dioxin and furan TEQs for these samples were less than the natural background level of 5 ng/kg. Based on these supplemental results, the DMMP determined that the sediment characterized by these samples were suitable for unconfined open-water disposal under the existing DMMP evaluation framework at the time of the determination.

The recency date for the initial April 2000 dredged material characterization of the Marine Area was set to expire in April 2005. However, the supplemental data collected during the July 2004 dredge material characterization recency evaluation suggested that sediment quality had not changed since the initial characterization, and that the recency date could be extended to July 2009. This recency extension

maintained that surficial fill material above the hard glacially compacted native sediment in DMMU-D2 was not suitable for open-water disposal. Dredged Material suitability and recency determination by the DMMP is presented in Appendix D.

In 2008, the Port completed dredging of the Marine Area as part of their Project Pier 1 redevelopment activities. The contaminated material not suitable for open-water disposal was removed from the Site and transferred to an upland landfill as part of an Ecology-approved Interim Action. Following removal of the contaminated material, the remaining dredge prism approved by the DMMP for unconfined open-water disposal was dredged and transferred to the Rosario Strait disposal site. The Ecology-approved Interim Action is further discussed in Section 4.0.

## 3.2. Historical Groundwater Characterization

Historical environmental studies completed to assess groundwater quality in the Upland Area of the Site included the following:

- Remedial Investigation Study (Landau 2002b)
- Groundwater Characterization Study (Floyd|Snider 2007)

Groundwater characterization studies listed above included in the installation of four monitoring wells (MW-1 through MW-4) and collection of groundwater samples for chemical analysis to evaluate groundwater conditions at the Site. Groundwater samples were submitted for a combination of analysis including total/dissolved metals, gasoline-, diesel- and heavy oil-range petroleum hydrocarbons, VOCs, SVOCs including PAHs, pesticides and herbicides based on review of historical activities at the Site. The schedule of laboratory analysis for groundwater samples collected as part of these studies are summarized in Table 6. Groundwater sample locations are shown on Figure 8. Well completion logs for historical groundwater monitoring wells installed at the Site are presented in Appendix E. Historical groundwater sample results are presented in Table F-1 (Appendix F) and summarized in the following sections.

### 3.2.1. Remedial Investigation (2001)

Four groundwater monitoring wells (MW-1 through MW-4) were installed by Landau Associates (Landau) as part of the 2001 Remedial Investigation Study. Three of the monitoring wells (MW-1 through MW-3) were installed along the shoreline to evaluate downgradient groundwater conditions while the fourth monitoring well (MW-4) was installed at the south end of the Site near 3rd Street to evaluate upgradient conditions. Groundwater samples from these wells were collected during two separate monitoring events in September 2001 and October 2001 and were submitted for a combination of analyses including dissolved metals, gasoline-, diesel- and heavy oil-range petroleum hydrocarbons and VOCs based on a review of historical activities at the Site.

Results of the chemical analysis identified detectable concentrations of metals including arsenic, chromium, copper, nickel, mercury and zinc, and diesel- and heavy oil-range petroleum hydrocarbons. Other analytes evaluated including lead, gasoline-range petroleum hydrocarbons and VOCs were not detected in groundwater. Groundwater sample results for this study are presented in Table F-1 (Appendix F).

#### 3.2.2. Groundwater Characterization Study (2006)

Floyd|Snider collected samples from monitoring well locations MW-1 through MW-4 on November 17, 2006 to further evaluate groundwater conditions at the Site. Petroleum hydrocarbons, the primary contaminant of concern for the 2002 independent cleanup action (summarized below), was not detected in groundwater samples collected from each four Site monitoring wells. In addition, other analytes evaluated either were not detected or were detected at concentrations less than 2002 VCP cleanup levels at monitoring well locations MW-1 through MW-4, except for arsenic at MW-4. Arsenic at monitoring well location MW-4 was detected at a concentration of 11.6 µg/L which exceeded the Washington State background level of 8 µg/L.

### 3.3. Historical Soil Characterization Studies

Historical environmental studies completed to assess soil quality in the Upland Area of the Site included the following:

- Phase 2 Environmental Site Assessment (Otten Engineering 1997)
- EPA Site Inspection (Weston 2001)
- Soil Characterization Study (Landau 2002b)

Soil characterization studies listed above included the collection of 17 shallow surface samples and completion of 25 subsurface explorations in the Upland Area of the Site. Soil samples were submitted for a combination of analyses including metals, gasoline-, diesel- and heavy oil-range petroleum hydrocarbons, organotins, VOCs, SVOCs including PAHs, pesticides based on review of historical Site uses and potential source areas. The schedule of laboratory analysis for soil samples collected as part of these studies are summarized in Table 7. Soil sample locations for these historical environmental studies are shown on Figure 9. Exploration logs for the historical soil explorations completed at the Site are presented in Appendix E. Historical soil sample results are presented in Tables G-1 and G-2 (Appendix G) and summarized in the following sections.

#### 3.3.1. Phase 2 Environmental Site Assessment (1997)

In 1997, Otten Engineering completed a Phase 2 Environmental Assessment in the Upland Area of the Site to evaluate soil conditions. The Phase 2 Environmental Assessment included the collection of surficial samples from suspected source areas based on historical Site use and included areas near the synchrolift, in the vicinity of the marine railways and in the 1975 earth fill area (Figure 9). Samples were analyzed for metals, petroleum hydrocarbons, VOCs, SVOCs including PAHs, pesticides and PCBs.

Results of the chemical analysis identified detectable concentrations of metals including arsenic, cadmium, chromium, copper, lead, nickel, mercury, silver and zinc, gasoline-, diesel- and heavy oil-range petroleum hydrocarbons, VOCs, SVOCs including PAHs, pesticides and PCBs. Soil sample results collected for this study are summarized in Tables G-1 and G-2 (Appendix G).

#### 3.3.2. Environmental Protection Agency (EPA) Site Inspection (2001)

Weston (on behalf of the EPA) collected 20 surface and subsurface soil samples at the Site during the 2001 EPA site inspection. During this study, five split samples were collected by Landau Associates (Landau) from near the marine railway and southwest of the former L dock.

Data results for samples collected by Weston are not available. Sample results from split samples collected by Landau identified detectable concentrations of metals, organotins, SVOCs, pesticides and PCBs. Soil sample results for split samples collected by Landau are summarized in Tables G-1 and G-2 (Appendix G).

#### 3.3.3. Soil Characterization Study (2001)

In August 2001, soil sampling and analysis were completed to characterize soil conditions in the Upland Area of the Site. As part of this study, Landau completed 13 borings to evaluate up to six potential source areas based on historical land use and the results of previous environmental studies. Potential source areas evaluated as part of this study included:

- Former Welding Shop;
- Former Machine Shop;
- 1975 Earth Fill Area;
- Former AST and underground storage tanks (UST) Area (Petroleum Area);
- Paint House; and
- East Marine Railway.

Based on the results of the initial investigation, Landau collected soil samples from an additional three surface locations near the marine railway and 10 borings in the Petroleum Area on October 24, 2001. Borings completed at the Property were advanced to depths of 7 to 13 feet below ground surface (bgs). Results of the soil characterization study identified three areas of concern in which contaminants exceeded the 2002 VCP cleanup levels. The areas of concern included:

- **Petroleum Area** – Metals including arsenic, copper, mercury, nickel, zinc, gasoline-, diesel-, and oil-range petroleum hydrocarbons, cPAHs, and PCBs were detected at concentrations greater than the 2002 VCP cleanup levels in the central portion of the Site south of the former East dock. In this area, identified soil contamination extended from approximately 1 to 7 feet bgs.
- **Marine Railway Area** – Metals including arsenic, copper, mercury, nickel, zinc, gasoline- and diesel-range petroleum hydrocarbons were detected at concentrations greater than the 2002 VCP cleanup levels south of the former east marine railway. In this area, identified soil contamination extended from approximately 0 to 2 feet bgs.
- **1975 Earth Fill Area** – Metals including arsenic, copper, mercury, nickel, zinc, cPAHs, and methylene chloride were detected in surface and near-surface soil at concentrations greater than the 2002 VCP cleanup levels in the southwest portion of the Site. In this area, identified soil contamination extended from approximately 1 to 7 feet bgs.

### 3.4. Historical Cleanup Actions and Confirmation Sampling

Historical cleanup actions were completed following the removal and closure of three USTs; (A-1 1991), removal of a hydraulic hoist located near the east marine railway (Landau 2001) and to address soil contamination identified during Landau's 2002 Soil Characterization Study (Landau 2002c). Cleanup actions completed and confirmation soil sampling results are summarized in the following sections.

### 3.4.1. UST Removal and Closure (1991)

A-1 Pump Service oversaw the removal and closure of two USTs (one gasoline and one diesel) located near the south end of L dock in 1991 (Figure 3). The diesel UST, which was installed by DCI was in service less than six years before its removal. However, the age of the gasoline UST was not determined. As part of the UST removal and closure activities, approximately 20 cubic yards of soil was removed from this area and transferred from the Site for landfill disposal. At the limits of the UST removal excavation, verification base and sidewall samples were collected for petroleum hydrocarbon (gasoline and diesel) and benzene, ethylbenzene, toluene and total xylenes (BETX) analysis.

The UST removal and closure area and confirmation sample locations are shown on Figure 9. Confirmation soil sample results are summarized in Tables G-1 and G-2 (Appendix G). Based on a review of the confirmation sample results, gasoline-range petroleum hydrocarbon was detected in soil at concentrations ranging from 59 to 166 mg/kg and diesel-range petroleum hydrocarbon was detected in soil at concentrations ranging from 35 to 136 mg/kg. Other analytes evaluated including heavy oil-range petroleum hydrocarbons and BETX were not detected in base and sidewall samples collected from the UST removal excavation.

### 3.4.2. Marine Railway Hydraulic Winch Remedial Excavation (2001)

In July 2001, the hydraulic winch and its timber frame were removed from their former location south of the east marine railway (Figure 3). Petroleum hydrocarbon impacted soil resulting from historical releases to soil around the former winch and frame were excavated and transferred from the Site for landfill disposal. To verify the removal of the petroleum impacted soil, a total of six confirmation samples (VS-1 through VS-3 and VS-6 through VS-8) were collected by Landau from the remedial excavation limit.

The hydraulic winch remedial excavation area and confirmation sample locations are shown on Figure 9. Confirmation soil sample results are summarized in Tables G-1 and G-2 (Appendix G). Based on a review of the confirmation sample results, diesel- and heavy oil-range petroleum hydrocarbon were detected in soil at concentrations ranging from 6.6 to 1,900 mg/kg.

### 3.4.3. Independent Cleanup Action (2002)

Independent cleanup actions were completed to address soil contamination previously identified including the Petroleum Area, Marine Railway Area and 1975 Earth Fill Area. Cleanup of these areas were completed between August 19 and August 30, 2002. Based on the historical and future use of the Site and land zoning, MTCA Method A cleanup levels for petroleum hydrocarbons, lead, and PCBs and Method C cleanup levels industrial soil cleanup levels for all other analytes were established as the remediation levels for the independent cleanup action.

Cleanup actions for the Petroleum Area, Marine Railway Area, and 1975 Earth Fill Area are summarized in the following sections. Cleanup action areas and confirmation sample locations are shown on Figures 10 and 11. Confirmation soil sample results are summarized in Tables G-1 and G-2 (Appendix G).

#### *3.4.3.1. Petroleum Cleanup Action Area*

The Petroleum Area was defined as the area where soil with petroleum hydrocarbons (predominantly gasoline-range and diesel-range) concentrations exceeding the cleanup levels and known or suspected sources of releases had been identified. A remediation level of 2,000 mg/kg was established for diesel- and heavy oil-range petroleum hydrocarbons, and 100 mg/kg for gasoline-range petroleum hydrocarbons.

The cleanup action for the Petroleum Area extended from the location of a building formerly identified as an equipment maintenance shed to the former location of several ASTs (Figure 10).

Excavation depths ranged from 1.5 feet at the south end of the excavation, near the aluminum shop, to 8 feet in the area further north of the aluminum shop. Based on confirmation sample results, a total of approximately 1,300 cubic yards of contaminated soil was excavated and transferred from the Site for landfill disposal. An additional 1,300 cubic yards of excavated soil was temporarily stockpiled onsite, tested, and used as backfill in the completed excavation.

Forty-four confirmation samples were collected from the bottom and sidewalls of the excavation to verify the removal of the petroleum contaminated soil. Gasoline and/or diesel-range hydrocarbons exceeded remediation levels in five of these samples (CS-17, CS-19, CS-20, CS-26 and CS-38). Subsequently, soil represented by these samples was over-excavated and transferred from the Site for landfill disposal. To evaluate other contaminants of potential concern based on known or suspected sources, samples CS-30 and CS-33 were also submitted for chemical analysis of metals, PAHs, and PCBs. Metals, PAHs and PCBs were not detected except for lead, which was detected at a concentration of 8 mg/kg.

#### *3.4.3.2. Marine Railway Cleanup Action Area*

The Marine Railway Area was defined as the area near the east marine railway structure in which petroleum hydrocarbons and arsenic concentrations exceeded the 2002 VCP cleanup levels. A cleanup level of 2,000 mg/kg was established for diesel-range hydrocarbons and oil-range hydrocarbons and 100 mg/kg for gasoline-range hydrocarbons. For arsenic, a cleanup level of 88 mg/kg was established. The cleanup action for the Marine Railway Area included seven separate excavation areas (Figure 11).

Surface soil (0 to 1 feet bgs) was excavated to remove previously identified petroleum hydrocarbon contamination at four locations in the Marine Railway Area. The four approximately 10- by 10-foot excavations were centered on the sample locations from previous investigations with elevated petroleum hydrocarbons. Discrete confirmation samples were collected from base of each of these excavation areas to verify the removal of petroleum contamination. Petroleum hydrocarbons were not detected at concentrations greater than the 2002 VCP cleanup levels in each of completed excavation areas.

Two surface soil samples in the Marine Railway Area, that were collected during the 2001 EPA Site Inspection (described above), contained concentrations of PAHs that were elevated (with concentrations of individual PAHs up to 8.9 mg/kg), but below cleanup levels protective of the direct contact pathway. Even through the detected concentrations were below cleanup levels, the Port elected to excavate surface soil in this area and transport the soil offsite for disposal. No confirmation samples were collected from the excavation base at these locations to verify the removal of PAHs.

The main excavation in the Marine Railway Area (Figure 11) extended to depths ranging from 3.5 to 5 feet bgs. Approximately 300 cubic yards of soil were excavated from this area for landfill disposal. A total of seven confirmation samples were collected from the excavation bottom and sidewalls to verify the removal of petroleum contamination. Petroleum hydrocarbons were not detected in any of the confirmation samples collected from this area.

#### *3.4.3.3. 1975 Earth Fill Area*

Based on a review of historical Sanborn maps and aerial photographs, this area was used for residential purposes from before 1925 until after 1966. When DCI became a tenant on this parcel in 1975, this area

was topographically lower than the surrounding ground surface. This area is called the 1975 Earth Fill Area because fill material was used to bring it to grade around 1975.

The results of the Landau 2001 Soil Characterization Study identified petroleum hydrocarbons and PAHs in surface and near-surface soil in the 1975 Earth Fill Area at concentrations exceeding the 2002 VCP cleanup levels protective of surface water however, these concentrations did not exceed the MTCA Method C Cleanup Levels protective of direct contact with soil. Based on empirical evidence that groundwater was not being adversely affected by soil (i.e., groundwater results from MW-1) and that the results were less than the MTCA method C cleanup levels protective of direct contact with the soil, no cleanup action was completed for the 1975 Earth Fill Area.

#### 3.4.4. Post-Independent Cleanup Action Groundwater Monitoring

Following completion of the 2002 Independent Cleanup Action, two rounds of groundwater monitoring (June 2002 and August 2002) were completed at monitoring well locations MW-1 through MW-4. The results of the sampling activities relative to the 2002 VCP cleanup levels are summarized below:

- Arsenic was detected in groundwater at concentrations greater than the Washington State background level of 8 µg/L at monitoring well location MW-4 during both the June 2002 and August 2002 monitoring events.
- Diesel-range petroleum hydrocarbons exceeded VCP cleanup levels at monitoring well locations MW-2 and MW-3 during the June 2002 monitoring event. However, during the August 2002 monitoring event, petroleum hydrocarbons were not detected in any of the wells sampled.

Other analytes evaluated at part of the post-independent cleanup action monitoring events either were not detected or were detected at concentrations less than the 2002 VCP cleanup levels.

### 3.5. 2007 Ecology Agreed Order Remedial Investigation Field Activities

As required by the 2007 Agreed Order, the Port completed a RI field investigation to fill data gaps in the characterization of Site sediment, groundwater and soil conditions and to define the nature and extent of contamination. The investigation activities completed to meet the objectives of the Ecology-approved RI/FS Work Plan are summarized in the following sections.

#### 3.5.1. Contaminants of Potential Concern

As described in the Ecology-approved RI/FS Work Plan, Site contaminants of potential concern (COPCs) for the Marine Area sediment and Upland Area soil and groundwater were established for the RI based on a review of the previous environmental studies completed at the Site and historical/current land uses. The COPCs and rationale for their selection is summarized below.

**MARINE AREA SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN**

| Contaminants of Potential Concern | Rationale |
|---|---|
| Copper | Exceeded preliminary screening level protective of benthic organisms in surface (0-10cm) sediment at location DC-SED-03. |

| Contaminants of Potential Concern | Rationale |
|---|---|
| Lead | Exceeded preliminary screening level protective of human health and higher trophic level receptors in surface (0-10cm) sediment at location DC-SED-02 and DC-SED-03. |
| Mercury | Exceeded preliminary screening level protective of human health and higher trophic level receptors in surface (0-10cm) sediment in the composite DMMP sample for DMMU-D2. |
| Zinc | Exceeded preliminary screening level protective of benthic organisms in surface (0-10cm) sediment at location DC-SED-03. |
| Tributyltin (Bulk and Porewater) | Exceeded preliminary screening level protective of human health and higher trophic level ecological receptors in surface (0-10cm) at location DC-SED-05. |
| Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) | Exceeded preliminary screening level protective of benthic organisms and/or human health and higher trophic level ecological receptors in surface (0-10cm) sediment at locations DC-SED-02 and DC-SED-08, and in surface (0-10cm) sediment in the composite DMMP sample for DMMU-D2. |
| High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) | Exceeded preliminary screening level protective of benthic organisms and/or human health and higher trophic level ecological receptors in surface (0-10cm) sediment at locations DC-SED-02, DC-SED-03 and DC-SED-08, and in surface (0-10cm) sediment in the composite DMMP sample for DMMU-D2. |
| Total cPAHs (TEQ) | Exceeded preliminary screening level protective of human health and higher trophic level ecological receptors in surface (0-10cm) at locations multiple locations within the Marine Area. |
| Total PCBs | Exceeded preliminary screening level protective of benthic organisms and/or human health and higher trophic level ecological receptors in surface (0-10cm) sediment at locations DC-SED-02, DC-SED-03 and DC-SED-08. |
| Dioxins/Furans | Exceeded preliminary screening level protective of human health and higher trophic level ecological receptors in surface (0-10cm) at locations DC-106-4, DC-106-5, DC-106-6 and DC-106-7. |

The listed contaminants above were identified as COPCs based on preliminary cleanup level exceedances and were the focus of the sediment investigation completed for the RI. In addition, other metals (arsenic, cadmium, chromium and silver) and SVOCs (including polycyclic aromatic hydrocarbons [PAHs], phenols, phthalates, chlorinated organics and miscellaneous extractables) were also analyzed as part of the RI for consistency with SMS requirements.

**UPLAND AREA SOIL AND GROUNDWATER CONTAMINANTS OF POTENTIAL CONCERN**

| Contaminants of Potential Concern (COPCs) | Rationale |
|---|---|
| Arsenic | Exceeded preliminary cleanup levels at multiple locations throughout the Upland Area in soil and groundwater. |
| Nickel | Exceeded preliminary cleanup levels at multiple locations throughout the Upland Area in soil and groundwater. |
| Gasoline-Range Hydrocarbons | Exceeded preliminary cleanup levels in upland soil in the 1975 Earth Fill and Petroleum Areas. |

| Contaminants of Potential Concern (COPCs) | Rationale |
|---|---|
| Diesel and Heavy Oil-Range Hydrocarbons | Exceeded preliminary cleanup levels in upland soil and groundwater in the Petroleum Area. |
| Total cPAHs (TEQ) | Exceeded preliminary cleanup levels at multiple locations throughout the Upland Area in soil. |

The listed contaminants above were identified as COPCs based on preliminary cleanup level exceedances and were the focus of the upland soil and groundwater investigations completed for the RI. Additionally, other metals (including cadmium, chromium, copper, lead, mercury and zinc), SVOCs, VOCs (including BETX, methyl tertiary-butyl ether [MTBE], dibromoethane, 1-2 [EDB], dichloroethane, 1-2 [EDC]), and dioxins and furans were also analyzed as part of the RI to further evaluate subsurface conditions based on historical and current land use.

### 3.5.2. Sediment Remedial Investigation

The sediment RI was completed in general accordance with the Ecology-approved RI/FS Work Plan to characterize the vertical extent of sediment contamination in areas previously identified as exceeding the SMS criteria and to evaluate sediment quality in the Marine Area where no data previously existed. Sample locations are shown on Figure 12. Field procedures including sample handling, equipment decontamination and field screening are presented in Appendix H. Surface and subsurface sediment sampling activities are summarized in the following sections.

#### *3.5.2.1. Sediment Sample Collection*

The sediment samples were collected in from seven locations (G-1 through G-7) within the Marine Area (Figure 12). Sediment samples at locations G1, G2 and G7 were collected using a vibracore deployed from a research vessel. Sediment samples at locations G3 through G6 were collected from the upland area using a limited access direct-push drill rig during low tide. Surface and subsurface sediment samples were collected from cores that were advanced to depths ranging from approximately 4 to 7 feet below the mudline surface.

Upon collection, sediment samples were visually evaluated for the presence of wood debris, visually classified in accordance with ASTM International (ASTM) D 2488 methods and the Unified Soil Classification System (ASTM D 2487), homogenized in a stainless-steel bowl to a uniform in color and texture and placed into laboratory-prepared sample containers for analysis. Field screening results, observed wood content and a description of the material encountered during surface sediment sampling activities are summarized on the exploration logs presented in Appendix H.

#### *3.5.2.2. Sediment Sample Laboratory Analysis*

Samples collected for the sediment RI were submitted to Analytical Resources, Inc. (ARI) located in Tukwila, Washington. Selected samples were submitted for analysis of one or more of the COPCs identified above based on proximity to specific historical activities and previous sample results in accordance with the RI/FS Work Plan, including:

- Grain size by Puget Sound Estuary Program (PSEP) 1986 protocol;
- Total organic carbon (TOC) by PSEP protocol 1986;

- Total volatile solids (TVS) by PSEP protocol 1986;
- Total Solids (TS) by PSEP protocol 1986;
- Total Ammonia by EPA Method 350.1 M;
- Total Sulfides Standard Method (SM) 4500-S2;
- Tributyltin by EPA Method 8270D-SIM/KRONE;
- SMS metals by EPA Method 6000/7000 series;
- SMS SVOCs by EPA Method 8270/8270-SIM; and,
- PCBs by EPA Method 8082.

The schedule of analysis for sediment samples collected during the sediment RI are summarized in Table 5. Sediment sample results for this and previous environmental studies are presented in Table C-1 and C-2 (Appendix C) and were used as the basis for the 2008 Interim Action. Interim action activities including confirmation sampling are further discussed in Sections 4.0.

#### *3.5.2.3. Deviations from RI/FS Work Plan*

The surface and subsurface samples were collected in general accordance with the Ecology-approved RI/FS Work Plan. However, sediment sample location G-2 was moved approximately 15 feet to the west due to core refusal on the initial attempt. During the initial sampling attempt, the vibracore reached refusal at a depth of 2 feet below the mudline surface. At the new sample location, the vibracore was advanced to a depth of approximately 4 feet below mudline.

### 3.5.3. Groundwater Remedial Investigation

The groundwater RI was completed in general accordance with the Ecology-approved RI/FS Work Plan to characterize groundwater conditions at the shoreline where groundwater discharges to surface water, evaluate groundwater conditions within the Petroleum Area (independent cleanup action area), to estimate the hydraulic conductivity of the shallow aquifer, and to evaluate tidal influence on the shallow aquifer. Groundwater sampling activities are summarized in the following sections. Sample locations are shown on Figure 13. Field procedures including monitoring well installation and development, sample handling, equipment decontamination and field screening are presented in Appendix H. Groundwater RI field activities are summarized below.

#### *3.5.3.1. Groundwater Sample Collection*

The groundwater RI included the installation and development of new monitoring wells MW-2A, MW-2B, MW-3A, MW-5, MW-6, MW-7 and MW-8 and collection of groundwater samples from the four existing monitoring wells (MW-1 through MW-4) at the Site[1]. Following installation, a GeoEngineers field representative completed monitoring well development and a field survey to obtain coordinates and top of casing rim elevation for new monitoring wells. Well installation, development, and surveying activities completed for MW-5 is summarized in Appendix H.

In accordance with the Ecology-approved RI/FS Work Plan, monitoring well MW-5 was initially installed in May 2008 for completion of the June 2008 monitoring event to evaluate groundwater conditions. Following

[1] Monitoring wells with the suffix "A" or "B" indicate a replacement well was installed in place of the original well.

completion of the 2008 Interim Action in the Marine Area of the Site and reconfiguration of the shoreline by the Project Pier 2 redevelopment, Ecology required that four additional rounds of quarterly groundwater monitoring be completed to evaluate groundwater conditions. Quarterly groundwater monitoring events were completed in May 2012, August 2012, November 2012 and February 2013. In preparation for these monitoring activities, replacement wells MW-2A and MW-3A, and new monitoring wells MW-6 and MW-7 were installed in advance of the quarterly monitoring events to further evaluate groundwater conditions at the Site.

Due to inconclusive evidence linking contaminant exceedances identified in soil to contaminant exceedances in groundwater (further discussed in Section 5.5), Ecology required that four additional rounds of groundwater monitoring be completed on a semi-annual basis to further evaluate the potential source of soil contamination to groundwater (Ecology 2015). In addition, Ecology determined that the location of monitoring well MW-1 (Figure 13) may not adequately represent the conditional point of compliance in this area of the Site and that a new well (MW-8) be installed north of MW-1 to serve as the point of compliance. To avoid potential utilities, structural obstructions and minimize impacts to DCI's operations, MW-8 was positioned within Warehouse 9 located west of the Syncorlift Pier in an area which soil and groundwater conditions had not been previously evaluated.

During each monitoring event, groundwater samples were collected for chemical analytical testing using a peristaltic pump and disposable polyethylene tubing using low-flow/low-turbidity sampling techniques. A Horiba or YSI multi-probe field meter with a flow-through cell and/or Hach Turbidimeter were used to monitor water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, TDS, turbidity, oxidation-reduction potential and temperature. Water samples were obtained once these parameters were measured to vary by less than 10 percent on three consecutive measurements. If water quality parameters did not stabilize, samples were collected after purging approximately three well-volumes.

#### *3.5.3.2. Groundwater Sample Laboratory Analysis*

Samples collected for the groundwater RI were submitted to CCI Analytical (CCI) located in Everett, Washington, ARI located in Tukwila, Washington, and OnSite located in Redmond, Washington. Samples were submitted for analysis of one or more of the COPCs identified based on proximity to specific historical activities and previous sample results in accordance with the RI/FS Work Plan and in discussions with Ecology following their review of the initial 2008 and 2012/2013 groundwater monitoring data. Groundwater samples were submitted for a combination of the following analysis:

- Total and dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc) by EPA Method 6000/7000 series;
- Gasoline-, diesel- and heavy oil-range petroleum hydrocarbons by NWTPH-Gx and NWTPH-Dx;
- VOCs by EPA Method 8260;
- SVOCs/PAHs by EPA Method 8270/SIM;
- Pesticides and herbicides by EPA Method 8081/8151; and
- Dioxins and Furans using EPA Method 8290 or EPA Method 1613B.

The schedule of laboratory analysis for samples collected during the groundwater RI are summarized in Table 6. Groundwater sample results for this and previous environmental studies are presented in Table F-1 (Appendix F) and discussed in Sections 5.4 and 5.5.

#### *3.5.3.3. Hydraulic Conductivity Study*

Hydraulic conductivity (K) testing was performed on June 16, 2008 on monitoring wells MW-1 through MW-5 within the shallow groundwater unit. The location of monitoring wells used to measure hydraulic conductivity are shown on Figure 13. Falling and rising head slug tests were performed on each well. Prior to conducting each slug test, an electronic water-level sensor consisting of a pressure transducer and automated datalogger was installed in the well. The hydraulic response was measured by the electronic water-level sensor, which was programmed to record the hydraulic pressure at 1-second intervals. Additionally, the depth to groundwater was measured manually using an electronic water level indicator to document the static groundwater level prior to initiating the slug tests as well as during and after each slug test.

The falling head slug test was performed by rapidly lowering a slug constructed of a sealed and weighted 5-foot-long section of polyvinyl chloride (PVC) pipe of known volume into the well causing the water level to rise rapidly above the initial, static water level. The groundwater level was then monitored until it returned (fell) to the approximate initial water level. Falling head tests were not evaluated for wells where the water table was within the well screen because the falling head response is affected by drainage into the unsaturated zone above the water table.

The rising head slug test was conducted following the falling head test in each well after recovery of the water table to the initial water level. Rising head tests were conducted by rapidly removing the slug from the well causing the water level to fall rapidly below the initial level. The groundwater level was monitored until it returned (rose) to the approximate initial water level. Wells where the water table was within the well screen interval were evaluated for hydraulic conductivity using the rising head data.

Data from the falling head or rising head tests were used to estimate hydraulic conductivity at each well using the Bouwer-Rice (1976) method. Field procedures for the slug tests are presented in Appendix H. The results of the slug tests are summarized in Section 5.3.

#### *3.5.3.4. 72-hour Tidal Study*

A 72-hour tidal study was completed between June 17 to June 20, 2008 using selected monitoring wells in the Upland Area to evaluate the influence of tidal variations in the level of surface water in the adjacent Guemes Channel on groundwater levels at the Site. Monitoring locations adjacent to the shoreline including MW-1 through MW-3 and at varying distances from the shoreline including MW-4 and MW-5 were selected to evaluate the lateral influence of tidal action on groundwater. The locations that were monitored as part of the tidal study are shown on Figure 13.

The tidal study recorded groundwater/potentiometric level response to tidal fluctuations using electronic water-level sensors consisting of a pressure transducer and automated datalogger installed in each monitoring location. Additionally, an electronic water-level sensor was attached to the East Dock (now removed) within the Marine Area to directly monitor and record the surface water level for comparison to water levels recorded in upland monitoring locations. The water-level sensors were removed from the monitoring locations and Marine Area after completion of the tidal study.

The data generated as part of the tidal study was analyzed using the Serfes (1987) method to identify the mean groundwater elevations and flow direction during the 72-hour tidal study and the Ferris (1951) method to evaluate hydraulic parameters of the shallow and deep groundwater units. Field procedures for the tidal study are presented in Appendix H. Results of the tidal study are summarized in Section 5.3.

#### *3.5.3.5. Deviations from RI/FS Work Plan*

The following deviations from the Ecology-approved RI/FS Work Plan occurred during the groundwater RI:

- During the February 2016 groundwater monitoring event, monitoring well MW-2A was observed to be damaged and as a result, no water samples were collected from this location for laboratory analysis. In August 2016, a replacement monitoring well (MW-2B) was installed for evaluating groundwater conditions.
- Prior to the 2012/2013 quarterly groundwater monitoring activities, the location of monitoring well MW-5 could not be identified. Ecology determined that a replacement well for MW-5 was not necessary and the existing monitoring well network was sufficient to evaluate groundwater conditions at the Site.

### 3.5.4. Soil Remedial Investigation

The soil RI was completed in general accordance with the Ecology-approved RI/FS Work Plan to characterize soil conditions in the Upland Area of the Site. The primary objective of the soil RI was to fill identified data gaps in the historical site characterization studies. Soil sample locations for the RI are shown on Figure 14. Field procedures including sample collection and handling, equipment decontamination and field screening are presented in Appendix H. The soil RI field activities are summarized below.

#### *3.5.4.1. Soil Sample Collection*

The soil RI included the collection of samples from the Site using a combination of hollow stem auger (HSA) drilling, direct push (DP) drilling, test pit (TP) and hand auger (HA) drilling technologies. In June 2008, subsurface soil samples were collected from eleven HSA explorations, ten test pit explorations and three hand auger explorations to meet the objectives of the RI/FS Work Plan.

As described in Section 3.5.3, the Port completed additional quarterly groundwater monitoring activities between May 2012 and February 2013 following completion of the 2008 Interim Action and reconfiguration of the shoreline during the Project Pier 1 redevelopment to evaluate whether previously identified contaminants in soil were adversely effecting groundwater. The results of the quarterly groundwater monitoring activities (further discussed in Sections 5.4 and 5.5) identified concentrations of arsenic, nickel and cPAHs exceeding groundwater PCULs during one or more quarterly monitoring events. In 2014, a supplemental soil investigation was completed to further characterize the nature and extent of these contaminants in soil. During this supplemental soil investigation, 43 DP explorations were completed to further evaluate subsurface soil conditions.

Three additional DP explorations were completed in July 2018 to evaluate soil conditions adjacent to and upgradient from monitoring well MW-8 based on the detected concentrations of arsenic and cPAHs in groundwater at this location.

Soil from each exploration was visually classified in general accordance with ASTM D-2488 and screened in the field for the presence of contamination. In addition, the presence of wood debris by type (i.e., saw dust, bark, chips, chunks, twigs, fibers, etc.) was also recorded when encountered. Field screening consisted of visual observation of contamination (i.e., staining, discoloration, etc.), water sheen testing, and organic vapor monitoring using a photo-ionization detector (PID). Exploration logs for soil investigation activities detailing observed soil conditions and field screening results are presented in Appendix H.

#### *3.5.4.2. Laboratory Analyses*

Samples collected as part of the soil RI were submitted to CCI located in Everett, Washington, and OnSite located in Redmond, Washington. Samples were submitted for analysis of one or more of the COPCs identified based on proximity to specific historical activities and previous sample results in accordance with the RI/FS Work Plan and discussions with Ecology following review of the initial 2008 and 2012/2013 groundwater monitoring data. Soil samples were submitted for a combination of the following analysis:

- Metals (arsenic, copper, nickel and zinc) by EPA Method 6000/7000 series;
- PAHs by SW-846 8270-SIM;
- Gasoline-range hydrocarbons by NWTPH-Gx;
- Diesel- and oil-range petroleum hydrocarbons by NWTPH-Dx with silica gel cleanup;
- VOCs including MTBE, EDB, and EDC by EPA Method 8260B and 8011; and
- Dioxins and furans using EPA Method 8290 or EPA Method 1613B.

#### *3.5.4.3. Deviations from RI/FS Work Plan*

The following deviations from the Work Plan were noted during the soil field investigation:

- Exploration locations for SB-1, SB-2, SB-4, SB-7 and SB-11 were adjusted in the field due to access restrictions resulting from shipyard operations (i.e., equipment storage and staged steel for vessel construction).
- Ten test pit explorations (TP-3 through TP-5 and TP-10 through TP-16) were completed in the east portion of the Site in October 2008. The purpose of the test pit explorations was to supplement the existing data in this area and to further evaluate the limits of arsenic, copper and zinc exceedances previously identified in this area. The test pits were completed during installation of subsurface infrastructure as part of the Project Pier 1 Redevelopment.

### 3.5.5. Evaluation of Site Outfalls and Catch Basins

During development of the RI/FS Work Plan, Ecology identified sediment in DCI catch basins as a potential source of contamination to the Marine Area sediments. However, the DCI stormwater system has been significantly modified since preparation of the RI/FS Work Plan. Over-time, the majority of the Site surfaces have been paved and a new stormwater collection system (described in detail in Section 1.4.6) was installed as part of the Port's Project Pier 1 redevelopment to capture the stormwater and wastewater from the Site for treatment prior to discharge. Stormwater and wastewater captured at the Site is treated prior to discharge to the City's sanitary sewer or to Guemes Channel under NPDES General Permit WAR045711. DCI performs regular monitoring of the water collection systems in accordance with DCI's SWPPP to ensure compliance with the discharge requirements of the NPDES permit.

Potential historical contaminant discharges to the Marine Area prior to the stormwater system upgrade activities have been addressed as part of the 2008 Interim Action (further discussed below), where the contaminated surficial and underlying clean native sediments were removed. The 2008 Interim Action dredging resulted in the removal of the known contaminated sediments from the Marine Area, therefore establishing a new baseline relative to potential contaminant sources.

As a result of the ongoing treatment and monitoring activities for stormwater and wastewater from the Site, discharges from the DCI stormwater/wastewater collection systems are no-longer a potential source of contamination to the Marine Area.

## 3.6. Environmental Data Used for the RI

Data sources for this RI report include data collected in general accordance with the Ecology-approved RI/FS Work Plan. Environmental data collected under the RI/FS Work Plan to fulfil the requirements of the Agreed Order were reviewed for technical quality. Based on this technical review, the data were determined to be of acceptable quality, as qualified and have been entered into Ecology's Environmental Information Management (EIM) System under Study ID FS2670 DCI. Laboratory data reports for sediment, groundwater and soil RI activities completed by GeoEngineers are presented in Appendix I. Validation reports for these data are presented in Appendix J.

Historical sediment, groundwater and soil data were also reviewed for technical quality. Environmental data in which sample locations, sample depth, analytical methods and chemical analytical results (as qualified) could be verified are considered acceptable for use to identify Site COPCs. Chemical analytical data used for this RI to identify COPCs and to evaluate the nature and extent of contaminates exceeding PCULs are described below.

### 3.6.1. Sediment

The sediment data used for this RI consists of samples obtained by GeoEngineers in March 2008 in general accordance with the RI/FS Work Plan to evaluate near shore sediment conditions as well as data collected by others to support dredge material suitability determination. These data were used to identify COPCs in the Marine Area and form the basis for Interim Action dredging completed in 2008 (further discussed in Section 4.0).

Confirmation sample results obtained following completion of the 2008 Interim Action as well as sediment sample results collected as part of the 2007 Fidalgo Bay Sediment Investigation represent current (post Interim Action) sediment conditions for the Marine Area and north adjacent Guemes Channel.

### 3.6.2. Groundwater

A network of monitoring wells installed in the Upland Area of the Site were used to evaluate hydrogeologic conditions and the nature and extent of contamination in groundwater. The network of groundwater wells used to evaluate groundwater conditions is comprised of eight monitoring wells (MW-1 through MW-8) screened in the shallow unconfined aquifer. Well completion logs for the groundwater monitoring well network are presented in Appendix E and H.

Groundwater data collected during previous environmental studies were used to identify COPCs[2]. In accordance with the Ecology-approved RI/FS Work Plan and as requested by Ecology, groundwater data

[2] Groundwater data collected prior to the 2002 Petroleum and Marine Area Cleanup Actions are not considered representative of Site conditions given the extent of soil contamination removal completed for these areas (see Section 3.4), and therefore were not used to identify COPCs.

was obtained by GeoEngineers between June 2008 and August 2017 to evaluate the nature and extent of COPCs. These groundwater sampling results represent the data set for the RI.

#### 3.6.3. Soil

Soil data collected during previous environmental studies were used to identify COPCs for the RI. In addition, Groundwater data obtained by GeoEngineers were used to support identification of soil COPCs (i.e., if a COPC was not previously identified in soil and the results of RI groundwater sampling confirmed that a COPC was not present, then it was not retained as a soil COPC for further evaluation). In accordance with the Ecology-approved RI/FS Work Plan and as requested by Ecology, soil data was obtained by GeoEngineers between June 2008 and July 2018 to evaluate the nature and extent of COPCs. These soil sampling results represent the data set for the RI.

## 4.0 INTERIM ACTION

An Interim Action was completed within the Marine Area as part of the Project Pier 1 redevelopment in 2008. The purpose of the Interim Action was to remove contaminated sediment from the Marine Area identified by the sediment RI and other sediment characterization studies. In addition, contaminated soil from the Upland Area of the Site where new underground utility infrastructure was installed was also removed. The extent of contaminated sediment for removal was based on the sample results from previous environmental studies and sediment investigation activities completed as part of the RI (Sections 3.1 and 3.5). Contaminated soil was removed from new subsurface utility corridors that were constructed as part of the Site redevelopment.

A detailed description of the Ecology-approved 2008 Interim Action is presented in the Interim Action Report (GeoEngineers 2010; Appendix K). Characterization activities and results for dredged material management and Upland Area soil, interim action dredging and nearshore excavation activities, confirmation sampling and restoration are summarized in the following sections.

### 4.1. Dredged Material Characterization

The Marine Area sediments were characterized for the purposes of dredged material disposal in addition to the RI sediment characterization. For the purposes of the dredged material characterization, the Marine Area was divided into two DMMUs (DMMU-D1 and DMMU-D2). DMMU-D1 encompassed sediment in the north and outer approximate half of the Marine Area and was located farther offshore from known sources while DMMU-D2 encompassed the sediment in the south and inner approximate half of the Marine Area, adjacent to the uplands and known historical sources of contamination (Figure 7).

Based on the results of the dredged material characterization, the DMMP determined that surface and subsurface sediment in DMMU-D1 was suitable for open-water disposal. In DMMU-D2, the DMMP determined that recent sediments (above the native glaciomarine layer) were contaminated and therefore, not suitable for open-water disposal. However, the underlying native glaciomarine sediments were suitable for open-water disposal. A copy of the DMMP open-water suitability determination is presented in Appendix D.

## 4.2. Marine and Upland Area Characterization Results

### 4.2.1. Marine Area Sediment Characterization

Marine Area sediment characterization (including the RI; Section 3.1 and 3.5) identified contaminant concentrations exceeding SMS cleanup standards including metals (arsenic, copper, lead, mercury and zinc), HPAHs, LPAHs, phenols and PCBs in recent fill sediment within DMMU-D2. At the time that the Interim Action was completed, PCULs for dioxins and furans, and cPAHs were not yet established by Ecology under the SMS. The existing data on the Marine Area sediments show however, that the detected exceedances of dioxins and furans, and cPAHs (relative to current SMS standards) were only present in the surficial fill sediment above the native glaciomarine deposits and that PCUL exceedances of these contaminants were not observed in subsurface sediment based on historical core sample results (i.e., AN-P1-2, AN-DCI-1A/B and AN-DCI-2) and Interim Action confirmation sample results (i.e., SMA-1 through SMA-5).

Sediment characterization activities completed as part of the 2008 RI showed that that the vertical extent of sediment contamination extended from the mudline to approximately 1-foot below the mudline surface along the eastern edge of the basin (sample location G-2), to approximately 4 feet below the mudline surface along the southwest corner of the Marine Area (sample locations G-5 and G-6) and to the native glaciomarine contact in the southeast corner of the basin (sample locations G-3 and G-4). In accordance with the DMMP suitability determination, contaminated sediment deposits within DMMU-D2 were removed as part of the 2008 Interim Action and transferred from the Site for upland disposal.

Historical and RI sediment sample results are summarized in Tables C-1 and C-2 (Appendix C) and shown relative to the Property on Figures 7 and 12.

### 4.2.2. Upland Area Soil Characterization

In the Upland Area, environmental studies (including the RI; Section 3.2 through 3.5) identified PCUL exceedances of metals (arsenic and nickel) and cPAHs in soil and/or groundwater (further discussed in Section 5.4 and 5.5). Arsenic results in soil samples collected during the 2008 RI were used to evaluate the Upland Area component of the Interim Action. Based on the analytical results of the 2008 RI, the native deposits underlying upland fill soil was identified as the vertical limit of the upland soil contamination. The interim action in the Upland Area included the excavation and disposal of fill soil excavated to facilitate the installation of new subsurface utility infrastructure as part of the Project Pier 1 redevelopment project.

Historical and RI soil sample results are summarized in Tables G-1 and G-2 (Appendix G) and shown relative to the Property on Figures 9 and 14.

## 4.3. Summary of the 2008 Interim Action Activities

Interim action dredging and excavation activities were completed between July and November 2008 in general accordance with the Ecology-approved RI/FS Work Plan and Interim Action Work Plan Addendum, and in general accordance with the MTCA Cleanup regulation and applicable state and federal laws described in WAC 173-340-430.

The Port's general contractor for interim action construction was Pacific Pile and Marine (PPM) of Seattle, Washington. The extent of contaminated sediment dredging and soil excavation during the interim action was defined based on the results of previous environmental studies as described above and field observations and chemical analyses of confirmation samples completed during construction. A

GeoEngineers field representative was onsite during dredging and excavation activities to field screen dredged and excavated materials for evidence of contamination and to assist the contractor in identifying the limits of contamination. In general, the native glaciomarine layer underlying the recent fill deposits was used as the lower limit of contamination for sediment dredging in the Marine Area and soil excavation in the Upland Area. Confirmation samples were collected from the post-dredge surface to confirm the completeness of the contaminated sediment removal action.

As a result of the interim action dredging, approximately 26,000 cubic yards (approximately 38,000 tons) of contaminated sediment was dredged from the Marine Area and transported by truck for disposal at the Waste Management's Subtitle D landfill facility in Wenatchee, Washington. Following removal of the contaminated material, dredging was completed to deeper elevations to meet the planned redevelopment navigation depths. Deeper dredging completed following the interim action included removal of an additional approximately 230,000 cubic yards of sediment from the Marine Area that was transported by barge to the Rosario Strait dispersive site to meet the design grade of -35 feet MLLW within the Marine Area. Prior to completion of the deeper dredging activities, confirmation samples (SMA-1 through SMA-5) were collected to verify the removal of sediment contamination. Confirmation sample locations are shown on Figure 12. Confirmation sample results documenting the removal of previously identified sediment contamination are summarized in Tables C-1 and C-2. Included in Tables C-1 and C-2 are sediment sample results collected during the 2007 Fidalgo Bay Sediment Characterization Study. Confirmation sample results and sediment sample results for the 2007 Fidalgo Bay Sediment Characterization Study represent the current sediment conditions for the Marine Area and surrounding area.

In the Upland Area, approximately 570 cubic yards (approximately 860 tons) of arsenic contaminated soil was excavated from the Upland Area and transported by truck for disposal at the Waste Management's Subtitle D landfill facility in Wenatchee, Washington. Excavation activities in the upland area ranged in depth from approximately 3 feet to 9.5 feet bgs to facilitate installation of the new subsurface utility corridors.

### 4.4. Backfill and Restoration

Project Pier 1 redevelopment involved expansion of the Upland Area northward by filling the part of the remediated Marine Area. To facilitate the filling, a permanent sheet pile wall (open cell bulkhead) was installed in the Marine Area (Figure 13) and the area behind the sheet pile wall was backfilled with imported material in accordance with the redevelopment project requirements to match the surrounding upland grade. Along the eastern slope of the Marine Area, up to 1-foot of habitat mix was imported and placed within SMA-1 (Figure 13) to restore the subtidal slopes to design grades following dredging.

The current Site layout including the location of new bulkhead and subsurface utility corridors is shown on Figure 4. The current Marine Area is maintained to an approximate navigational depth of -35 feet MLLW. The ground surface in the upland portion of the DCI shipyard has a grade of approximately +13 feet MLLW south of the open cell bulkhead.

# 5.0 REMEDIAL INVESTIGATION RESULTS

## 5.1. Sediment Stratigraphy

The stratigraphy of sediment in the Marine Area was characterized based on observations of materials encountered in explorations completed as part of the RI and as part the previous sediment investigations completed at the Site (Section 3.0). Prior to dredging in 2008, subsurface sediment conditions in the Marine Area generally consisted of approximately 3 to 7 feet of recent deposits consisting of loose silt and sand with occasional shell fragments overlying glaciomarine deposits consisting of very dense sand and hard silt. Near the outer harbor line, glaciomarine deposits were encountered at depths ranging between -35 and -40 feet MLLW. In the nearshore portion of the Marine Area, glaciomarine deposits were encountered at depths ranging between -10 and -15 MLLW.

During the 2008 Project Pier 1 redevelopment activities, sediment in the Marine Area north of the installed open cell bulkhead (Figure 5) was dredged to an approximate depth of -35 feet MLLW – well into the clean glaciomarine layer. South of the open cell bulkhead, Marine Area dredging was completed to remove the contaminated recent silt and sand deposits to the surface of the clean native glaciomarine layer. At the completion of the Project Pier 1 redevelopment, the area south of the open cell bulkhead was filled with clean imported material to the current grade of approximately 15 feet MLLW.

The stratigraphy of the Marine Area prior to dredging is shown in cross-section on Figure 15. The stratigraphy of the Marine Area following dredging is shown in cross-section on Figure 16. Information from the sediment cores from the RI and previous environmental studies were used to prepare these cross-sections.

## 5.2. Soil Stratigraphy

The stratigraphy of soil in the Upland Area was characterized based on observations of materials encountered in soil explorations completed as part of the RI and as part of the previous soil investigations completed at the Site (Section 3.0). The information from observations of the soil explorations was used to prepare cross-sections illustrating soil stratigraphy in the Upland Area. Cross-section locations in the Upland Area are shown on Figure 14. Cross-sections illustrating soil stratigraphy are presented on Figures 17 and 18.

Development of the Site has included filling of the nearshore part of the Marine Area to expand the Upland Area of the Site. Based on observations from the soil explorations, the stratigraphy at the Site generally consists of artificial fill soil deposits overlying native sand and silt. The stratigraphy of Upland Area generally includes the following:

- **Recent Fill Deposits:** Project Pier 1 redevelopment activities resulting in the expansion of the Upland Area northward of the historical shoreline after completion of the interim action dredging. To facilitate the infilling of this area, an open cell bulkhead was installed and the area behind the wall was backfilled to match the surrounding upland grade with clean imported material to meet the project design requirements. In addition, subsurface utilities (electric power, water, sewer, etc.) located within the upland interim action area (Figure 14) that served historical and existing facilities at the Site were decommissioned and replaced with new utility infrastructure to support DCI operations. The fill placed as part of Project Pier 1 ranges in thickness from approximately 3 to 20 feet with the thickest deposits located immediately south of the open cell bulkhead.

- **Historical Fill Deposits:** The historical fill deposits are comprised of layers of sand, silty sand and silt with variable gravel content ranging from approximately 2 to 16 feet thick that were placed during initial shoreline development in the 1960s to extend the historical shoreline northward. Contained in the historical fill deposits are occasional debris including concrete asphalt, brick and wood fragments. Historical fill deposits generally increase in thickness north of 3rd Street
- **1975 Earth Fill Area Deposits:** The "1975 Fill Area" located in the southwestern portion of the Site was used for residential purposes from before 1925 until after approximately 1966 based on a review of historical Sanborn maps and aerial photographs. This area was topographically lower than the surrounding ground surface and was filled around 1975. In this area, fill deposits consist of layered silt, clay and silty sand deposits with occasional wood debris that are approximately 6 to 7 feet in thickness suggesting that some fill was placed prior to 1975.
- **Native Deposits:** Native material underlying the fill deposits at the Site include beach sands overlying glacial deposits. The beach sand deposits are typically poorly sorted and loose in nature and vary in thickness from 2 to 4 feet. Glacial deposits consist of a medium dense glaciomarine drift with varying amounts of silt, sand, and gravel that extend to all depths explored. A layer of dark brown organic deposits is present below the fill layer in central and southwestern portions of the Site. The organic layer varies in thickness from several inches to 2 feet.

## 5.3. Hydrogeology

Based on the results of the RI, groundwater occurs at the Site in a single aquifer comprised of two separate hydrostratigraphic units that control groundwater elevations, flow directions and the degree of influence from tidal fluctuations in the adjacent Guemes Channel. The two hydrostratigraphic units include a shallow unconfined aquifer and underlying confining unit. The shallow water-bearing unit at the Site is comprised of sand and gravel fill and native sand deposits (i.e., native beach sands). The confining unit at the Site is comprised of the glacially consolidated deposits.

Within the shallow groundwater unit, the groundwater elevation varies seasonally, with observed wet season elevations being higher than dry seasons by up to approximately 1 foot. Asphalt and concrete pavement at the Site inhibit the infiltration of precipitation across the majority of the Upland Area making the primary recharge mechanism for the shallow groundwater unit precipitation falling onto and infiltrating into soil south of the Site where it subsequently flows toward the Guemes Channel. Precipitation falling on the asphalt and concrete pavement is captured in catch basins and is treated prior to discharge to Guemes Channel. Precipitation falling on the limited areas that are gravel surfaced at the Site infiltrates into the ground and recharges to some degree, shallow groundwater within these areas.

### 5.3.1. Tidal Study Results

A 72-hour tidal study was completed using existing monitoring well locations at varying distances from the shoreline to evaluate the lateral influence of tidal action in the Guemes Channel on groundwater. A surface water location in the Marine Area was also monitored to directly record the surface water level for comparison to water levels recorded in the upland monitoring locations. Where present, tidal fluctuations in groundwater levels in individual monitoring locations were analyzed to identify the following:

- The magnitude of the tidal influence on the groundwater level in the well relative to distance from the shoreline, which is identified as the stage ratio and presented as a percent (%);

- The length of time it took for the tidal effect observed at the shoreline to reach an individual monitoring well location, which is identified as the time lag and presented in hours; and
- The effect of tidal fluctuations on groundwater gradients.

Based on the results of the tidal study, shallow groundwater at the shoreline was determined to be tidally influenced. Tidal influence on groundwater at other monitoring locations located further upland of the shoreline and within the interior portion of the Upland Area was indeterminate based on the Serfes (1987) analysis method (Appendix H). The magnitude of tidal influence on shallow groundwater, as indicated by the stage ratio, was greatest at monitoring wells MW-2 (16 percent) and MW-3 (5.1 percent) located adjacent to the shoreline. Limited tidal influence (stage ratio of 3 percent or less) was observed at the other monitoring wells evaluated as part of this study. In general, the results of the tidal study indicate that there is limited communication between tidally influenced marine water and shallow groundwater at the Site except within approximately 150 feet of the shoreline.

The monitoring well locations used for the tidal study and the observed tidal effects are shown on Figure 19. A detailed description of the methodology used to perform the tidal study as well as the tidal study results are presented in Appendix H. Please note that the 72-hour tidal study was completed prior to installation of the open cell bulkhead as part the 2008 Interim Action for the Site. Currently, the open cell bulkhead which now separates the Upland Area from the Marine Area likely provides a physical barrier restricting the direct discharge of groundwater north to Guemes Channel.

#### 5.3.2. Groundwater Gradients

Characterization of the groundwater gradient and flow direction in the Upland Area is based on the results of the tidal study by averaging the groundwater elevations measured over the 72-hour tidal study. The results of the tidal study indicate that shallow groundwater generally flows north toward the Marine Area and Guemes Channel. Using the results of the tidal study, shallow groundwater gradients were also estimated for the Site. In the central portion of Upland Area, the shallow groundwater gradient is estimated to be 0.0134 feet per feet (ft/ft) between monitoring wells MW-4 (upgradient well location) and MW-2 (shoreline well location).

Groundwater flow based on average groundwater elevation measured over the 72-hour tidal study are shown on Figure 19. A detailed description of the methodology used to estimate groundwater gradients is presented in Appendix H.

#### 5.3.3. Hydraulic Conductivity

Hydraulic conductivity for the shallow and deep groundwater units were evaluated using information from slug tests performed on selected monitoring wells (Figure 19). The values resulting from slug tests are considered estimates of the hydraulic conductivity at the test location or in a localized portion of the aquifer where the test was performed due to the radius of influence generated during slug testing. The methodology and procedures for evaluating and calculating hydraulic conductivities based on slug tests as well as the slug test results are presented in Appendix H.

Slug tests were performed on five monitoring wells (MW-1 through MW-5). Hydraulic conductivity (K) values calculated from slug test data for the shallow groundwater unit ranged from approximately 1.43 ft/day to

14.93 feet per day (ft/day) with an average K value of 4.29 ft/day. These calculated K values were used to estimate the average linear groundwater velocity, as discussed in the following section.

The K values calculated based on the slug tests generally correspond to the material in which the wells are screened that is identified in the exploration logs presented in Appendix E and H. The wide range of K values calculated for the shallow groundwater unit reflect the heterogeneous nature of the hydrogeologic unit, which includes fine to coarse sand, gravel, silt and clay.

#### 5.3.4. Groundwater Velocity

Calculated hydraulic conductivity values and groundwater gradients were used to estimate linear groundwater velocities for the Site. The average linear groundwater velocity between monitoring well pair MW-4 and MW-2 was 0.06 ft/day and the average linear groundwater velocity between monitoring well pair MW-4 and MW-3 was 0.07 ft/day with a northerly flow direction.

Groundwater monitoring wells used to calculate groundwater velocities are shown on Figure 19. A detailed description of the methodology used to evaluate groundwater conditions is presented in Appendix H.

### 5.4. Determination of Contaminants of Concern

COPCs were screened to 1) identify which contaminants were not detected and which contaminants were detected, but at concentrations less than the PCUL; and 2) identify frequency at which a contaminant exceeds the PCUL for identifying Site contaminants of concern (COCs). Tables 8 through 11 summarize the frequency at which analytes were detected and identifies which analytes were detected at a concentration exceeding the PCULs. The PCULs developed for the Site are summarized in Section 2.0.

Analytes that were detected at concentrations greater than the PCUL were considered as a COC if they met either of the following criteria:

1. The analyte had an exceedance frequency of at least 10 percent; or
2. The analyte had an exceedance factor of 2 or more.

The frequency at which a contaminant exceeds the PCUL is termed the “exceedance frequency”. The magnitude by which a contaminant exceeds the PCUL is termed the “exceedance factor”. The exceedance factor is derived by dividing the detected contaminant concentration by the concentration of the PCUL.

Evaluation of COCs in each medium was completed in a step wise fashion where sediments were evaluated, then groundwater followed by soil. If an analyte was not detected in sediment above the PCUL, then the groundwater to sediment exposure pathway was determined to be incomplete and that the corresponding analyte in groundwater not need to be protective of sediment. Groundwater PCULs in Table 3 for the protection of sediment were then adjusted based on this evaluation. Similarly, if an analyte was not detected in groundwater above the PCUL, then the soil to groundwater exposure pathway was determined to be incomplete and that the corresponding analyte in soil not need to be protective of groundwater. Soil PCULs in Table 4 for the protection of groundwater were then adjusted based on this evaluation.

The selection of COCs for each medium of concern are summarized in Tables 8 through 11. These tables present frequency of exceedance and exceedance factor summary statistics for the analytes detected in

each medium as well as a description of other considerations that were evaluated as part of the COC selection process. COCs identified for each medium are summarized in the following Sections.

### 5.4.1. Sediment Contaminants of Concern

Tables 8 and 9 present the COC evaluation for Marine Area sediment. Table 8 presents the COC evaluation for the protection of benthic organisms. Table 9 presents the COC evaluation for the protection of human health and higher trophic level ecological receptors. Identified sediment COCs include the following:

- **Metals** – Based on the frequency of detection and/or exceedance factor, metals including arsenic, copper, lead, mercury and zinc are identified as COCs for Marine Area sediment.
- **Tributyltins** – Based on the frequency of detection and/or exceedance factor, tributyltin is identified as a COC for Marine Area sediment.
- **LPAHs** – Based on the frequency of detection and/or exceedance factor, LPAH compounds are identified as COCs for Marine Area sediment.
- **HPAHs** – Based on the frequency of detection and/or exceedance factor, LPAH compounds are identified as COCs for Marine Area sediment.
- **Total cPAH TEQ** – Based on the frequency of detection and/or exceedance factor, total cPAH TEQ is identified as COCs for Marine Area sediment.
- **PCBs** – Based on the frequency of detection and/or exceedance factor, PCBs are identified as COCs for Marine Area sediment.
- **Dioxins and Furans** – Based on the frequency of detection and/or exceedance factor, dioxin and furans are identified as COCs for Marine Area sediment. However, dioxin and furan exceedances were only identified in surface (0 to 10 cm) sediment. Results of subsurface investigation activities indicate that dioxins and furan exceedances to do not extend below the surface sediment in the Marine Area.

Other analytes were not selected as COCs because they were infrequently detected, had a low exceedance frequency and/or only slightly exceeded the PCUL.

### 5.4.2. Groundwater Contaminants of Concern

Table 10 presents the COC evaluation for Upland Area groundwater. Identified groundwater COCs include the following:

- **Metals** – Based on the frequency of detection and/or exceedance factor, metals including arsenic and nickel are identified as COCs for Upland Area groundwater.
- **Total cPAH TEQ** – Based on the frequency of detection and/or exceedance factor, total cPAH TEQ is identified as COCs for Upland Area groundwater.

Other analytes were not selected as COCs because they were infrequently detected, had a low exceedance frequency and/or only slightly exceeded the PCUL.

### 5.4.3. Soil Contaminants of Concern

Table 11 presents the COC evaluation for Upland Area soil. Identified soil COCs include the following:

- **Metals** – Based on the frequency of detection and/or exceedance factor, metals including arsenic and nickel are identified as COCs for Upland Area soil.
- **Total cPAH TEQ** – Based on the frequency of detection and/or exceedance factor, total cPAH TEQ is identified as COCs for Upland Area soil.
- **Petroleum Hydrocarbons** – Although verification sampling data confirmed the removal of petroleum contaminated soil from the 1991 UST Cleanup Action, 2001 Hydraulic Winch Cleanup Action and 2002 Petroleum and Marine Railway Cleanup Action areas, the technical quality of these data could not be independently validated. Therefore, gasoline-, diesel- and heavy oil-range petroleum hydrocarbons are retained as a COC for Upland Area soil.

Other analytes were not selected as COCs because they were infrequently detected, had a low exceedance frequency and/or only slightly exceeded the PCUL.

## 5.5. Nature and Extent of Contamination

The nature and extent of COCs in Site sediment, groundwater and soil are summarized in the following sections. As discussed in Section 3.5.5, catch basin solids are not considered a media of concern for further evaluation because the current stormwater collection system for DCI (described in detail in Section 1.4.6) installed as part of the Port's Project Pier 1 redevelopment captures stormwater and wastewater generated from the Site for treatment prior to discharge. Potential contaminant discharges from stormwater discharges prior to the Project Pier 1 redevelopment have been addressed as part of the 2008 interim action dredging in the Marine Area.

### 5.5.1. Sediment Contamination

Dredging within the Marine Area was completed as part of the 2008 Interim Action at the Site and is described in Section 4. The interim action dredging removed approximately 26,000 cubic yards (approximately 38,000 tons) of contaminated sediment, processed and transported by truck for disposal at the Waste Management's Subtitle D landfill facility in Wenatchee, Washington. Following removal of the contaminated near surface sediments, further dredging was completed into the clean native sediments to meet a design grade of -35 feet MLLW.

Confirmation sediment samples collected as part of the 2008 Interim Action dredging activities and sediment samples collected during previous environmental studies representing current conditions within the Marine Area are presented in Tables 12 and 13. Sample locations are shown relative to the Marine Area on Figure 13.

Based on the sediment sample results representative of the post-dredge condition, COC at concentrations exceeding PCULs were removed from the Marine Area. Due to the completeness of the interim action dredging and subsequent dredging of up to 30 additional feet of underlying native sediments, no sediment contamination is known to be present and sediment following the interim action is no longer considered a media of concern.

### 5.5.2. Groundwater Contamination

The groundwater data set for this RI consists of groundwater samples obtained by GeoEngineers between June 2008 and August 2017 from new and existing Upland Area monitoring wells. Groundwater results for

identified COCs (described above) are presented in Table 14. Groundwater monitoring locations are shown on Figures 20 through 22. Based on a review of the chemical analytical data, the nature and extent of groundwater contamination includes the following:

- **MW-1 (Upland Well)** – Total and dissolved arsenic were detected at a concentration greater than the groundwater PCUL in monitoring well MW-1 which is located in the western portion of the Site during one or more monitoring events. However, dissolved arsenic concentrations at this location did not exceed the groundwater PCUL during semi-annual groundwater monitoring activities completed between February 2016 and August 2017.
- **MW-2/2A/2B (Shoreline Well)** – Dissolved nickel was detected at a concentration greater than the groundwater PCUL in monitoring well MW-2A/2B which is located in the north central portion of the Site during one or more monitoring events. However, dissolved nickel concentrations at this location did not exceed the groundwater PCUL during semi-annual groundwater monitoring activities completed between February 2016 and August 2017 except for in February 2017 in which dissolved nickel detected at a concentration of 8.3 µg/L marginally exceeded the groundwater PCUL of 8.2 µg/L. In addition, the cPAH TEQ concentration at this location slightly exceeded the groundwater PCUL during the June 2008 monitoring event. In subsequent monitoring events, cPAHs were not detected in this monitoring well.
- **MW-3/3A (Shoreline Well)** – Dissolved nickel was detected at a concentration greater than the groundwater PCUL in monitoring well MW-3A which is located in the north central portion of the Site during one or more monitoring events. However, dissolved nickel concentrations at this location did not exceed the groundwater PCUL during semi-annual groundwater monitoring activities completed between February 2016 and August 2017.
- **MW-4 (Upland Well)** – Total arsenic and cPAHs were detected at concentrations greater than the groundwater PCUL in monitoring well MW-4 which is located in the south-central portion of the Site. However, total arsenic and cPAH TEQ concentrations at this location did not exceed the groundwater PCUL during semi-annual groundwater monitoring activities completed between February 2016 and August 2017.
- **MW-5 (Upland Well)** – Total arsenic was detected at a concentration greater that the groundwater PCUL in monitoring well MW-5 which is located in the central portion of the Site. However, dissolved arsenic at this location and down gradient of this location (i.e., MW-2) was detected at a concentration less than the groundwater PCUL.
- **MW-6 (Shoreline Well)** – Dissolved nickel was detected at a concentration greater than the groundwater PCUL in monitoring well MW-6 which is located in the north central portion of the Site during one or more monitoring events. However, dissolved nickel concentrations at this location did not exceed the groundwater PCUL during semi-annual groundwater monitoring activities completed between February 2016 and August 2017.
- **MW-7 (Upland Well)** – Total and dissolved arsenic and nickel and cPAH TEQ concentrations exceeded groundwater PCLs in monitoring well MW-7 located in the southeastern portion of the Site during one or more monitoring events. Downgradient of MW-7, total/dissolved arsenic and nickel, and cPAHs did not exceed groundwater PCULs in MW-6 during semi-annual groundwater monitoring activities completed between February 2016 and August 2017.
- **MW-8 (Shoreline Well)** – Total and dissolved arsenic and nickel, and cPAH TEQ concentrations exceeded groundwater PCULs in monitoring well MW-8 located in the northwestern portion of the Site

during one or more monitoring events. The concentration of dissolved nickel did not exceed PCUL levels in MW-8 during each of the semi-annual monitoring events. Although dissolved arsenic and cPAHs exceeded the groundwater PCUL, the concentration of dissolved arsenic appears to be stable and the concentration of cPAHs exceeding the PCUL was only observed during the August 2017 groundwater monitoring event with no detected concentrations of cPAHs during previous events.

Between 2015 and 2016, DCI replaced a significant portion of their gravel working surface with asphalt pavement that prevents stormwater infiltration through the soil column. A comparison of the initial (2008 to 2013) groundwater monitoring results to the recent semi-annual groundwater monitoring results (2016 to 2017) suggest that the paving activities have significantly reduced contaminant exceedances in groundwater and that in shoreline monitoring wells, exceedances of the groundwater PCULs are generally not observed. Trend plots for COCs including arsenic, nickel and cPAHs which were detected in monitoring wells MW-1 through MW-8 at concentrations exceeding groundwater PCULs during one or more monitoring event are shown on Figures 20 through 22.

### 5.5.3. Soil Contamination

The soil data set for this RI consists of soil samples obtained by GeoEngineers between June 2008 and August 2018 from subsurface explorations. In addition, soil sample results from previous environmental studies in which PCUL exceedances were observed are also being used to support the delineation of COC exceedances. Soil sample results for identified COCs (described above) are presented in Table 15. Soil sample locations and the distribution of soil COCs including arsenic, nickel, cPAHs and petroleum hydrocarbons are shown on Figures 23 through 26. Based on a review of the chemical analytical data, the nature and extend of identified soil contamination at the Site includes the following:

- **Metals** – Arsenic and/or nickel was detected at concentrations exceeding PCULs in soil throughout the Site as follows:
    - In the eastern portion of the Site, arsenic and nickel exceeded PCULs in historical fill deposits from the ground surface up to a depth of approximately 8 feet bgs.
    - In the north central portion of the Site, arsenic and nickel exceeded PCULs in historical fill deposits from the ground surface up to a depth of approximately 10 feet bgs.
    - In the south-central portion of the Site, arsenic exceeded the PCUL in historical fill deposits from between approximately 5 and 8 feet bgs.
    - In the western portion of the Site, nickel exceeded the PCUL in the 1975 Earth fill area deposits from the ground surface up to a depth of approximately 10 feet bgs.

  Results of soil/sediment samples collected at the Site from the underlying native surface suggest that the observed arsenic and nickel exceedance are contained within the overlying fill soil. Although soils at the Site contain concentrations of arsenic and nickel greater than the PCUL, groundwater monitoring data (summarized above) show that concentrations exist but are not exacerbating the current groundwater contamination at the Site. Decreasing concentrations due to paving indicates hydraulic connectivity and adverse effects from soil, but the modifications appeared to minimize contribution.
- **Total cPAH TEQ** – Concentrations of cPAHs were detected at concentrations exceeding PCULs in soil as follows:
    - In the south and central portions of the Site, total cPAH TEQ concentrations exceeded the PCUL in historical fill deposits between approximately 5 and 13 feet bgs.

- In the western portion of the Site, total cPAH TEQ concentrations exceeded the PCUL in the 1975 Earth fill area deposits from the ground surface to a depth of approximately 8 feet bgs.

Results of soil/sediment samples collected at the Site from the underlying native surface suggest that the observed cPAHs exceedance are contained within the overlying fill soil. Although soil at the Site contain total cPAH TEQ concentrations greater than the PCUL, groundwater monitoring data (summarized above) indicate that the observed contamination is not adversely affecting groundwater at the Site and that the contaminant concentration in ground is stable or is decreasing over-time.

- **Petroleum Hydrocarbons** – Results of previous environmental studies identified concentrations of gasoline-, diesel- and heavy oil-range petroleum hydrocarbons exceeding PCULs in historical fill deposits from the ground surface to a depth of approximately 8 feet bgs within the footprint of the 2002 Petroleum and Marine Railway Cleanup Action Areas. The nature and extent of petroleum hydrocarbons is as follows:
  - As previously discussed, the Port completed independent cleanup actions (i.e., 1991 UST, 2001 Hydraulic Winch and 2002 Petroleum and Marine Railway Cleanup Actions) to remove the previously identified petroleum contamination from the Site. Confirmation sample results obtained from the limits of these excavations indicated that the petroleum contamination was successfully removed from the Site. However, confirmation soil sample results for these areas could not be independently validated. Therefore, the absence or presence of petroleum hydrocarbons within the footprints of the previously completed cleanup action areas are not confirmed until subsequent sampling result confirm their removal[3]. In groundwater, petroleum hydrocarbons and petroleum-related constituents (i.e., BETX, EDB, EDC and MTBE) either were not detected or were detected at concentrations less than the PCULs within and downgradient of the previously completed cleanup action areas during each of the RI monitoring events providing further evidence for the completeness of the removal actions.
  - Petroleum hydrocarbons exceeding the PCULs were also identified in surficial soil (0-4 feet) in the western portion of the Site (i.e., Earth Fill Area). However, because petroleum hydrocarbons are not in contact with groundwater and groundwater monitoring results downgradient of the Earth Fill Area did not identify PCUL exceedances, PCULs for petroleum hydrocarbons in this area were adjusted for protection of direct contact only using Ecology's worksheet calculating soil cleanup levels for petroleum contaminated sites (MTCA TPH 11.1 Excel Workbook) in accordance with WAC 173-340-745. The maximum detected concentrations of petroleum hydrocarbons for this area were used as input parameters in this worksheet to calculate adjusted PCULs for gasoline- and heavy oil-range hydrocarbons for protection of direct contact. For this calculation, all petroleum hydrocarbons were assumed to be present in the most toxic form for each hydrocarbon range (i.e., gasoline-range hydrocarbons were assumed to be aliphatics with a 10- to 12-carbon chain and diesel range-hydrocarbons were assumed to be aliphatics with a 12- to 16-carbon chain). Adjusted PCUL calculations for the Earth Fill Area are presented in Appendix L. The resulting adjusted PCULs for this area were not exceeded, therefore do not require further cleanup evaluation.

[3] To verify the completeness of the previously completed cleanup actions, additional soil investigation activities is being proposed within the footprints of the previously completed remedial excavations. Previsions for additional soil investigation activities to verify the completeness of the previous cleanup actions will be presented in the CAP to support cleanup action alternative refinement to address Site contamination.

## 6.0 CONCEPTUAL SITE MODEL

For the RI, a conceptual site model (CSM) for potential contaminant sources, release mechanisms, transport processes, and exposure routes by which receptors may be affected was developed. The CSM incorporating the results of RI is shown on Figure 27 and is discussed below.

### 6.1. Media of Concern

#### 6.1.1. Marine Area

Results of the RI identified COCs including metals, tributyltins, LPAHs, HPAHs, cPAHs, PCBs and dioxins and furans in the Marine Area. However, the interim action completed in the Marine Area followed by additional dredging resulted in the complete removal of known sediment contamination from the Site. As a result, sediment is not identified as a media of concern at the Site.

#### 6.1.2. Upland Area

In the Upland Area, COCs including metals (arsenic and nickel) and cPAHs were identified in soil and groundwater at concentrations exceeding PCULs. Based on the results of the RI, Upland Area groundwater and soil are media of concern for the Site.

#### 6.1.3. Stormwater Conveyance

As part of the Project Pier 1 redevelopment project, new systems were installed to capture and treat stormwater and wastewater at the Site prior to discharge. Because historical stormwater impacts (if any) to the Marine Area were removed by the interim action dredging and new infrastructure is in place to collect and treat stormwater prior to discharge, stormwater solids, are not identified as a media of concern for the Site.

### 6.2. Sources of Contamination to Media of Concern

The following have been identified as potential contaminant sources to the Site:

- Historical spills and releases onto Site soils;
- Placement of contaminated fill material; and
- Atmospheric deposition.

These potential contaminant sources are further described below.

#### 6.2.1. Historical Spills and Releases onto Site Soils

The shoreline at the Site was historically located southwest of the former railway spur (Figure 4) based on a review of Sanborn maps and aerial photographs. Historical commercial and industrial activities at the Site since the late 1800s, including bulk fuel storage, shipping, shipbuilding, ship repairs and other maritime-related operations may have caused releases of contamination to the native and fill soils. The source of PAH contamination at the Site may include historical combustion of fossil fuels from residents, machinery (boiler, power, etc.), vehicles and marine vessels operating and wood burning. Metals contamination is likely the result of direct discharge of industrial wastes such as paint chips, grinding and blast grit residues to the ground from vessel maintenance and repair activities at the Site. These historical operations represent a potential source of contamination to the identified media of concern.

As previously discussed, independent cleanup actions of the Upland Area completed in 2002 resulted in the removal of identified petroleum contamination sourcing from bulk fuel storage and distribution operations. The results of confirmation sampling competed as part of these cleanup activities verified the removal of petroleum contaminated soil from the Site.

#### 6.2.2. Placement of Contaminated Fill Material

Infilling of the historical Site shoreline has resulted in the placement of up to approximately 16 feet of fill material prior to the 1960s to expand the shoreline northward in support of maritime operations. These historical fill deposits are comprised of layers of sand, silty sand and silt with variable gravel content and contain debris including concrete asphalt, brick and wood fragments suggesting that they may have been re-used from other industrial sources and have the potential to contain contaminants of concern. Releases from historical commercial and industrial activities at the Site and surrounding area during infilling of the historical shoreline as well as contaminants contained within the fill material placed represent potential contaminant sources to the Site.

#### 6.2.3. Atmospheric Deposition

Gases and particulates may be released to the atmosphere from current and historical combustion (vehicle emissions, burning, etc.) and/or industrial operations and may contain concentrations of metals and PAHs. Contaminants present in the atmosphere may be deposited by settling of particulates or precipitation directly to the land surfaces at the Site and surrounding area.

As described in previous sections, Project Pier 1 redevelopment in 2008 resulted in the installation of new infrastructure to collect and treat stormwater/wastewater generated at the Site prior to discharge. Since this time, DCI has completed facility upgrades that include paving much of the Upland area with asphalt that limits the infiltration of precipitation falling to the ground surface. Stormwater runoff is subsequently captured by a network of storm drains and is treated prior to discharge. However, atmospheric deposition prior to redevelopment and paving of the Site as well as atmospheric deposition onto currently unpaved areas activities represent a potential source of contamination to the Site.

### 6.3. Fate and Transport

The fate and transport of contaminants are affected by their chemical properties and the physical, chemical, and biological processes which they are exposed to at the Site. These properties and how they impact the fate and transport of the Site contaminants are discussed in the following sections.

#### 6.3.1. Environmental Fate

##### *6.3.1.1. Arsenic*

Arsenic is a naturally occurring and persistent mineral that is not naturally degraded. Arsenic exists in the environment in four oxidation states that include +3 (arsenite), +5 (arsenate), 0 (arsenic metal) and -3 (arsine). The two most common oxidation states are +3 and +5. The mobility of arsenic in the environment depends strongly on the pH and redox conditions and can change oxidation states in response to environmental redox conditions. However, the change is generally slow. In the environment, arsenic bonds with a wide variety of other elements, producing inorganic and organic compounds with a range of mobilities.

Arsenic is capable of dissolution in pH ranges from 2.0 to 11.0 under suitable physical and chemical conditions. It is most soluble at both high (basic) pH and low (acidic) pH conditions, and less soluble at a neutral pH. Arsenic is also mobile under both oxidizing and reducing conditions. Arsenic transport could be characterized as cycling between sorbed and aqueous phases due to environmental changes that affect pH, redox, concentrations of other chemicals present in the water, and biologic activity (Panagiotaras and Nikolopoulos 2015).

#### *6.3.1.2. Nickel*

Nickel is a naturally occurring and persistent mineral present in soil is not naturally degraded. Nickel exists in several oxidation states, of which +2 is the most common. Nickel is generally, strongly adsorbed by soil. There are many factors that affect the extent to which nickel is adsorbed by soil, so the adsorption of nickel by soil is site specific. Amorphous oxides of iron and manganese, and to a lesser extent clay minerals are the most important adsorbents in soil (ASTDR 2017).

The solubility of nickel increases as pH decreases, causing it to become more mobile. Most nickel compounds are relatively soluble at pH values less than 6.5 and is relatively insoluble at high pH conditions.

#### *6.3.1.3. PAHs*

Transport and partitioning of PAHs in the environment are determined to a large extent by physicochemical properties such as water solubility, vapor pressure, Henry's law constant, octanol-water partition coefficient ($K_{OW}$), and organic carbon partition coefficient ($K_{OC}$). In general, PAHs have low water solubilities. Because of their low solubility and high affinity for organic carbon, PAHs in aquatic systems are primarily found sorbed to particles that either have settled to the bottom or are suspended in the water column. Volatilization and adsorption to suspended sediments with subsequent deposition are the primary removal processes for medium and high molecular weight PAHs, whereas volatilization and biodegradation are the major removal processes for low molecular weight compounds.

#### *6.3.1.4. Petroleum Hydrocarbons*

Gasoline is a mixture of relatively volatile hydrocarbons, including normal and branched chain alkanes, cycloalkanes, alkenes, and aromatics, that vary widely in their physical and chemical properties. Upon release to the environment, gasoline is not transported as a mixture; rather, the various components of the mixture selectively partition to the atmosphere, soil, or water according to their individual physical/chemical properties. Gasoline released to surface soils will differentially partition by volatilization, dissolution, or adsorption of individual constituents according to their physical/chemical properties. Gasoline exists in soil in four states: 1) as a free-moving liquid, 2) adsorbed to soil particulates, 3) dissolved in groundwater, and 4) as a vapor. Components of gasoline that are not volatilized or sorbed to non-colloidal soil particulates will migrate downward through the unsaturated zone by gravity or leaching to the water table. Liquid gasoline, as a result of its lower kinematic viscosity, is expected to move through the unsaturated zone of the soil at a velocity 2-3 times that of water. The amount of liquid product that reaches the water table is dependent upon the amount of product released and site-specific soil and hydrogeological conditions.

The transport and dispersion of diesel and heavy oil petroleum hydrocarbons are dependent on the water solubility and volatility of the aliphatic and aromatic hydrocarbon fractions. Lower molecular weight hydrocarbons such as n-alkanes may volatilize relatively quickly from both water and soil, while larger aliphatics (greater than $C_9$ chain length) may be sorbed to organic particles in water or soil. Aromatic hydrocarbons will be dissolved in the aqueous phase in both soil and water and may undergo some volatilization. Liquid diesel and heavy oils, as a result of their higher kinematic viscosity, are expected to

move through the unsaturated zone of the soil at a slower velocity as compared to gasoline. Similar to gasoline, the amount of liquid product that reaches the water table is dependent upon the amount of product released and site-specific soil and hydrogeological conditions.

Petroleum hydrocarbons immobilized in the unsaturated zone may be solubilized by downward moving soil water or fluctuating elevations of groundwater, and this residual material may serve as a source of contamination through leaching of solubilized components for long periods of time. Water-soluble components will dissolve in groundwater, whereas insoluble components will float as a separate phase on top of the water table. Water-soluble compounds, such as benzene, toluene, and xylene, show a greater potential for transport in groundwater aquifer than insoluble forms.

Overall, mass reduction of petroleum hydrocarbons occurs naturally through biodegradation. Biodegradation of petroleum is most efficient under aerobic conditions. Biodegradation of petroleum also results in reducing conditions as the available oxygen in the substrate is consumed during aerobic biodegradation. Anaerobic biodegradation of petroleum also occurs, but it is a slower process than aerobic biodegradation.

### 6.3.2. Environmental Transport

Release and transport mechanisms for Site contaminants to media of concern are presented on Figure 27. The specific release and transport mechanisms by which Site contaminants have been transported at the Site include:

- **Infiltration and Leaching** – Infiltration of precipitation and leaching of contaminants in unpaved portions of the Site can transport COCs contained within the soil column. COCs that are soluble may enter solution and remain in solution until reaching groundwater or may be sorbed to soil in other portions of the soil column.

  Since 2015, DCI has paved a significant portion of the Upland Area. Groundwater sampling results prior to this paving of the Site (i.e., 2008 to 2013 monitoring events) identified detected COC concentrations exceeding PCULs. However, groundwater monitoring completed since paving of the majority of the Site (i.e., 2016 to 2018 monitoring events) show a decrease in detected COC concentrations over-time. These findings indicate that infiltration and leaching of COCs from soil to groundwater is significantly reduced by the pavement and stormwater management practices at the Site.

- **Shallow Unconfined Aquifer Solute Transport** – Solute transport in the shallow unconfined aquifer is governed by the environmental chemistry of the COCs described above and aquifer properties including hydraulic conductivity, groundwater velocity, gradient and tidal influence. As described in Section 5.3, the average shallow groundwater flow direction was measured to be to the north toward Guemes Channel with an estimated velocity of approximately 0.06 feet per day.

- **Tidal Mixing** - Based on the results of the tidal study, there is a tidal mixing zone within approximately 150 feet of the shoreline. The results of the tidal study show that groundwater in shoreline wells are being influenced by fluctuations in sea level. However, monitoring wells located in the central and southern portions of the Site do not show a response to fluctuations in sea level and are therefore, less likely to be influenced by tidal mixing.

## 6.4. Exposure Pathways and Receptors

COCs released as the result of historic commercial and industrial operations at the Site have resulted in direct impacts to soil and secondary impacts to groundwater. Potential exposure pathways related to these media are discussed below.

### 6.4.1. Soil

The following potential exposure pathways and receptors existed for contaminants in Site soil:

- Contact (dermal, incidental ingestion or inhalation) by Site workers (including workers excavating soil); and
- Leaching of contaminants contained within the soil column to groundwater.

Visitors and terrestrial wildlife are not potential receptors of concern because access is limited to authorized personnel performing work at the Site (Section 1.1), and because pavement and gravel working surfaces limit the area of terrestrial habitat.

### 6.4.2. Groundwater

The following are potential exposure pathways and receptors for contaminants in Site groundwater:

- Contact (dermal or incidental ingestion) by Site workers (including workers excavating soil below the water table);
- Contact (dermal or incidental ingestion) by aquatic receptors to impacted groundwater that may discharge to the Marine Area resulting in acute or chronic effects; and
- Ingestion of aquatic organisms affected by the discharge of impacted groundwater to the Marine Area.

Human ingestion of contaminated groundwater from the Site is not a potential exposure pathway because groundwater at the Site is not a current or reasonable future source of drinking water (Section 1.4)

# 7.0 BASIS FOR CLEANUP ACTION

## 7.1. Cleanup Action Objectives

Cleanup action objectives (CAOs) are established to eliminate, reduce, or otherwise control to the maximum extent feasible and practicable, unacceptable risks to human health and the environment posed by Site-related hazardous substances in Upland Area soil and groundwater in accordance with the MTCA Cleanup Regulation (WAC 173-340) and other applicable regulatory requirements. CAOs form the basis for evaluating and selecting remedial technologies and cleanup actions that will be successful. CAOs consist of location-, chemical- and medium-specific goals for protecting human health and the environment. CAOs are dependent on the chemicals and pathways that represent a risk to people and natural resources associated with a site. Development of CAOs involves 1) identification of potentially applicable or relevant and appropriate requirements (ARARs) that set the framework and requirements for the development of cleanup standards and implementation of a cleanup action; 2) development of cleanup levels and points of compliance at which an acceptable risk level can be attained; and 3) identification of the locations and media requiring cleanup based on selected cleanup standards.

The following CAOs for the Site have been developed to mitigate risks associated with the Site COCs discussed in Section 5.5 and to address potential exposure routes and receptors discussed in Section 6.4 based on known subsurface conditions, and current and future land use:

- Contact (dermal, incidental ingestion or inhalation) by Site workers (including workers excavating soil below the water table);
- Leaching of contaminants contained within the soil column to groundwater;
- Contact (dermal or incidental ingestion) by aquatic receptors to impacted groundwater that may discharge to the Marine Area resulting in acute or chronic effects; and
- Ingestion of aquatic organisms affected by the discharge of impacted groundwater to the Marine Area by higher trophic level ecological receptors.

PCULs and points of compliance for sediment, groundwater and soil considered for the development of the CAOs are discussed in Section 2.0 and are expected to be adopted as final cleanup levels by Ecology for the Cleanup Action Plan (CAP). Areas and media requiring cleanup considered for the development of the CAOs are discussed in Section 5.5. ARARs considered for the development of the CAOs are further discussed below.

### 7.2. Potentially Applicable or Relevant and Appropriate Requirements

Under Washington Administrative Code (WAC) 173-340-710, MTCA requires that cleanup actions comply with all legally applicable local, state and federal laws, and requirements that are legally applicable and determined by Ecology to be relevant and appropriate requirements for the cleanup site. Legally "applicable" requirements under MTCA are those cleanup standards, standards of control, and other human health and environmental protection requirements, criteria, or limitations adopted under state or federal law that specifically address a hazardous substance, cleanup action, location, or other circumstance at a site (WAC 173-340-200). "Relevant and appropriate" requirements include those cleanup standards, standards of control, and other human health and environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site (WAC 173-340-200).

Potential ARARs and their descriptions/applicability are presented in Table 16. In accordance with WAC 173-340-710(9)(b), cleanup actions conducted by Ecology under MTCA are exempt from most procedural requirements of state and local laws, and related permitting requirements. Although exempt from procedural requirements of certain state and local laws and related permitting requirements, pertinent substantive compliance requirements remain applicable.

In addition, the Fidalgo Bay region is known to be archaeologically sensitive. Therefore, previsions of the National Historic Preservation Act of 1966, and the Archeological and Historical Preservation Act (16 USCA 469) are to remain applicable. The Samish Indian Nation, Swinomish Tribal Community, and other interested tribes, and the Washington State Department of Archaeology and Historic Preservation (DAHP) will be consulted on potential cultural resource and archaeological matters as they relate to the cleanup action. Ecology will take lead and carry out consultation in accordance with Executive Order 05-05 on locations not covered under Section 106.

### 7.3. Supplemental Soil Investigation

As previously discussed, environmental data collected during previous studies to confirm the completeness of the remedial actions could not be independently validated. As a result, a supplemental soil investigation is proposed as a pre-remedial design activity for the Site to verify the completeness of the 1991 UST removal excavation, 2001 marine railway winch remedial excavation, 2002 Petroleum and Marine Railway Cleanup Action areas. In general, borings will be advanced within the footprint of the previously completed remedial excavations which extended to depths greater than 1-foot (i.e., remedial excavations completed to remove previously identified soil contaminated located beneath the former gravel working surface). The borings will be advanced to a depth of below the base of the previous remedial excavations to collect soil samples that are representative of the previous verification sample interval. Samples will be analyzed for COCs previously identified for these areas including gasoline-, diesel- and heavy oil-range petroleum hydrocarbons and/or cPAHs.

The results of this supplemental soil investigation will be used to confirm the completeness of the previous removal actions. Sampling and analysis will be completed under an Ecology-approved addendum to the RI/FS Work Plan. The results of this investigation will be reported in the CAP and used to refine the preferred cleanup action alternative for the Site. Proposed sampling locations are shown relative to the previous removal action areas on Figure 28.

## 8.0 CLEANUP ACTION ALTERNATIVE DEVELOPMENT

### 8.1. Identification and Screening of Remedial Technologies

Potentially applicable remedial technologies for identified COCs in Upland Area media of concern (i.e., soil and groundwater) were screened and evaluated for developing cleanup action alternatives in accordance with MTCA requirements (WAC 173-340-350). Sources of information used to develop the list of remedial technologies include EPA publications and databases, vendor information, and professional experience gained at similar sites.

Under MTCA, remedial alternatives are developed from remedial technologies that are screened and identified as capable of meeting cleanup requirements to achieve the CAOs. Initial screening of remedial technologies allows development of a range of tools that can be used individually or in combination to address contamination at the Site. The screening process determines the most appropriate technologies and process options for addressing COCs in soil and groundwater based on their expected implementability, reliability, and relative cost as follows:

- **Implementability** – This evaluation encompasses both technical and administrative feasibility of implementing a technology. Aspects of implementability include the ability to obtain permits, the availability of treatment methods, physical conditions of the site, and availability of required equipment and skilled workers.
- **Effectiveness** – This evaluation focuses on 1) the potential effectiveness of a technology in handling the estimated areas or volumes of media and meeting CAOs; 2) the potential impacts to human health and the environment during the construction and implementation phase; and 3) how proven and reliable a technology is with respect to the contaminants and conditions at the site.

- **Cost** – This evaluation takes into consideration relative capital, and operation and maintenance (O&M) cost rather than detailed estimates. During the screening process, the relative capital and O&M cost between alternatives (based on engineering judgement) is evaluated as to whether costs are high, low, or moderate relative to the other technologies. Since remedial alternatives and associated quantities are not defined during technology screening stage, relative cost is presented qualitatively as a range rather than quantitatively.

Remedial technologies to address COCs in soil and groundwater in the Upland Area portion of the Site are discussed in the following sections. In general, remedial technologies that had limited implementability, low effectiveness, and/or high relative cost were screened out and the most appropriate technologies were retained for use in the development of remedial alternatives. Technologies retained through the screening process were selected as is or combined into remedial alternatives, as appropriate, for a detailed alternative evaluation.

#### 8.1.1. Remedial Technologies for Soil

Descriptions and screening of applicable remedial technologies for soil are presented in Table 17. Based on the results of screening, the following are the remedial technologies for soil which were retained for development of remedial alternatives:

- Institutional controls including environmental covenants, land use restrictions and fencing and signage;
- Containment and capping including low permeability caps comprised of asphalt or concrete pavement with drainage controls;
- In situ treatment including stabilization; and
- Removal including excavation and offsite disposal to a permitted landfill.

#### 8.1.2. Remedial Technologies for Groundwater

Descriptions and screening of applicable remedial technologies for groundwater are presented in Table 18. Based on the results of screening, the following are the remedial technologies for groundwater that are retained for development of remedial alternatives:

- Institutional controls including environmental covenants and groundwater use restrictions;
- Containment including low permeability sheet pile wall to restrict groundwater flow and contaminant migration; and
- Monitoring to assess attenuation of contaminants in groundwater via natural processes.

### 8.2. Description of Cleanup Action Alternatives

Cleanup action alternatives for the Upland Area were developed by combining technologies and process options retained through the remedial technology screening evaluation (Tables 17 and 18) to address soil and groundwater contamination and meet the CAOs. Cleanup action alternatives developed for the Site are summarized in Table 19 and described in the following sections. These alternatives represent a reasonable number and range of potentially applicable cleanup actions to provide a further basis for comparative evaluation. The cleanup action alternatives developed for the Site are based on a conceptual-level design for the implementation of the individual technologies described above. The design parameters used to

develop the alternatives are based on engineering judgment and the current knowledge of Site conditions. The final design for the preferred cleanup action alternative may require additional characterization and analysis of Site media and potential changes to specific plans for the future development of the Site to better define the cleanup action and associated costs. The comparative analysis for the cleanup action alternatives summarized below is presented in Section 9.2.

#### 8.2.1. Cleanup Action Alternative 1 – Containment and Compliance Groundwater Monitoring

Cleanup Action Alternative 1 relies on containment technologies (i.e., capping and sheet pile wall) in conjunction with institutional controls to address Site contaminants. Capping in the form of asphalt paving will be completed in unpaved portions of the Site to further prevent stormwater infiltration through the soil column and mobility of contaminants in the subsurface. Existing stormwater infrastructure will be used to capture and treat stormwater runoff prior to discharge from the Site. Long-term monitoring would then be performed to evaluate groundwater conditions over time to assess contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants. Groundwater data collected prior to and following significant asphalt paving of the Site provide a line of evidence that suggests COCs that remain in place in saturated zone soils have stabilized and are not migrating downgradient toward the Guemes Channel since paving was completed.

Specific actions to be performed at the Site as part of Cleanup Action Alternative 1 include the following:

- Install asphalt pavement in the central and eastern portions of the Upland Area that currently consist of a gravel working surface to further prevent potential stormwater infiltration and contaminant leaching/migration through the soil column. This physical barrier will also further prevent direct contact with Site contaminants contained in the subsurface. Stormwater captured by the new paving will be directed to the stormwater treatment system at the Site. Note that the existing treatment system will require a capacity upgrade to handle the additional volume of stormwater that will result from the new paving.
- Maintain the existing concrete and asphalt caps in other portions of the Site to prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site contaminants.
- Maintain the existing sheet pile wall that separates the Marine Area from the Upland Area to contain Site COCs identified in Upland Area soil as well as to provide a physical barrier to prevent direct contact. As previously discussed, tidal study results represent groundwater conditions prior to the 2008 Interim Action. As part of the interim action, an open cell bulkhead was installed in the central portion of the Site to extend the Upland Area northward and create additional land to facilitate DCI operations. As a result, the open cell bulkhead (which now separates the Upland Area from the Marine Area) provides a physical barrier that restricts the direct discharge of groundwater north to Guemes Channel.
- Maintain the existing fencing and security procedures to restrict public access to the Site.
- Install warning signs to inform Site workers and/or visitors to the Site regarding health risks and land use restrictions (as necessary).
- Implement a deed restriction (environmental covenant) compliant with the Uniform Environmental Covenants Act and with Ecology's model environmental covenant.

- Develop and implement a Compliance Monitoring Plan describing the groundwater confirmational and long-term monitoring to verify the effectiveness of the cleanup action including procedures for sample collection, sample frequency, data review, quality control and reporting.
- Perform compliance groundwater monitoring utilizing the existing network of wells to evaluate groundwater conditions over time to evaluate contaminant concentrations relative to the cleanup standards and natural attenuation performance of Site contaminants. It is assumed that groundwater monitoring would be completed on a semi-annual basis for up to five years targeting wet and dry season months. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Perform long-term groundwater monitoring utilizing the existing network of monitoring wells (MW-1 through MW-8) to evaluate groundwater conditions over time to ensure compliance with the cleanup standards and effectiveness of the cleanup action. It is assumed that groundwater monitoring would be completed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Develop and implement an Engineering Controls Monitoring and Maintenance Plan to identify the engineering and institutional controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance of the Site controls to ensure protection of human health and the environment, and to provide guidelines on the proper handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
- Perform annual inspection of the asphalt/concrete pavement cap and sheet pile wall that separates the Upland and Marine Areas to ensure the long-term performance of these containment barriers.

The estimated cost of Cleanup Action Alternative 1 is $1,180,000 (Table M-1, Appendix M). The cost estimate is in 2019 dollars, include contingencies, and represent order-of-magnitude with a range of -30 percent to +50 percent based on EPA guidance (EPA 2000) and does not include the stormwater treatment system capacity upgrade. Existing Site features including paved portions of the Site, the location of sheet pile walls and existing monitoring well network that would be utilized to evaluate long-term groundwater conditions are shown on Figure 29.

#### 8.2.2. Cleanup Action Alternative 2 – Partial Source Area Removal

Cleanup Action Alternative 2 includes partial removal of contaminant source areas located in the southeast portion of the Site which is generally centered around sampling location SB-12 followed by Site restoration. Contaminant source areas are defined as areas in which concentrations of metals (arsenic and nickel) in soil exceed three times (3x) the PCUL. Partial source area removal under Cleanup Action Alternative 2 will be used in conjunction with existing containment barriers as well as institutional controls to address remaining COCs in the central and western portions of the Site. Compliance monitoring would then be performed to verify the effectiveness of the removal action. Long-term monitoring would then be performed to evaluate groundwater conditions over time to assess contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants.

Specific actions to be performed at the Site as part of Cleanup Action Alternative 2 include the following:

- Develop and implement an Engineering Design Report describing the plans and procedures that will be used for cleanup of the Site.
- Removal followed by offsite disposal of an estimated 3,600 in-place cubic yards (bcy) of soil to a permitted landfill from the identified southeast contaminant source area which is defined as an area in which the concentration of metals (arsenic and nickel) in soil exceed three times (3x) the PCUL. Prior to construction, monitoring well MW-7 located in the removal area will be decommissioned. Verification sampling will be performed to confirm the vertical and lateral extent of remediation from this area during construction. Upon verification of the remedial excavation extent, backfill consisting of overburden material generated during construction that is determined to be both structurally and chemically suitable for reuse and/or imported structural fill will be placed.
- Restore portions of the asphalt pavement which are disturbed by the removal action.
- Install a replacement well for MW-7 decommissioned as part of the removal action.
- Maintain the existing concrete and asphalt pavement caps in other portions of the Site to prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to remaining Site contaminants.
- Maintain the existing sheet pile wall that separates the Marine Area from the Upland Area to contain Site COCs identified in Upland Area soil as well as to provide a physical barrier to prevent direct contact. As previously discussed, the open cell bulkhead (which now separates the Upland Area from the Marine Area) physical barrier that restricts the direct discharge of groundwater north to Guemes Channel.
- Maintain the existing fencing and security procedures to restrict public access to the Site.
- Install warning signs to inform Site workers and/or visitors to the Site regarding health risks and land use restrictions (as necessary).
- Implement a deed restriction (environmental covenant) compliant with the Uniform Environmental Covenants Act and with Ecology's model environmental covenant.
- Develop and implement a Compliance Monitoring Plan describing the performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action including procedures for sample collection, sample frequency, data review, quality control and reporting.
- Perform compliance monitoring utilizing existing network of monitoring wells (MW-2B through MW-6) and new replacement monitoring well (MW-7A) following soil removal activities and restoration to evaluate groundwater conditions relative to the cleanup standards and effectiveness of the removal action. It is assumed that groundwater monitoring would be completed on a quarterly basis for a period of one year followed by semi-annual monitoring for up to an additional four years targeting wet and dry season months. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Perform long-term groundwater monitoring utilizing the existing network of monitoring wells (MW-1 through MW-6 and MW-8) and new replacement monitoring well (MW-7A) to evaluate groundwater conditions over time to ensure compliance with the cleanup standards and natural attenuation of Site contaminants remaining in place at the Site. It is assumed that groundwater monitoring would be completed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.

- Develop and implement an Engineering Controls Monitoring and Maintenance Plan to identify the engineering and institutional controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance of the Site controls to ensure protection of human health and the environment, and to provide guidelines on the proper handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
- Perform annual inspection of the asphalt/concrete pavement cap and sheet pile wall that separates the Upland and Marine Areas to ensure the long-term performance of these containment barriers.

The estimated cost of Cleanup Action Alternative 4 is $2,120,000 (Table M-2, Appendix M). The cost estimate is in 2019 dollars, include contingencies, and represent order-of-magnitude with a range of -30 percent to +50 percent based on EPA guidance (EPA 2000). Existing Site features including paved portions of the Site, the location of sheet pile walls and existing monitoring well network that would be utilized to evaluate long-term groundwater conditions are shown on Figure 30.

#### 8.2.3. Cleanup Action Alternative 3 – Source Area In Situ Treatment

Cleanup Action Alternative 3 includes in situ treatment of contaminant source areas (described above) to stabilize contaminants. In situ treatment of contaminant source areas under Cleanup Action Alternative 3 will be used in conjunction with containment and institutional controls as discussed under previous alternatives to prevent direct contact and the migration of contaminants contained in the subsurface. Compliance monitoring would then be performed to verify the effectiveness of the cleanup action. Long-term monitoring would then be performed to evaluate groundwater conditions over time to assess contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants.

Specific actions to be performed at the Site as part of Cleanup Action Alternative 3 include the following:

- Develop and implement an Engineering Design Report describing the plans and procedures that will be used for cleanup of the Site.
- Perform in situ soil stabilization through the injection of chemical reagents into the subsurface within contaminant source areas to immobilize (i.e., precipitate and/or bond to soil particles) Site contaminants. In situ stabilization would be completed using standard drilling and injection technologies and would result in minimal disturbance to the existing asphalt paved surfaces that are working to restrict stormwater infiltration through the soil column and thus preventing contaminant leaching/migration through the subsurface. Contaminant source areas are defined as areas in which concentrations of metals (arsenic and nickel) in soil exceed three times (3x) the PCUL. Groundwater data in the vicinity of MW-2B and MW-7 indicate that PCUL exceedances are only observed in areas in which metals concentrations in soil exceed three times the PCUL. In other portions of the Site, groundwater data indicate that concentrations of arsenic and nickel in soil are stable and are not adversely impacting groundwater. In addition, groundwater data indicate that concentrations of total cPAH TEQ in soil are stable and are not adversely impacting groundwater at the Site. Based on a review of the existing data, three (3) contaminant source areas have been identified and are located in the eastern, southern and central portions of the Site (Figure 31).
- Install asphalt pavement in the central and eastern portions of the Upland Area that currently consist of a gravel working surface to further prevent potential stormwater infiltration and contaminant leaching/migration through the soil column. This physical barrier will also further prevent direct contact

with Site contaminants contained in the subsurface. Stormwater captured by the new paving will be directed to the stormwater treatment system at the Site. Note that the existing treatment system will require a capacity upgrade to handle the additional volume of stormwater that will result from the new paving.

- Maintain the existing concrete and asphalt pavement caps in other portions of the Site to prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site contaminants.
- Maintain the existing sheet pile wall that separates the Marine Area from the Upland Area to contain Site COCs identified in Upland Area soil as well as to provide a physical barrier to prevent direct contact. As previously discussed, the open cell bulkhead (which now separates the Upland Area from the Marine Area) physical barrier that restricts the direct discharge of groundwater north to Guemes Channel.
- Maintain the existing fencing and security procedures to restrict public access to the Site.
- Install warning signs to inform Site workers and/or visitors to the Site regarding health risks and land use restrictions (as necessary).
- Implement a deed restriction (environmental covenant) compliant with the Uniform Environmental Covenants Act and with Ecology's model environmental covenant.
- Develop and implement a Compliance Monitoring Plan describing the groundwater performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action including procedures for sample collection, sample frequency, data review, quality control and reporting.
- Install temporary monitoring wells upgradient and downgradient of the identified source areas and complete performance monitoring to verify the effectiveness of the cleanup action and whether the injection of additional chemical reagents is necessary to stabilize Site contaminants remaining in place. It is assumed that performance groundwater monitoring would be completed on quarterly basis for up to 2 years.
- Perform compliance monitoring following performance monitoring activities utilizing the existing network of monitoring wells (MW-1 through MW-8) to evaluate groundwater conditions over time to assess residual contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants. It is assumed that groundwater monitoring would be completed on a semi-annual basis for up to 5 years targeting wet and dry season months. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Perform long-term groundwater monitoring utilizing the existing network of monitoring wells (MW-1 through MW-8) to evaluate groundwater conditions over time to ensure compliance with the cleanup standards and natural attenuation of Site contaminants remaining in place at the Site. It is assumed that groundwater monitoring would be competed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Develop and implement an Engineering Controls Monitoring and Maintenance Plan to identify the engineering and institutional controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance of the Site controls to ensure protection of human health and the environment, and to provide guidelines on the proper handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.

- Perform annual inspection of the asphalt/concrete pavement cap and sheet pile wall that separates the Upland and Marine Areas to ensure the long-term performance of these containment barriers.

The estimated cost of Cleanup Action Alternative 3 is $2,610,000 (Table M-3, Appendix M). The cost estimate is in 2019 dollars, include contingencies, and represent order-of-magnitude with a range of -30 percent to +50 percent based on EPA guidance (EPA 2000). Existing Site features including paved portions of the Site, the location of sheet pile walls and existing monitoring well network that would be utilized to evaluate long-term groundwater conditions are shown on Figure 31.

#### 8.2.4. Cleanup Action Alternative 4 – Source Area Removal

Cleanup Action Alternative 4 includes removal of contaminant source areas (described above) followed by Site restoration. Source area removal under Cleanup Action Alternative 4 will be used in conjunction with containment and institutional controls as discussed in previous alternatives to prevent direct contact and the migration of remaining contaminants contained in the subsurface. Compliance monitoring would then be performed to verify the effectiveness of the cleanup action. Long-term monitoring would then be performed to evaluate groundwater conditions over time to assess contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants.

Specific actions to be performed at the Site as part of Cleanup Action Alternative 4 include the following:

- Develop and implement an Engineering Design Report describing the plans and procedures that will be used for cleanup of the Site.
- Removal followed by offsite disposal of an estimated 9,000 in-place cubic yards (bcy) of soil to a permitted landfill from the identified contaminant source areas in the central and eastern portions of the Site. Contaminant source areas are defined as areas in which concentrations of metals (arsenic and nickel) in soil exceed three times (3x) the PCUL. Prior to construction, monitoring well MW-7 located in the removal area will be decommissioned. Verification sampling will be performed to confirm the vertical and lateral extent of remediation from this area during construction. Upon verification of the remedial excavation extent, backfill consisting of overburden material generated during construction that is determined to be both structurally and chemically suitable for reuse and/or imported structural fill will be placed.
- Restore portions of the asphalt pavement which are disturbed by the removal action.
- Install a replacement well for MW-7 decommissioned as part of the removal action.
- Maintain the existing concrete and asphalt pavement caps in other portions of the Site to prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to remaining Site contaminants.
- Maintain the existing sheet pile wall that separates the Marine Area from the Upland Area to contain Site COCs identified in Upland Area soil as well as to provide a physical barrier to prevent direct contact. As previously discussed, the open cell bulkhead (which now separates the Upland Area from the Marine Area) physical barrier that restricts the direct discharge of groundwater north to Guemes Channel.
- Maintain the existing fencing and security procedures to restrict public access to the Site.
- Install warning signs to inform Site workers and/or visitors to the Site regarding health risks and land use restrictions (as necessary).

- Implement a deed restriction (environmental covenant) compliant with the Uniform Environmental Covenants Act and with Ecology's model environmental covenant.
- Develop and implement a Compliance Monitoring Plan describing the performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action including procedures for sample collection, sample frequency, data review, quality control and reporting.
- Perform compliance monitoring utilizing existing network of monitoring wells (MW-1 through MW-8) following soil removal activities and restoration to evaluate groundwater conditions over time to assess residual contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants in other portions of the Site. It is assumed that groundwater monitoring would be completed on a quarterly basis for a period of one year followed by semi-annual basis for up to an additional four years four additional years targeting wet and dry season months. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Perform long-term groundwater monitoring utilizing the existing network of monitoring wells (MW-1 through MW-8) to evaluate groundwater conditions over time to ensure compliance with the cleanup standards and effectiveness of the cleanup action. It is assumed that groundwater monitoring would be completed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Develop and implement an Engineering Controls Monitoring and Maintenance Plan to identify the engineering and institutional controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance of the Site controls to ensure protection of human health and the environment, and to provide guidelines on the proper handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
- Perform annual inspection of the asphalt/concrete pavement cap and sheet pile wall that separates the Upland and Marine Areas to ensure the long-term performance of these containment barriers.

The estimated cost of Cleanup Action Alternative 4 is $4,390,000 (Table M-4, Appendix M). The cost estimate is in 2019 dollars, include contingencies, and represent order-of-magnitude with a range of -30 percent to +50 percent based on EPA guidance (EPA 2000). Existing Site features including paved portions of the Site, the location of sheet pile walls and existing monitoring well network that would be utilized to evaluate long-term groundwater conditions are shown on Figure 32.

#### 8.2.5. Cleanup Action Alternative 5 – Site-Wide In Situ Treatment

Cleanup Action Alternative 5 includes Site-wide in situ treatment to stabilize Site contaminants. In situ treatment under Cleanup Action Alternative 5 will be used in conjunction with institutional controls as discussed under previous alternatives to prevent direct contact and the migration of contaminants contained in the subsurface. Compliance monitoring would then be performed to verify the effectiveness of the cleanup action. Long-term monitoring would then be performed to evaluate groundwater conditions over time to assess contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants.

Specific actions to be performed at the Site as part of Cleanup Action Alternative 5 include the following:

- Develop and implement an Engineering Design Report describing the plans and procedures that will be used for cleanup of the Site.
- Perform in situ soil treatment through the injection of chemical reagents/oxidants into the subsurface throughout the Site to immobilize (i.e., precipitate and/or bond to soil particles) and/or degrade Site contaminants. In situ treatment would be completed using standard drilling and injection technologies and would result in minimal disturbance to the existing asphalt paved surfaces.
- Install asphalt pavement in the central and eastern portions of the Upland Area that currently consist of a gravel working surface to provide a physical barrier to prevent direct contact to remaining Site contaminants. Direct stormwater captured by the new paving to the stormwater treatment system at the Site. Note that the existing treatment system will require a capacity upgrade to handle the additional volume of stormwater that will result from the new paving.
- Maintain the existing concrete/asphalt/gravel pavement caps in other portions of the Site to provide a physical barrier to prevent direct contact to remaining Site contaminants.
- Maintain the existing fencing and security procedures to restrict public access to the Site.
- Install warning signs to inform Site workers and/or visitors to the Site regarding health risks and land use restrictions (as necessary).
- Implement a deed restriction (environmental covenant) compliant with the Uniform Environmental Covenants Act and with Ecology's model environmental covenant.
- Develop and implement a Compliance Monitoring Plan describing the performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action including procedures for sample collection, sample frequency, data review, quality control and reporting.
- Install temporary monitoring wells upgradient and downgradient of the identified contamination areas and complete performance monitoring to verify the effectiveness of the cleanup action and whether the injection of additional chemical reagents is necessary to stabilize Site contaminants remaining in place. It is assumed that performance groundwater monitoring would be competed on quarterly basis for up to 2 years.
- After this time period, compliance monitoring would be completed utilizing the existing network of monitoring wells (MW-1 through MW-8) to evaluate groundwater conditions over time to assess residual contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants. It is assumed that groundwater monitoring would be competed on a semi-annual basis for up to 3 years following performance monitoring activities targeting wet and dry season months. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Perform long-term groundwater monitoring utilizing the existing network of monitoring wells (MW-1 through MW-8) to evaluate groundwater conditions over time to ensure compliance with the cleanup standards and effectiveness of the cleanup action. It is assumed that groundwater monitoring would be competed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Develop and implement an Engineering Controls Monitoring and Maintenance Plan to identify the engineering and institutional controls that are being utilized at the Site, to provide guidelines for the

monitoring and maintenance of the Site controls to ensure protection of human health and the environment, and to provide guidelines on the proper handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.

- Perform annual inspection of the asphalt/concrete pavement cap and sheet pile wall that separates the Upland and Marine Areas to ensure the long-term performance of these containment barriers.

The estimated cost of Cleanup Action Alternative 5 is $7,030,000 (Table M-5, Appendix M). The cost estimate is in 2019 dollars, include contingencies, and represent order-of-magnitude with a range of -30 percent to +50 percent based on EPA guidance (EPA 2000). Existing Site features including paved portions of the Site, the location of sheet pile walls and existing monitoring well network that would be utilized to evaluate long-term groundwater conditions are shown on Figure 33.

#### 8.2.6. Cleanup Action Alternative 6 – Site-Wide Removal

Cleanup Action Alternative 6 includes removal of contaminated soil throughout the Site followed by restoration. Compliance monitoring would then be performed to verify the effectiveness of the cleanup action. Specific actions to be performed at the Site as part of Cleanup Action Alternative 6 include the following:

- Removal followed by offsite disposal of an estimated 46,500 bcy of soil to a permitted landfill. Prior to construction, monitoring well MW-2B, MW-4 and MW-7 located in the removal area will be decommissioned. The vertical and lateral extent of remedial will be verified through confirmation samples collected during construction. Remedial excavations will be backfilled with overburden material generated during construction that is determined to be both structurally and chemically suitable for reuse and/or imported structural fill.
- Restore portions of the asphalt pavement which are disturbed by the removal action.
- Install replacement wells at locations MW-2B, MW-4 and MW-7 and complete compliance groundwater monitoring utilizing the existing network of monitoring wells (MW-1 through MW-8) to verify the effectiveness of the cleanup action. It is assumed that groundwater monitoring would be completed on quarterly basis for up to two years. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.
- Complete long-term groundwater monitoring at MW-8 to evaluate groundwater conditions over time to assess contaminant concentrations relative to the cleanup standards and natural attenuation of Site contaminants. It is assumed that groundwater monitoring would be completed on a semi-annual basis for up to 10 years targeting wet and dry season months. After this time period, Ecology would be consulted to determine additional groundwater requirements (if any) for the Site.

The estimated cost of Cleanup Action Alternative 4 is $15,060,000 (Table M-6, Appendix M). The cost estimate is in 2019 dollars, include contingencies, and represent order-of-magnitude with a range of -30 percent to +50 percent based on EPA guidance (EPA 2000). Existing Site features including paved portions of the Site, the location of sheet pile walls and existing monitoring well network that would be utilized to evaluate long-term groundwater conditions are shown on Figure 34.

# 9.0 EVALUATION OF CLEANUP ALTERNATIVES

Evaluation criteria and a comparative analysis of the cleanup action alternatives developed for the Site are summarized in the following sections. Each alternative is evaluated with respect to the MTCA evaluation criteria and are compared to each other relative to their expected performance under each criterion. The components of the cleanup action alternatives are described above in Section 3.2 and are summarized in Table 19. A detailed evaluation of the alternatives relative to the MTCA evaluation criteria is presented in Table 20, and the results of the evaluation are summarized in Table 21. Concept design level cleanup action cost estimates for each alternative are presented in Appendix M.

## 9.1. Cleanup Alternative Evaluation Criteria

Threshold requirements for cleanup actions under MTCA and the additional criteria used to evaluate the cleanup action alternatives are described in the following sections.

### 9.1.1. Threshold Requirements

Cleanup actions performed under MTCA must comply with basic threshold requirements. Cleanup action alternatives that do not comply with the threshold requirements are not considered suitable cleanup actions under MTCA. As provided in WAC 173-340-360(2)(a), the four threshold requirements for remedial actions are that they must:

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

The following sections further describe the threshold requirements.

#### *9.1.1.1. Protection of Human Health and the Environment*

The results of cleanup actions performed under MTCA must ensure that both human health and the environment are protected.

#### *9.1.1.2. Compliance with Cleanup Standards*

Compliance with cleanup standards requires, in part, that cleanup levels are met at the applicable points of compliance. If a cleanup action does not comply with cleanup standards, the cleanup action is an interim action, not a cleanup action. Where a cleanup action involves containment of hazardous substance concentrations exceeding cleanup levels at the point of compliance, the cleanup action may be determined to comply with cleanup standards, provided the requirements specified in WAC 173-340-740(6)(f) are met.

#### *9.1.1.3. Compliance with Applicable State and Federal Laws*

Cleanup actions conducted under MTCA must comply with applicable state and federal laws. The term "applicable state and federal laws" includes legally applicable requirements and those requirements that Ecology determines to be relevant and appropriate as described in WAC 173-340-710.

#### *9.1.1.4. Provision for Compliance Monitoring*

The cleanup action must allow for compliance monitoring in accordance with WAC 173-340-410. Compliance monitoring consists of protection monitoring, performance monitoring and confirmational

monitoring. Protection monitoring is conducted to confirm that human health and the environment are adequately protected during construction, and the operation and maintenance period of a cleanup action. Performance monitoring is conducted to confirm that the cleanup action has attained cleanup standards, remediation levels and/or other performance standards, as appropriate. Confirmational monitoring is conducted to confirm the long-term effectiveness of the cleanup action.

### 9.1.2. Other MTCA Requirements

Under MTCA, when selecting from the alternatives that meet the minimum requirements, the alternatives shall be further evaluated against the following additional criteria:

- Use permanent solutions to the maximum extent practicable [WAC 173-340-360(2)(b)(i)]. MTCA requires that when selecting from cleanup action alternatives that fulfill the threshold requirements, the selected action shall use permanent solutions to the maximum extent practicable [WAC 173-340-360(2)(b)(i)]. MTCA specifies that the permanence of these qualifying alternatives shall be evaluated by balancing the costs and benefits of each of the alternatives using a "disproportionate cost analysis" in accordance with WAC 173-340-360(3)(e). The criteria for conducting this analysis are described in Section 4.1.3 below.
- Provide a reasonable restoration time frame [WAC 173-340-360(2)(b)(ii)]. In accordance with WAC 173-340-360(2)(b)(ii), MTCA places a preference on those cleanup action alternatives that, while equivalent in other respects, can be implemented in a shorter period of time. MTCA includes a summary of factors to be considered in evaluating whether a remedial action provides for a reasonable restoration time frame [WAC 173-340-360(4)(b)].
- Consideration of Public Concerns [WAC 173-340-360(2)(b)(iii)]. Ecology will consider public comments submitted during the RI and FS process in making its preliminary selection of an appropriate remedial action alternative. This preliminary selection is subject to further public review and comment when the proposed remedy is published in the Draft Cleanup Action Plan (DCAP).

### 9.1.3. MTCA Disproportionate Cost Analysis

The MTCA disproportionate cost analysis (DCA) is used to further evaluate which of the alternatives that meet the threshold requirements are permanent to the maximum extent practicable. This analysis involves comparing the costs and benefits of alternatives and selecting the alternative whose incremental costs are not disproportionate to the incremental benefits. The evaluation criteria for the DCA are specified in WAC 173-340-360(2) and (3), and include protectiveness, permanence, cost, long-term effectiveness, management of short-term risks, implementability and consideration of public concerns.

As outlined in WAC 173-340-360(3)(e), MTCA provides a methodology that uses the criteria listed below to determine whether the costs associated with each cleanup alternative are disproportionate relative to the incremental benefit of the alternative above the next lowest-cost alternative. The comparison of benefits relative to costs may be quantitative but will often be qualitative. When possible for this FS, quantitative factors such as mass of contaminant removed or percentage of area of impacts remaining were compared to costs for the alternatives evaluated, but many of the benefits associated with the criteria described below were necessarily evaluated qualitatively. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative [WAC 173-340-360(e)(i)]. Where two or more alternatives are equal in benefits, the less costly alternative is retained as the preferred alternative [WAC 173-340-360(e)(ii)(c)].

MTCA criteria used in the DCA are described in the following sections.

#### *9.1.3.1. Protectiveness*

The overall protectiveness of a cleanup action alternative is evaluated based on several factors. First, the extent to which human health and the environment are protected and the degree to which overall risk at a Site is reduced are considered. Both on-site and off-site reduction in risk resulting from implementing the alternative are considered.

#### *9.1.3.2. Permanence*

MTCA specifies that when selecting a cleanup action alternative, preference shall be given to actions that are "permanent solutions to the maximum extent practicable." Evaluation criteria include the degree to which the alternative permanently reduces the toxicity, mobility or mass of hazardous substances, including the effectiveness of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment processes, and the characteristics and quantity of treatment residuals generated.

#### *9.1.3.3. Cost*

The analysis of cleanup action alternative costs under MTCA includes the costs associated with implementing an alternative, including design, construction, long-term monitoring, and institutional controls. Costs are intended to be comparable among different alternatives to assist in the overall analysis of relative costs and benefits of the alternatives. The costs to implement an alternative include the cost of construction, the net present value of any long-term costs, and agency oversight costs. Long-term costs include operation and maintenance costs, monitoring costs, equipment replacement costs, and the cost of maintaining institutional controls. Unit costs used to develop overall remediation costs for this FS were derived using a combination of published engineering reference manuals (i.e., R.S. Means); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment.

#### *9.1.3.4. Long-Term Effectiveness*

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the cleanup action. The MTCA regulations contain a specific preference ranking for different types of technologies that is to be considered as part of the comparative analysis. The ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineered controls, and institutional controls and monitoring.

#### *9.1.3.5. Management of Short-term Risks*

Evaluation of this criterion considers the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action. Cleanup actions carry short-term risks, such as potential mobilization of contaminants during construction, or safety risks typical of large construction projects. In-water dredging activities carry a risk of temporary water quality degradation and potential sediment recontamination. Some short-term risks can be managed through the use of Best Management Practices (BMPs) during project design and construction, while other risks are inherent to project alternatives and can offset the long-term benefits of an alternative.

#### *9.1.3.6. Implementability*

Implementability is an overall metric expressing the relative difficulty and uncertainty of implementing the cleanup action. Evaluation of implementability includes consideration of technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work. It also includes administrative factors associated with permitting and completing the cleanup.

#### *9.1.3.7. Consideration of Public Concerns*

The public involvement process under MTCA is used to identify potential public concerns regarding remedial action alternatives. The extent to which an alternative can address public concerns is considered as part of the evaluation process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the Site. In particular, the public concerns for this Site would generally be associated with environmental concerns and performance of the cleanup action, which are addressed under other criteria such as protectiveness and permanence.

## 9.2. Evaluation and Comparison of Cleanup Action Alternatives

Cleanup action alternatives developed for the Site were evaluated with respect to the MTCA threshold and other relevant requirements described above, then were compared to each other relative to the expected performance under each criterion. The following sections provide an evaluation and comparative analysis of the cleanup action alternatives developed to address Site contamination.

### 9.2.1. Threshold Requirements

Cleanup action alternatives developed for the Site incorporate varying combinations of capping and containment, in situ treatment and/or removal technologies in combination with institutional controls to meet the minimum threshold requirements of protecting human health and the environment, complying with cleanup standards, and complying with applicable state and federal laws within a reasonable time frame. Remediation technologies are intended to be protective of the ecological receptors, prevent direct contact with Site workers and prevent the offsite migration of contaminants. Performance and/or compliance monitoring would be completed for each cleanup action alternative to confirm compliance with the cleanup standards at the point of compliance. To ensure the effectiveness and compliance with the cleanup standards over time, Cleanup Action Alternatives 1 through 5 which leave residual contamination in place also have a provision for long-term monitoring of engineering controls to contain Site contaminants and groundwater monitoring to confirm compliance with the cleanup standards. Due to the complete removal of contaminated soil under Cleanup Action Alternative 6, long-term compliance monitoring would only be required at MW-8 to evaluate groundwater conditions at this location over time to assess contaminant concentrations relative to the cleanup standards and potential for natural attenuation.

Cleanup Action Alternative 1 achieves the lowest level of protectiveness by isolating residual contamination with a combination of institutional and engineering controls (i.e., protective caps and containment barriers to prevent direct contact). Cleanup Action Alternative 3 results in a slightly higher degree of protectiveness relative to Alternative 1 through in situ treatment/stabilization, however the full extent of contamination remains in place at the site. Cleanup Action Alternatives 2 and 4 achieves a higher degree of protectiveness than Alternative 3 as the result of removal of contaminants from the identified source areas. Cleanup Action Alternatives 5 and 6 have the highest degree of protectiveness through Site-wide stabilization of residual contamination (Cleanup Action Alternative 5) and through complete removal of Site contamination (Cleanup Action Alternative 6).

### 9.2.2. Other MTCA Requirements

#### *9.2.2.1. Permanent to the Maximum Extent Practicable*

Similar to threshold criteria, Cleanup Action Alternative 1 achieves the lowest level of permanence while Cleanup Action Alternative 3 achieves a higher degree of permanence over Cleanup Action Alternative 1 with the use of treatment technologies. Cleanup Action Alternatives 2 and 4 provide a higher degree of permanence through the use of permanent removal technologies to address source area material. Site-wide in situ treatment to stabilize Site contaminants under Cleanup Action Alternative 5 followed by complete removal of soil contamination under Cleanup Action Alternative 6 provide the highest degree of permanence.

#### *9.2.2.2. Reasonable Restoration Time Frame*

Each of the cleanup action alternatives evaluated are all expected to achieve remedial action objectives in reasonable restoration time frames. The time frame for design, permitting, contracting, and construction for each of the proposed cleanup action alternatives is expected to be on the order of 1 to 4 years. The restoration time frame for Cleanup Action Alternatives 1, 2 and 4 is expected to be the lowest; however, monitoring of the engineered caps and groundwater conditions to document compliance with cleanup objectives is expected to occur over time (minimum of 5 years). Cleanup Action Alternatives 3 and 5 are expected to occur over a 2- to 3-year time frame due to the potential of multiple rounds of in situ chemical reagent injection or complexities in soil removal to address source areas and/or Site-wide contamination followed by compliance monitoring to confirm the effectiveness of the cleanup action over a 5 year period. Cleanup Action Alternative 6 is expected to have the longest restoration time frame due to the complexities of remediating within an active shipyard including sequencing of the remedial action to limit potential impacts to DCI operations.

#### *9.2.2.3. Considerations of Public Concerns*

The cleanup alternatives proposed for the Site are generally expected to be acceptable to the public. Cleanup Action Alternative 6 achieves the greatest level of protection and certainty as a result of the greatest level of contaminated removal; however, is the most intrusive alternative requiring a high level of coordination with DCI to minimize disruption to shipyard operations and with the city and local residents for any concerns related to increased truck traffic during construction. Cleanup Action Alternatives 2 through 5 also result in a high level of protection and certainty through source removal/treatment and containment technologies; however, residual contamination will remain in place with each of these alternatives which may draw public concern for potential exposure. The public may be concerned for Cleanup Action Alternative 1 due to the level of residual contamination left in place; however, containment technologies combined with institutional controls will results in protection to human health and the environment and prevent contaminant exposure which may limit the potential for public concern.

### 9.2.3. MTCA Disproportionate Cost Analysis

The MTCA DCA is used to make a relative comparison the costs and benefits of the remedial alternatives under consideration for the Site. The comparison of benefits relative to costs are quantitative; however, quantitative factors such as mass of contaminant treated/removed, percentage of area of impacts remaining following implementation of the cleanup alternative and/or actual alternative cost when compared to the relative benefit score criteria described above may be more of a qualitative assessment in that a cleanup alternative with similar relative benefit to cost ratios. The remedial alternative with the highest ratio of benefit to cost is identified as the preferred alternative.

The evaluation of the level of achievement for how each individual criterion applies to each alternative, using a numeric scoring scale of 1 (lowest) to 10 (highest) and the methodology described above in Section 9.1.3. Table 20 presents an evaluation of the relative benefits ranking and numeric score for the individual criterion. Table 21 summarizes the results of the DCA and ranks each of the cleanup action alternatives based on relative cost and benefit. Preliminary planning level construction cost estimate for each cleanup action alternative incorporated into the DCA are presented in Appendix M and have an accuracy that is considered to be -30 to +50 percent based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 2000). The conclusions of this evaluation are shown on Figure 35.

### 9.3. Preferred Cleanup Action Alternative and Basis for Selection

Under MTCA, "costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of lower cost alternative" (WAC 173-340-360[3][e][i]). From the resulting benefit/cost ratio (Figure 35), the overall cost for Cleanup Action Alternatives 3 through 6 are disproportionate to the environmental benefit that they provide relative to Cleanup Action Alternatives 1 and 2. Furthermore, the environmental benefit for Cleanup Action Alternative 2 is greater than for Cleanup Action Alternative 1. As a result, Cleanup Action Alternative 2 emerges as the preferred alternative for the Site. This alternative may be refined during development of the Draft Cleanup Action Plan (DCAP).

Cleanup Action Alternative 2 addresses Site contamination through partial source area removal in the southeast portion of the Site and is not expected to significantly disrupt DCI operations or limit access to buildings and other infrastructure utilized by DCI. Remaining Site contamination will be address through containment technologies (i.e., isolation by existing paving and sheet pile wall) in conjunction with institutional controls. This alternative is permanent to the maximum extent practicable and reduces immediate risk to potential human and ecological receptors through:

- Partial removal of Site contaminants exceeding three times the PCUL in the southeast portion of the Site. Results of groundwater monitoring provide a line of evidence that contaminant levels exceeding three times the PCUL in soil in this area are adversely impacting groundwater. Additionally, groundwater data collected prior to and following significant asphalt paving of the Site also provides a line of evidence that contaminants remaining in place in other portions of the Site have stabilized and are not migrating downgradient toward the Guemes Channel since paving was completed.
- Maintenance of the existing concrete and asphalt caps in other portions of the Site to prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site contaminants.
- Maintain the existing sheet pile wall that separates the Marine Area from the Upland Area to contain Site COCs identified in Upland Area soil as well as to provide a physical barrier to prevent direct contact.
- Maintenance of the existing fencing and security procedures to restrict public access to the Site.
- Installation of warning signs to inform Site workers and/or visitors to the Site regarding health risks and land use restrictions (as necessary).
- Implementation of a deed restriction (environmental covenant) compliant with the Uniform Environmental Covenants Act and with Ecology's model environmental covenant. It is expected that an

environmental covenant will not be required for the southeast portion of the DCI lease area following remedial excavation as part of this cleanup action.

Implementation of Cleanup Action Alternative 2 will result in contaminant mass reduction, containment and prevention of direct human contact with remaining COCs, and the prevention of stormwater infiltration/leaching and migration of COCs contained in other portions of the Site to the Marine Area. Although Cleanup Action Alternative 2 does not achieve complete mass removal, containment of the COCs in the fill body by way of the existing paving has been shown empirically to be effective at preventing the mobility and migration of COCs in groundwater at the Site. Therefore, the contaminant mass reduction acts to increase protectiveness and permanence of the alternative over containment focused alternatives.

# 10.0 CONCLUSIONS

## 10.1. Remedial Investigation and Interim Action

Pursuant to the Ecology Agreed Order DE DE-07TCPHQ -5080 and MTCA cleanup regulations (Chapter 173-340 WAC), remedial investigation activities were completed by the Port to characterize environmental conditions at the Anacortes Port of Dakota Creek site located along the shoreline of Guemes Channel at the northern terminus of Q Avenue in Anacortes, Washington.

Upland Area environmental data was collected in accordance with the Ecology-approved RI/FS Work Plan to supplement and fill identified data gaps in existing data for the Site, to determine the nature and extent of contamination in soil and groundwater. Marine Area environmental data was collected in accordance with the Ecology-approved RI/FS Work Plan to characterize the nature and extent of sediment contamination in areas previously identified as exceeding the PCULs. The data collected for the RI provided the basis for identification and evaluation of cleanup action alternatives for addressing Site contamination. In addition, the Marine Area data was used to support planning and design of the Interim Action that was completed in 2008.

## 10.2. Nature and Extent of Contamination

Based on a review of the Upland and Marine Area RI results as well as a review of previous Site characterization data, the following COCs were identified for sediment, groundwater and soil at the Site:

- **Sediment** – Metals including arsenic, cadmium, copper, lead, mercury and zinc, TBT, LPAHs, HPAHs, cPAHs, PCBs, dioxin and furans were identified as COCs for Marine Area sediment. However, interim action dredging in the Marine Area in 2008 resulted in the complete removal of sediment contamination at the Site. As a result, sediment is no longer considered a media of concern.
- **Groundwater** – Metals including arsenic and nickel, and cPAHs were identified as groundwater COCs for the Upland Area.
- **Soil** – Metals including arsenic and nickel, and cPAHs were identified as soil COCs for the Upland Area. In addition, results of previous environmental studies identified concentrations of gasoline-, diesel- and/or heavy oil-range petroleum hydrocarbons exceeding PCULs. As indicated above, the Port completed independent cleanup actions (i.e., 1991 UST, 2001 Hydraulic Winch and 2002 Petroleum and Marine Railway Cleanup Actions) to remove the previously identified petroleum contamination from the Site. Confirmation sample results obtained from the limits of these excavations indicated that the petroleum contamination was successfully removed from the Site. However, confirmation soil sample

results for these areas could not be independently validated. Therefore, petroleum hydrocarbons within the footprints of the previously completed cleanup action areas are unverified until subsequent sampling result confirm their removal.

The nature and extent for COCs in Site media is further discussed below.

### 10.2.1. Marine Area

Interim action dredging and excavation activities completed between July and November 2008 in general accordance with the Ecology-approved RI/FS Work Plan and Interim Action Work Plan Addendum were completed to remove identified COCs from the Marine Area. The interim action resulted in the removal of approximately 26,000 cubic yards (approximately 38,000 tons) of contaminated sediment from the southern portion of the Marine Area for upland landfill disposal. An additional 230,000 cubic yards of sediment (approximate) determined to be suitable for open-water disposal by the DMMP was then dredged from the Marine Area as part of the Project Pier 1 redevelopment for disposal at the Rosario Strait dispersive site to meet the design grade of -35 feet MLLW. Due to the completeness of the interim action and subsequent Marine Area dredging to remove contaminated sediment deposits and up to 30 feet of native glaciomarine deposits, no identified sediment contamination remained in the Marine Area and sediment is no longer considered a media of concern for the Site.

### 10.2.2. Upland Area

In the Upland area, COCs including arsenic, nickel and cPAHs were detected at concentrations exceeding PCULs in soil throughout the Site. In the eastern portion of the Site, arsenic and nickel exceeded PCULs in fill deposits from the ground surface up to a depth of approximately 8 feet bgs. In the north central portion of the Site, arsenic and nickel exceeded PCULs in fill deposits from the ground surface up to a depth of approximately 10 feet bgs. In the southwestern portion of the Site, arsenic, nickel and cPAHs exceeded the PCUL in fill deposits from the ground surface up to a depth of approximately 13 feet bgs. Results of soil/sediment samples collected at the Site from the underlying native surface show that the Upland Area PCUL exceedances are limited to the overlying fill soil and do not extend into the native surface.

Between 2015 and 2016, DCI replaced a significant portion of their gravel working surface with asphalt pavement which prevents stormwater infiltration through the soil column. A comparison of the initial (2008 to 2013) groundwater monitoring results to the recent semi-annual groundwater monitoring results (2016 to 2017) show that the paved surfaces are limiting the infiltration, leaching and subsequent migration of contaminants through the soil column to groundwater.

At shoreline monitoring well locations, the following COCs were detected at concentrations greater than the groundwater PCUL since completion of the Upland Area paving activities:

- Dissolved nickel detected at a concentration of 8.3 µg/L marginally exceeded the groundwater PCUL of 8.2 µg/L at shoreline monitoring well location MW-2B during the February 2017 monitoring event. However, total nickel at this location was not detected at a concentration exceeding the groundwater PCUL during this event and dissolved nickel did not exceed the PCUL in subsequent monitoring events at this location.
- Total cPAH TEQ concentrations and/or dissolved arsenic exceeded the groundwater PCUL at shoreline monitoring well location MW-8 during one or more semi-annual monitoring events between February

2016 and August 2017. However, cPAHs and arsenic concentrations at monitoring well location MW-1 (upgradient monitoring well location) were less than the PCUL for each of these monitoring events. Supplemental sampling and analysis to further evaluate soil conditions in the vicinity of MW-8 did not identify potential source materials for cPAHs or arsenic in saturated soil adjacent to or upgradient of this location.

At upgradient monitoring well locations, the following COCs were detected at concentrations greater than the groundwater PCUL since completion of the Upland Area paving activities:

- Total and dissolved arsenic and nickel, and total cPAH TEQ concentrations exceeded the groundwater PCULs at monitoring well location MW-7 during one or more semi-annual monitoring events. However, at downgradient monitoring well locations MW-3A and MW-6, total and dissolved arsenic and nickel, and cPAHs either were not previously detected or were detected at concentrations less than the groundwater PCUL during each of the four semi-annual groundwater monitoring events.

The distribution of COCs including arsenic, nickel and cPAHs in Upland Area soil and groundwater representing current conditions at the Site are summarized on Figures 20 through 25.

### 10.3. Supplemental Soil Investigation

Results of previous environmental studies identified concentrations of gasoline-, diesel- and/or heavy oil-range petroleum hydrocarbons exceeding PCULs in historical fill deposits from the ground surface to a depth of approximately 8 feet bgs in the central and eastern portions of the Site. Between 1991 and 2002, the Port completed independent cleanup actions in these areas to remove the previously identified petroleum contamination from the Site. However, confirmation soil sample results for these areas could not be independently validated and will require subsequent sampling to confirm the completeness of the removal.

A supplemental soil investigation is proposed as a pre-remedial design activity to verify the effectiveness of the previous cleanup actions. As part of this investigation, sampling will be performed within the footprint of the previously completed remedial excavations which extended to depths greater than 1-foot (i.e., remedial excavations extending beneath the former gravel working surface). Samples will be collected from a depth of below the base of the previous remedial excavations to represent the previous verification sample interval and analyzed for COCs previously identified for these areas including gasoline-, diesel- and heavy oil-range petroleum hydrocarbons and/or cPAHs. The results of this investigation will be reported in the CAP and used to refine the preferred cleanup action alternative for the Site.

### 10.4. Feasibility Study Development and Preferred Cleanup Action Alternative Selection

The nature and extent of contamination in sediment has been characterized in accordance with the Ecology-approved RI/FS Work Plan using PCULs for identified human and ecological receptors and exposure pathways based on current and future land use. Based on the results of the RI, sufficient data has been collected to identify and evaluate cleanup alternatives for contaminated media at the Site. A range of remedial technologies were screened considering the media requiring cleanup, COC present and current and future land use to develop a reasonable number and range of potentially applicable cleanup actions which were then evaluated relative to the following criteria:

- Compliance with cleanup standards and applicable laws;

- Provision for a reasonable restoration time frame; and
- Use of permanent solutions to the maximum extent practicable by comparison of the following criteria:
    - Protectiveness;
    - Permanence;
    - Cost;
    - Effectiveness over the long term;
    - Short-term risk management;
    - Net environmental benefit;
    - Technical and administrative implementability; and
    - Consideration of Public Concerns.

As a result of this evaluation, Cleanup Action Alternative 2 emerged as the preferred alternative which meets the minimum threshold requirements, achieves a high level of environmental benefit and is not disproportionate in cost relative to the other alternatives evaluated. Implementation of Cleanup Action Alternative 2 will result in contaminant mass reduction in the southeast portion of the Site and will be used in conjunction with containment technologies and institutional controls to prevent direct human contact and reduce the potential for leaching and migration of residual COCs contained within the fill soil within a reasonable restoration time frame.

## 11.0 LIMITATIONS

This report has been prepared for the exclusive use of the Port of Anacortes, their authorized agents and regulatory agencies for the Dakota Creek Industries Site located at 115 Q Avenue in Anacortes, Washington. No other party may rely on the product of our services unless we agree in advance and in writing to such reliance. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

## 12.0 REFERENCES

A-1 Pump Services (A-1) 1991. "Site Assessment Case File No. 6281, Dakota Creek Industries, 820 4th Street, Anacortes, Washington," dated October 1991.

Agency for Toxic Substances and Disease Registry (ATSDR 2017), http://www.atsdr.cdc.gov, accessed October 2, 2017.

Anchor Environmental, L.L.C. (Anchor) 2004. "Sampling and Analysis Data Report, Supplemental Sediment Characterization, Dakota Creek Industries Shipyard Facility/Pier 1 Redevelopment Area, Anacortes, Washington," prepared for Seattle District, US Army Corps of Engineers, dated October 2004.

Antrim et al., 2000. "Plan for Habitat Protection, Restoration, and Enhancement in the Fidalgo/Guemes Area. Battelle Marine Sciences Laboratory, Sequim, Washington", prepared for the City of Anacortes with assistance from the Fidalgo/Guemes Area Technical Committee by Antrim, L.D., R.M. Thom, A.B. Borde, and J.A. Southard, dated June 2000.

ASTM International, 2002. "Standard Test Method (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers", ASTM D 4044-96, Reapproved 2002.

Dakota Creek Industries (DCI) 2017. "Stormwater Pollution Prevention Plan (SWPPP)," prepared by Dakota Creek Industries Inc., revised June 2017.

Dredged Material Management Program (DMMP) 2009. "OSV Bold Summer 2008 Survey. Data Report, Final," Prepared by the Washington State Dredged Material Management Program, with assistance from Science Applications International, Avocet Consulting, TerraStat Consulting Group. Olympia WA: Washington State Department of Ecology, Toxics Cleanup Program, Publication No. 09-09-226, dated June 25, 2009.

Ecology & Environment (E&E) 2000. "Port of Anacortes – Dakota Creek Industries Inc. Preliminary Assessment Report, Anacortes, Washington," prepared for the U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team, Contract No. 68-W6-008, Technical Direction Document No. 00-01-0023, Seattle, Washington, dated November 2000.

GeoEngineers Inc. (GeoEngineers) 2010. "Interim Action Report, Dakota Creek Industries, Ecology Agreed Order No. DE-07TCPHQ-5080, Anacortes, Washington," prepared for the Port of Anacortes, GEI File No. 5147-006-06, dated October 6, 2010.

GeoEngineers Inc. (GeoEngineers) 2008a. "Final Work Plan, Remedial Investigation/Feasibility Study and Interim Action Work Plan – Dakota Creek Industries," prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, GEI File No. 5147-006-00, dated April 1, 2008.

GeoEngineers Inc. (GeoEngineers) 2008b. "Interim Action Work Plan Addendum, Dakota Creek Industries Shipyard, Ecology Agreed Order No. DE-07TCPHQ-5080," prepared for the Port of Anacortes, GEI File No. 5147-006-02, dated June 17, 2008.

GeoEngineers Inc. (GeoEngineers) 2010. "Interim Action Report, Dakota Creek Industries, Ecology Agreed Order No. DE-07TCPHQ-5080," prepared for the Port of Anacortes, GEI File No. 5147-006-06, dated October 6, 2010.

GeoEngineers Inc. (GeoEngineers) 2010. "Interim Action Final Work Plan, Remedial Investigation/Feasibility Study and Interim Action Work Plan – Dakota Creek Industries," prepared for the Washington State Department of Ecology on behalf of Port of Anacortes, GEI File No. 5147-006-00, dated April 1, 2008.

Kruseman, G.P. and N.A. deRidder, 1990. "Analysis and Evaluation of Pumping Test Data, Second Edition", International Institute for Land Reclamation and Improvement, The Netherlands. 377pp.

Landau Associates (Landau) 2002a. "Cleanup Action Plan and Cleanup Action Work Plan, Dakota Creek Industries Shipyard Facility, Anacortes, Washington," prepared for Port of Anacortes, dated March 20, 2002.

Landau Associates (Landau) 2002b. "Remedial Investigation/Feasibility Study, Dakota Creek Industries, Inc. Anacortes, Washington," prepared for Port of Anacortes, dated March 20, 2002.

Landau Associates (Landau) 2002c. "Completion Report, Independent Cleanup Action, Dakota Creek Industries, Inc. Anacortes, Washington," prepared for Port of Anacortes, dated December 20, 2002.

Landau Associates (Landau) 2001. "Technical Memorandum re: Marine Railway Hydraulic Winch Soil Excavation, Dakota Creek Industries Shipyard, Anacortes, Washington," prepared for Port of Anacortes, dated August 7, 2001.

Lapen, Thomas J. (Lapen) 2000. "Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington," Washington State Department of Natural Resources, Division of Geology and Earth Resources, dated December 2000.

Lenz, Brett (Lenz) 2013. "Cultural Resource Assessment for the Port of Anacortes Wyman's Property Habitat Mitigation (Pier 1 Mitigation Project), Skagit County, WA," prepared for the Port of Anacortes, dated February 15, 2013.

Floyd|Snider (2007). "Dakota Creek Industries Shipyard Facility, Sediment Sampling Data Report," prepared for Port of Anacortes, dated January 3, 2007.

Floyd|Snider (2006). "Dakota Creek Industries Shipyard Facility, Groundwater Sampling Results," prepared for Port of Anacortes, dated December 13, 2006.

National Academic Press (NAP) 2012. "Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future," Consensus Report, Committee on Sea Level Rise in California, Oregon, and Washington, Division on Earth and Life Studies, National Research Council of the National Academies, dated 2012.

National Oceanic Atmospheric Administration (NOAA) 2019, "West Coast Salmon & Steelhead Report," available at: https://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/salmon_and_steelhead_listings.html.

National Ocean Service (NOS) 2019. "Is Sea Level Rising?" https://oceanservice.noaa.gov/facts/sealevel.html, accessed March 1, 2019.

Otten Engineering (Otten) 1997. "Phase 2 Environmental Assessment, Dakota Creek Industries Site and Former Wastewater Treatment Plant Site, Port of Anacortes, Anacortes, Washington," prepared for Port of Anacortes, dated October 1, 1997.

Panagiotaras and Nikolopoulos 2015, "Arsenic Occurrence and Fate in the Environment; A Geochemical Perspective," Journal of Earth Science and Climate Change 6:269. doi: 10.4172/2157-7617.1000269, February 15, 2015.

PTI Environmental Services (PTI) 1989. "Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State," prepared for the Washington Department of Ecology, dated April 1989.

Science Application International Corporation (SAIC), 2008. "Fidalgo Bay Sediment Investigation Data Report, Anacortes, Washington," prepared for the Washington State Department of Ecology, dated March 14, 2008.

United States Fish and Wildlife Service (USFWS) 2018, "Information for Planning and Consultation," available at: https://ecos.fws.gov/ipac/.

Washington State Department of Ecology (Ecology) 2019. "Sediment Cleanup User's Manual II (SCUM II), Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC," Publication No. 12-09-057, original publication March 2015, revised December 2019.

Washington State Department of Ecology (Ecology) 2015, "Upland Soil Supplemental Investigation: Remedial Investigation Next Steps at Dakota Creek Industries Site (Ecology Agreed Order No. DE-07TCPHQ-5080), Memorandum of Record," dated June 15, 2015.

Washington State Department of Ecology (Ecology) 2007. "Agreed Order for Remedial Investigation/ Feasibility Study, Draft Cleanup Action Plan and Interim Action – Port of Anacortes Dakota Creek Site, No. DE DE-07TCPHQ-5080," Effective Date December 12, 20107.

Washington State Department of Ecology (Ecology) 1994. "Natural Background Soil Metals Concentrations in Washington State," Publication No. 94-115, dated October 1994.

Washington State Department of Fish and Wildlife (WDFW) 2019, "Priority Habitat and Species Interactive Map Viewer," available at: http://wdfw.wa.gov/mapping/phs/.

Weston 2001. "Dakota Creek Industries Shipyard Site Inspection Final Sampling and Quality Assurance Plan," prepared for the U.S. Environmental Protection Agency, Contract No. 68-S0-01-02, dated June 2001.

Water Quality Permitting and Reporting Information System (PARIS) 2019. "City of Anacortes NPDES Permit No. WA0020257 2017 CSO & Wet Weather Operation Report," https://apps.ecology.wa.gov/paris/FacilitySummary.aspx?FacilityId=86391745, accessed August 2, 2019.

# Table 1

## Proposed Sediment Cleanup Levels for Protection of Benthic Organisms

Dakota Creek Industries

Anacortes, Washington

| Analyte | Criteria for Protection of Benthic Organisms: Sediment Management Standard[1] (SMS) Units | SMS Sediment Quality Objectives (SQO) | SMS Cleanup Screening Level (CSL) | Apparent Effects Threshold (AET) Criteria[2] Units | AET Lowest AET (LAET) | AET Second Lowest AET (2LAET) | Proposed Sediment Cleanup Level[3] Units | Organic Carbon (0.5% to 3.5%) | Units | Organic Carbon (<0.5% or >3.5%) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | |
| Arsenic | mg/kg | 57 | 93 | mg/kg | 57 | 93 | mg/kg | 57 | mg/kg | 57 |
| Cadmium | | 5.1 | 6.7 | | 5.1 | 6.7 | | 5.1 | | 5.1 |
| Chromium | | 260 | 270 | | 260 | 270 | | 260 | | 260 |
| Copper | | 390 | 390 | | 390 | 390 | | 390 | | 390 |
| Lead | | 450 | 530 | | 450 | 530 | | 450 | | 450 |
| Mercury | | 0.41 | 0.59 | | 0.41 | 0.59 | | 0.41 | | 0.41 |
| Nickel | | NE | NE | | NE | NE | | NE | | NE |
| Silver | | 6.1 | 6.1 | | 6.1 | 6.1 | | 6.1 | | 6.1 |
| Zinc | | 410 | 960 | | 410 | 960 | | 410 | | 410 |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)** | | | | | | | | | | |
| Total LPAH[4] | mg/kg OC | 370 | 780 | µg/kg | 5,200 | 5,200 | mg/kg OC | 370 | µg/kg | 5,200 |
| 2-Methylnaphthalene | | 38 | 64 | | 670 | 670 | | 38 | | 670 |
| Acenaphthene | | 16 | 57 | | 500 | 500 | | 16 | | 500 |
| Acenaphthylene | | 66 | 66 | | 1,300 | 1,300 | | 66 | | 1,300 |
| Anthracene | | 220 | 1,200 | | 960 | 960 | | 220 | | 960 |
| Fluorene | | 23 | 79 | | 540 | 540 | | 23 | | 540 |
| Naphthalene | | 99 | 170 | | 2,100 | 2,100 | | 99 | | 2,100 |
| Phenanthrene | | 100 | 480 | | 1,500 | 1,500 | | 100 | | 1,500 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)** | | | | | | | | | | |
| Total HPAH[5] | mg/kg OC | 960 | 5,300 | µg/kg | 12,000 | 17,000 | mg/kg OC | 960 | µg/kg | 12,000 |
| Benzo(a)anthracene | | 110 | 270 | | 1,300 | 1,600 | | 110 | | 1,300 |
| Benzo(a)pyrene | | 99 | 210 | | 1,600 | 1,600 | | 99 | | 1,600 |
| Total Benzofluoranthenes | | 230 | 450 | | 3,200 | 3,600 | | 230 | | 3,200 |
| Benzo(ghi)perylene | | 31 | 78 | | 670 | 720 | | 31 | | 670 |
| Chrysene | | 110 | 460 | | 1,400 | 2,800 | | 110 | | 1,400 |
| Dibenzo(a,h)anthracene | | 12 | 33 | | 230 | 230 | | 12 | | 230 |
| Fluoranthene | | 160 | 1,200 | | 1,700 | 2,500 | | 160 | | 1,700 |
| Indeno(1,2,3-cd)pyrene | | 34 | 88 | | 600 | 690 | | 34 | | 600 |
| Pyrene | | 1,000 | 1,400 | | 2,600 | 3,300 | | 1000 | | 2,600 |
| **Chlorinated Organic Compounds** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | 0.81 | 1.8 | µg/kg | 31 | 51 | mg/kg OC | 0.81 | µg/kg | 31 |
| 1,2-Dichlorobenzene | | 2.3 | 2.3 | | 35 | 50 | | 2.3 | | 35 |
| 1,4-Dichlorobenzene | | 3.1 | 9 | | 110 | 110 | | 3.1 | | 110 |
| Hexachlorobenzene | | 0.38 | 2.3 | | 22 | 70 | | 0.38 | | 22 |
| **Phthalates** | | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | 47 | 78 | µg/kg | 1,300 | 1,900 | mg/kg OC | 47 | µg/kg | 1,300 |
| Butyl Benzyl Phthalate | | 5 | 64 | | 63 | 900 | | 4.9 | | 63 |
| Dibutyl Phthalate | | 220 | 1,700 | | 1,400 | 1,400 | | 220 | | 1,400 |
| Diethyl Phthalate | | 61 | 110 | | 200 | > 1,200 | | 61 | | 200 |
| Dimethyl Phthalate | | 53 | 53 | | 71 | 160 | | 53 | | 71 |
| Di-N-Octyl Phthalate | | 58 | 4,500 | | 6,200 | 6,200 | | 58 | | 6,200 |
| **Phenols** | | | | | | | | | | |
| 2,4-Dimethylphenol | µg/kg | 29 | 29 | µg/kg | 29 | 29 | µg/kg | 29 | µg/kg | 29 |
| 2-methylphenol | | 63 | 63 | | 63 | 63 | | 63 | | 63 |
| 4-methylphenol | | 670 | 670 | | 670 | 670 | | 670 | | 670 |
| Pentachlorophenol | | 360 | 690 | | 360 | 690 | | 360 | | 360 |
| Phenol | | 420 | 1,200 | | 420 | 1,200 | | 420 | | 420 |
| **Miscellaneous Extractables** | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 15 | 58 | µg/kg | 540 | 540 | mg/kg OC | 15 | µg/kg | 540 |
| Hexachlorobutadiene | | 3.9 | 6.2 | | 11 | 120 | | 3.9 | | 11 |
| N-Nitrosodiphenylamine | | 11 | 11 | | 28 | 40 | | 11 | | 28 |
| Benzoic Acid | µg/kg | 650 | 650 | µg/kg | 650 | 650 | µg/kg | 650 | µg/kg | 650 |
| Benzyl Alcohol | | 57 | 73 | | 57 | 73 | | 57 | | 57 |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | mg/kg OC | 12 | 65 | mg/kg | 0.13 | 1 | mg/kg OC | 12 | mg/kg | 0.13 |



**Notes:**

[1] Sediment Management Standards (SMS) (Chapter 173-204 WAC).

[2] Apparent Effects Threshold (AET) Criteria from Ecology's SCUM II guidance (Table 8-1; Ecology 2019).

[3] The organic carbon normalized SMS criteria are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Sediment with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the AET Screening Level on a dry weight basis (EPA 1988).

[4] Total LPAHs are the total of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene and anthracene; 2-methylnapthalene is not included in the sum of LPAHs.

[5] Total HPAHs are the total of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c-d)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene.

mg/kg = milligram per kilogram

mg/kg OC = milligram per kilogram normalized to organic carbon

µg/kg = microgram per kilogram

ng/kg = nanogram per kilogram

-- = Criteria not applicable or not available

# Table 2

## Proposed Sediment Cleanup Levels for Protection of Human Health and Higher Trophic Level Ecological Receptors

Dakota Creek Industries

Anacortes, Washington

| Analyte | Units | Criteria for Protection of Human Health: Bioaccumulation via Consumption of Aquatic Organisms – Natural Background or PQL[1] | Criteria for Protection of Human Health: Direct Contact via Net Fishing[2] – Carc. (at $10^{-6}$ risk) | Criteria for Protection of Human Health: Direct Contact via Net Fishing[2] – Non-Carc. | Proposed Sediment Cleanup Level | Adjustment Factors – Natural Background[3] | Adjustment Factors – PQL[4] | Proposed Sediment Cleanup Level[5] (After Adjustment for Background and PQL) – Subtidal Sediment (below -3 ft MLLW) |
|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | |
| Arsenic | mg/kg | 11 | 3.0 | 1,300 | 3.0 | 11 | 5 | 11 |
| Cadmium | | 0.8 | -- | 4,400 | 0.8 | 0.8 | 0.2 | 0.8 |
| Chromium | | -- | -- | 6,900,000 | 6,900,000 | 62 | 0.5 | 6,900,000 |
| Copper | | -- | -- | 180,000 | 180,000 | 45 | 0.2 | 180,000 |
| Lead | | 21 | -- | -- | 21 | 21 | 2 | 21 |
| Mercury | | 0.2 | -- | 460 | 0.2 | 0.2 | 0.05 | 0.2 |
| Nickel | | -- | -- | 92,000 | 92,000 | 50 | 1 | 92,000 |
| Silver | | -- | -- | 23,000 | 23,000 | 0.24 | 0.3 | 23,000 |
| Zinc | | -- | -- | 1,400,000 | 1,400,000 | 93 | 1 | 1,400,000 |
| **Tributyltin** | | | | | | | | |
| Tributyltin, bulk | µg/kg | 73[6] | -- | 1,200 | 73 | -- | 3.86 | 73 |
| Interstitial Tributyltin, porewater | µg/L | 0.15[6] | -- | -- | 0.15 | -- | 0.0052 | 0.15 |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)** | | | | | | | | |
| 2-Methylnaphthalene | mg/kg | -- | -- | 16,000 | 16,000 | -- | 0.005 | 16,000 |
| Acenaphthene | | -- | -- | 240,000 | 240,000 | -- | 0.005 | 240,000 |
| Acenaphthylene | | -- | -- | 240,000 | 240,000 | -- | 0.005 | 240,000 |
| Anthracene | | -- | -- | 1,200,000 | 1,200,000 | -- | 0.005 | 1,200,000 |
| Fluorene | | -- | -- | 160,000 | 160,000 | -- | 0.005 | 160,000 |
| Naphthalene | | -- | -- | 79,000 | 79,000 | -- | 0.005 | 79,000 |
| Phenanthrene | | -- | -- | 1,200,000 | 1,200,000 | -- | 0.005 | 1,200,000 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)** | | | | | | | | |
| Benzo(a)anthracene | mg/kg | -- | -- | -- | NE | -- | 0.005 | NE |
| Benzo(a)pyrene | | -- | cPAH TEQ | cPAH TEQ | cPAH TEQ | -- | 0.005 | cPAH TEQ |
| Total benzofluoranthenes | | -- | -- | -- | NE | -- | 0.005 | NE |
| Benzo(ghi)perylene | | -- | -- | 120,000 | 120,000 | -- | 0.005 | 120,000 |
| Chrysene | | -- | -- | -- | NE | -- | 0.005 | NE |
| Dibenzo(a,h)anthracene | | -- | -- | -- | NE | -- | 0.005 | NE |
| Fluoranthene | | -- | -- | 160,000 | 160,000 | -- | 0.005 | 160,000 |
| Indeno(1,2,3-cd)pyrene | | -- | -- | -- | NE | -- | 0.005 | NE |
| Pyrene | | -- | -- | 120,000 | 120,000 | -- | 0.005 | 120,000 |
| **Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)** | | | | | | | | |
| Total cPAHs - TEQ | µg/kg | 21 | 680 | 120,000 | 21 | 21 | 5 | 21 |
| **Chlorinated Organic Compounds** | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg | -- | 140 | 41,000 | 140 | -- | 0.2 | 140 |
| 1,2-Dichlorobenzene | | -- | -- | 370,000 | 370,000 | -- | 0.2 | 370,000 |
| 1,4-Dichlorobenzene | | -- | 760 | 290,000 | 760 | -- | 0.2 | 760 |
| Hexachlorobenzene | | -- | 2.5 | 3,300 | 2.5 | -- | 0.001 | 2.5 |
| **Phthalates** | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | mg/kg | -- | 290 | 82,000 | 290 | -- | 0.05 | 290 |
| Butyl Benzyl Phthalate | | -- | 2,100 | 820,000 | 2,100 | -- | 0.02 | 2,100 |
| Dibutyl Phthalate | | -- | -- | 410,000 | 410,000 | -- | 0.02 | 410,000 |
| Diethyl Phthalate | | -- | -- | 3,300,000 | 3,300,000 | -- | 0.02 | 3,300,000 |
| Dimethyl phthalate | | -- | -- | -- | NE | -- | 0.02 | NE |
| Di-N-Octyl Phthalate | | -- | -- | 41,000 | 41,000 | -- | 0.02 | 41,000 |
| **Phenols** | | | | | | | | |
| 2,4-Dimethylphenol | mg/kg | -- | -- | 82,000 | 82,000 | -- | 25 | 82,000 |
| 2-Methylphenol | | -- | -- | 200,000 | 200,000 | -- | 20 | 200,000 |
| 4-Methylphenol | | -- | -- | 410,000 | 410,000 | -- | 20 | 410,000 |
| Pentachlorophenol | | -- | 8.7 | 17,000 | 9 | -- | 100 | 100 |
| Phenol | | -- | -- | 1,200,000 | 1,200,000 | -- | 100 | 1,200,000 |
| **Miscellaneous Extractables** | | | | | | | | |
| Dibenzofuran | mg/kg | -- | -- | 4,100 | 4,100 | -- | 0.02 | 4,100 |
| Hexachlorobutadiene | | -- | 52 | 4,100 | 52 | -- | 0.001 | 52 |
| N-Nitrosodiphenylamine | | -- | 830 | -- | 830 | -- | 0.02 | 830 |
| Benzoic Acid | µg/kg | -- | -- | 16,000,000 | 16,000,000 | -- | 200 | 16,000,000 |
| Benzyl Alcohol | | -- | -- | 410,000 | 410,000 | -- | 20 | 410,000 |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | |
| Total PCBs (Sum of Aroclors) | mg/kg | 0.0035 | 1.9 | -- | 0.0035 | 0.0035 | 0.001 | 0.0035 |
| **Dioxins and Furans** | | | | | | | | |
| Total Dioxins/Furans - Human Health TEQ | ng/kg | 5 | 55 | 5,000 | 5 | 4 | 5[7] | 5 |

**Notes:**

[1] Bioaccumulative chemicals include arsenic, cadmium, lead, mercury, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), dioxin-like polychlorinated biphenyls (PCBs), and dioxins/furans. Currently site-specific human health and ecological risk-based sediment screening levels have not been developed for bioaccumulative chemicals. Therefore, sediment screening levels for these chemicals are based on the natural background or the practical quantification limit (PQL), whichever is higher.

[2] Sediment cleanup levels for the protection of human health via direct contact are calculated using equations and input parameters provided by Ecology in the Draft Sediment Cleanup Users Manual (SCUM) II guidance (Ecology 2019).

[3] Natural background concentrations are derived from the calculated values (90/90 UTL) from the Bold plus dataset and presented in Table 10-1 of Ecology's Draft SCUM II (Ecology 2019) guidance document.

[4] PQL is from the Remedial Investigation/Feasibility Study Work Plan (GeoEngineers 2008) and is the lowest available value from Analytical Resources Inc. (ARI) of Tukwila, Washington.

[5] The proposed cleanup levels (PCULs) presented in this table are to provide an evaluation of human health and ecological risk for higher trophic level ecological receptors. Human health and higher trophic level ecological receptor PCULs are chosen from lowest of bioaccumulative and direct contact pathways. If the risk-based value is lower than natural background or practical quantitation limit (PQL), the screening level defaults to the higher of natural background or PQL. The human health PCULs for subtidal areas include marine areas at elevations below -3 feet MLLW and the applicable direct contact pathway is net fishing.

[6] The bioaccumulative cleanup levels protective of higher trophic level ecological receptors is from the Dredged Material Management Program (DMMP) bioaccumulation triggers for bulk and porewater tributyltin. Measurement of tributyltin in interstitial water provides a more direct measure of potential bioavailability, and hence toxicity, than bulk sediment concentrations. Therefore porewater tributyltin

[7] PQL for Dioxin TEQ is the Programmatic PQL values from Ecology's SCUM II guidance (Table 11-1; Ecology 2019).

mg/kg = milligram per kilogram

µg/kg = microgram per kilogram

ng/kg = nanogram per kilogram

-- = No criterion is currently available for this analyte

Total LPAHs are the total of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene and anthracene; 2-methylnaphthalene is not included in the sum of LPAHs.

Total HPAHs are the total of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene.

Blue shading identifies the basis for proposed sediment cleanup level.

Green shading identifies the proposed sediment cleanup level after adjustment for background and the PQL.

# Table 3

## Proposed Groundwater Cleanup Levels

Dakota Creek Industries
Anacortes, Washington

| Analyte | Units | Criteria for Protection of Surface Water: Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Marine Aquatic Life: Acute | Chronic | Protection of Human Health (Organisms Only) | Federal Marine Water Quality Criteria for Washington[2] (40 CFR 131.45): Protection of Human Health (Organisms Only) | Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Marine Aquatic Life: Acute | Chronic | Protection of Human Health (Organisms Only) | MTCA Method B Surface Water Cleanup Level (Standard Formula Value): Carc. | Non-Carc. | Criteria for Protection of Vapor Intrusion: MTCA Method C Groundwater Screening Level: Carc. | Non-Carc. | Criteria for Protection of Sediment: Sediment Cleanup Objective (SCO) Screening Level[4]: $C_{sed}$ | Units | Equilibrium Partition Coefficients[5] (L/kg): $K_{oc}$ (CLARC) | $K_d$ (metals) | Groundwater Concentration Protective of Sediment[6] | Groundwater to Sediment Pathway Complete[7] (Yes/No) | Proposed Groundwater Cleanup Level | Adjustment Factors: Background Concentration[8] | Practical Quantitation Limit9 (PQL) | Proposed Groundwater Cleanup Level[10] (After Adjustment for Background and PQL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | µg/L | 69 | 36 | 10 | 0.14 | 69 | 36 | 0.14 | 0.1 | 18 | -- | -- | 11 | mg/kg | -- | 29 | 3.7E+02 | Yes | 0.1 | 8 | 4.5 | 8 |
| Cadmium | µg/L | 42 | 9.3 | -- | -- | 33 | 7.9 | -- | -- | -- | -- | -- | 0.8 | mg/kg | -- | 6.7 | 1.1E+02 | No | 7.9 | 2 | 4.0 | 7.9 |
| Total Chromium[11] | µg/L | 1,100 | 50 | -- | -- | 1,100 | 50 | -- | -- | 490 | -- | -- | 260 | mg/kg | -- | 19 | 1.3E+04 | No | 50 | 10 | 10.0 | 50 |
| Copper | µg/L | 4.8 | 3.1 | -- | -- | 4.8 | 3.1 | -- | -- | 2,900 | -- | -- | 390 | mg/kg | -- | 22 | 1.7E+04 | Yes | 3.1 | 20 | 10.0 | 20 |
| Lead | µg/L | 210 | 8.1 | -- | -- | 210 | 8.1 | -- | -- | -- | -- | -- | 21 | mg/kg | -- | 10,000 | 2.1E+00 | Yes | 2.1 | 10 | 1.0 | 10 |
| Mercury[12] | µg/L | 1.8 | 0.025 | -- | -- | 1.8 | 0.94 | -- | -- | -- | -- | 1.9 | 0.2 | mg/kg | -- | 52 | 3.8E+00 | Yes | 0.025 | -- | 0.025 | 0.025 |
| Nickel | µg/L | 74 | 8.2 | 190 | 100 | 74 | 8.2 | 4,600 | -- | 1,100 | -- | -- | 92,000 | mg/kg | -- | 65 | 1.4E+06 | No | 8.2 | -- | 5.6 | 8.2 |
| Silver | µg/L | 1.9 | -- | -- | -- | 1.9 | -- | -- | -- | 26,000 | -- | -- | 6.1 | mg/kg | -- | 8 | 6.9E+02 | No | 1.9 | -- | 10.0 | 10 |
| Zinc | µg/L | 90 | 81 | 2,900 | 1,000 | 90 | 81 | 26,000 | -- | 17,000 | -- | -- | 410 | mg/kg | -- | 62 | 6.5E+03 | Yes | 81 | 160 | 25.0 | 160 |
| **Petroleum Hydrocarbons[13]** | | | | | | | | | | | | | | | | | | | | | | | |
| Gasoline-Range | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | 800 | -- | -- | -- | -- | -- | -- | -- | No | 800 | -- | 250 | 800 |
| Diesel-Range | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | 500 | -- | -- | -- | -- | -- | -- | -- | No | 500 | -- | 250 | 500 |
| Heavy Oil-Range | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | 500 | -- | -- | -- | -- | -- | -- | -- | No | 500 | -- | 500 | 500 |
| **BETX Compounds** | | | | | | | | | | | | | | | | | | | | | | | |
| Benzene | µg/L | -- | -- | 1.6 | -- | -- | -- | 16 | 23 | 2,000 | 24 | 230 | -- | -- | 62 | -- | -- | No | 1.6 | -- | 1.0 | 1.6 |
| Ethylbenzene | µg/L | -- | -- | 270 | 31 | -- | -- | 130 | -- | 6,900 | -- | 6,100 | -- | -- | 204 | -- | -- | No | 31 | -- | 1.0 | 31 |
| Toluene | µg/L | -- | -- | 410 | 130 | -- | -- | 520 | -- | 19,000 | -- | 34,000 | -- | -- | 140 | -- | -- | No | 130 | -- | 1.0 | 130 |
| Xylenes | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 630 | -- | -- | 311 | -- | -- | No | 630 | -- | 2.0 | 630 |
| **Volatile Organic Compounds (VOCs)** | | | | | | | | | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | 74 | -- | -- | -- | -- | -- | -- | No | 74 | -- | 1.0 | 74 |
| 1,1,1-Trichloroethane | µg/L | -- | -- | 160,000 | 50,000 | -- | -- | 200,000 | -- | 930,000 | -- | 12,000 | -- | -- | 135 | -- | -- | No | 12,000 | -- | 1.0 | 12,000 |
| 1,1,2,2-Tetrachloroethane | µg/L | -- | -- | 0.46 | 0.3 | -- | -- | 3 | 6.5 | 10,000 | 62 | -- | -- | -- | 79 | -- | -- | No | 0.3 | -- | 1.0 | 1 |
| 1,1,2-trichloro-1,2,2-trifluoroethane (CFC113) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2,400 | -- | -- | -- | -- | -- | No | 2,400 | -- | 1.0 | 2,400 |
| 1,1,2-Trichloroethane | µg/L | -- | -- | 1.8 | 0.9 | -- | -- | 8.9 | 25 | 2,300 | 79 | 10 | -- | -- | 75 | -- | -- | No | 0.9 | -- | 1.0 | 1.0 |
| 1,1-Dichloroethane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | 110 | -- | -- | -- | 53 | -- | -- | No | 110 | -- | 1.0 | 110 |
| 1,1-Dichloroethene | µg/L | -- | -- | 4,100 | 4,000 | -- | -- | 20,000 | -- | 23,000 | -- | 280 | -- | -- | 65 | -- | -- | No | 280 | -- | 1.0 | 280 |
| 1,1-Dichloropropene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.00 | NE |
| 1,2,3-Trichlorobenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.00 | NE |
| 1,2,3-Trichloropropane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 2.0 | NE |
| 1,2,4-Trichlorobenzene | µg/L | -- | -- | 0.14 | 0.04 | -- | -- | 0.076 | 2 | 230 | -- | 84 | -- | -- | 1659 | -- | -- | No | 0.04 | -- | 5.0 | 5.0 |
| 1,2,4-Trimethylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 61 | -- | -- | -- | -- | -- | No | 61 | -- | 1.0 | 61 |
| 1,2-Dibromo-3-chloropropane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| 1,2-Dibromoethane (EDB) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.7 | 590 | -- | -- | 66 | -- | -- | No | 2.7 | -- | 1.0 | 2.7 |
| 1,2-Dichlorobenzene | µg/L | -- | -- | 2,500 | 800 | -- | -- | 3,000 | -- | 4,200 | -- | 5,700 | -- | -- | 379 | -- | -- | No | 800 | -- | 1.0 | 800 |
| 1,2-Dichloroethane (EDC) | µg/L | -- | -- | 120 | 73 | -- | -- | 650 | 59 | 13,000 | 42 | 310 | -- | -- | 38 | -- | -- | No | 42 | -- | 1.0 | 42 |
| 1,2-Dichloropropane | µg/L | -- | -- | 3.1 | -- | -- | -- | 31 | 43 | 25,000 | 39 | 62 | -- | -- | 47 | -- | -- | No | 3.1 | -- | 1.0 | 3.1 |
| 1,3,5-Trimethylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| 1,3-Dichlorobenzene | µg/L | -- | -- | 16 | 2 | -- | -- | 10 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 2 | -- | 1.0 | 2 |
| 1,3-Dichloropropane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| 1,4-Dichlorobenzene | µg/L | -- | -- | 580 | 200 | -- | -- | 900 | 22 | 3,300 | 49 | 17,000 | -- | -- | 616 | -- | -- | No | 22 | -- | 1.0 | 22 |
| 2,2-Dichloropropane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.00 | NE |
| 2-Butanone (MEK) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3,800,000 | -- | -- | -- | -- | -- | No | 3,800,000 | -- | 5.0 | 3,800,000 |
| 2-Chloroethyl Vinyl Ether | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| 2-Chlorotoluene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |

| Analyte | Units | Criteria for Protection of Surface Water: Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Marine Aquatic Life: Acute | Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Marine Aquatic Life: Chronic | Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Human Health (Organisms Only) | Federal Marine Water Quality Criteria for Washington[2] (40 CFR 131.45): Protection of Human Health (Organisms Only) | Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Marine Aquatic Life: Acute | Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Marine Aquatic Life: Chronic | Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Human Health (Organisms Only) | MTCA Method B Surface Water Cleanup Level (Standard Formula Value): Carc. | MTCA Method B Surface Water Cleanup Level (Standard Formula Value): Non-Carc. | Criteria for Protection of Vapor Intrusion: MTCA Method C Groundwater Screening Level: Carc. | Criteria for Protection of Vapor Intrusion: MTCA Method C Groundwater Screening Level: Non-Carc. | Criteria for Protection of Sediment: Sediment Cleanup Objective (SCO) Screening Level[4]: $C_{sed}$ | Criteria for Protection of Sediment: Sediment Cleanup Objective (SCO) Screening Level[4]: Units | Criteria for Protection of Sediment: Equilibrium Partition Coefficients[5] (L/kg): $K_{oc}$ (CLARC) | Criteria for Protection of Sediment: Equilibrium Partition Coefficients[5] (L/kg): $K_d$ (metals) | Criteria for Protection of Sediment: Groundwater Concentration Protective of Sediment[6] | Groundwater to Sediment Pathway Complete[7] (Yes/No) | Proposed Groundwater Cleanup Level | Adjustment Factors: Background Concentration[8] | Adjustment Factors: Practical Quantitation Limit9 (PQL) | Proposed Groundwater Cleanup Level[10] (After Adjustment for Background and PQL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Hexanone | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| 4-Chlorotoluene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.00 | NE |
| 4-Methyl-2-Pentanone (Methyl Isobutyl Ketone) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1,000,000 | -- | -- | -- | -- | -- | -- | No | 1,000,000 | -- | 5.0 | 1,000,000 |
| Acetone | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 32,000,000 | -- | -- | 0.575 | -- | -- | -- | No | 32,000,000 | -- | 5.0 | 32,000,000 |
| Acrolein | µg/L | -- | -- | 1.1 | -- | -- | -- | 400 | -- | -- | -- | 6 | -- | -- | -- | -- | -- | -- | No | 1.1 | -- | 50 | 50 |
| Acrylonitrile | µg/L | -- | -- | 0.03 | -- | -- | -- | 7 | 0.4 | 3,500 | 160 | 850 | -- | -- | -- | -- | -- | -- | No | 0.03 | -- | 1.0 | 1.0 |
| Bromobenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 233.9 | -- | -- | -- | No | NE | -- | 1.00 | NE |
| Bromochloromethane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.00 | NE |
| Bromoform | µg/L | -- | -- | 27 | 12 | -- | -- | 120 | 220 | 14,000 | 2,000 | -- | -- | -- | 126 | -- | -- | -- | No | 12 | -- | 1.0 | 12 |
| Bromomethane | µg/L | -- | -- | 2,400 | -- | -- | -- | 10,000 | -- | 970 | -- | 28 | -- | -- | 9 | -- | -- | -- | No | 28 | -- | 1.0 | 28 |
| Carbon Disulfide | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 870 | -- | -- | 45.7 | -- | -- | -- | No | 870 | -- | 1.0 | 870 |
| Carbon Tetrachloride | µg/L | -- | -- | 0.35 | -- | -- | -- | 5 | 4.9 | 550 | 5.6 | 130 | -- | -- | 152 | -- | -- | -- | No | 0.35 | -- | 1.0 | 1.00 |
| Chlorobenzene | µg/L | -- | -- | 890 | 200 | -- | -- | 800 | -- | 5,000 | -- | 640 | -- | -- | 224 | -- | -- | -- | No | 200 | -- | 1.0 | 200 |
| Chloroethane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 40,400 | -- | -- | -- | -- | -- | -- | No | 40,400 | -- | 1.0 | 40,400 |
| Chloroform | µg/L | -- | -- | 1,200 | 600 | -- | -- | 2,000 | 56 | 6,900 | 12 | 1,100 | -- | -- | 53 | -- | -- | -- | No | 12 | -- | 1.0 | 12 |
| Chloromethane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 340 | -- | -- | 6 | -- | -- | -- | No | 340 | -- | 1.0 | 340 |
| Cis-1,2-Dichloroethene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 35.5 | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Cis-1,3-Dichloropropene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Dibromochloromethane | µg/L | -- | -- | 3 | 2.2 | -- | -- | 21 | 21 | 14,000 | 45 | -- | -- | -- | 63.1 | -- | -- | -- | No | 2.2 | -- | 1.0 | 2.2 |
| Dibromomethane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Dichlorobromomethane | µg/L | -- | -- | 3.6 | 2.8 | -- | -- | 27 | 28 | 14,000 | 18 | -- | -- | -- | 55 | -- | -- | -- | No | 2.8 | -- | 1.0 | 2.8 |
| Dichlorodifluoromethane (CFC 12) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 12 | -- | -- | -- | -- | -- | -- | No | 12 | -- | 1.0 | 12 |
| Hexachlorobutadiene | µg/L | -- | -- | 4.1 | 0.01 | -- | -- | 0.01 | 30 | 930 | 8 | -- | -- | -- | 53700 | -- | -- | -- | No | 0.01 | -- | 5.0 | 5.0 |
| Isopropylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1,600 | -- | -- | -- | -- | -- | -- | No | 1,600 | -- | 1.0 | 1,600 |
| Methyl Iodide | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Methyl t-Butyl Ether (MTBE) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6,100 | 190,000 | -- | -- | 10.9 | -- | -- | -- | No | 6,100 | -- | 5.0 | 6,100 |
| Methylene Chloride | µg/L | -- | -- | 250 | 100 | -- | -- | 1,000 | 3,600 | 17,000 | 44,000 | 11,000 | -- | -- | 10 | -- | -- | -- | No | 100 | -- | 2.0 | 100 |
| Naphthalene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | 4,900 | 89 | 360 | -- | -- | 1191 | -- | -- | -- | No | 89 | -- | 5.0 | 89 |
| n-Butylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| n-Propylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4,900 | -- | -- | -- | -- | -- | -- | No | 4,900 | -- | 1.0 | 4,900 |
| p-Isopropyltoluene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| sec-Butylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Styrene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 18,000 | -- | -- | 912 | -- | -- | -- | No | 18,000 | -- | 1.0 | 18,000 |
| tert-Butylbenzene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Tetrachloroethene (PCE) | µg/L | -- | -- | 7.1 | 2.9 | -- | -- | 29 | 100 | 500 | 240 | 100 | -- | -- | 265 | -- | -- | -- | No | 2.9 | -- | 0.2 | 2.9 |
| Trans-1,2-Dichloroethene | µg/L | -- | -- | 5,800 | 1,000 | -- | -- | 4,000 | -- | 33,000 | -- | 250 | -- | -- | 38 | -- | -- | -- | No | 250 | -- | 1.0 | 250 |
| Trans-1,3-Dichloropropene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Trans-1,4-Dichloro-2-butene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| Trichloroethene (TCE) | µg/L | -- | -- | 0.86 | 0.7 | -- | -- | 7 | 13 | 120 | 26 | 8 | -- | -- | 94 | -- | -- | -- | No | 0.7 | -- | 1.0 | 1.0 |
| Trichlorofluoromethane (CFC 11) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 260 | -- | -- | -- | -- | -- | -- | No | 260 | -- | 1.0 | 260 |
| Vinyl Acetate | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 17,000 | -- | -- | 5.25 | -- | -- | -- | No | 17,000 | -- | 5.0 | 17,000 |
| Vinyl Chloride | µg/L | -- | -- | 0.26 | 0.18 | -- | -- | 1.6 | 3.7 | 6,600 | 3 | 120 | -- | -- | 18.6 | -- | -- | -- | No | 0.18 | -- | 1.0 | 1.0 |
| **Semi-Volatile Organic Compounds (SVOCs)** | | | | | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | µg/L | -- | -- | 0.14 | 0.04 | -- | -- | 0.076 | 2.0 | 230 | -- | 84 | 0.031 | mg/kg | 1,659 | -- | 9.7E-01 | No | 0.04 | -- | 1.0 | 1.0 |
| 1,2-Dichlorobenzene | µg/L | -- | -- | 2,500 | 800 | -- | -- | 3,000 | -- | 4,200 | -- | 5,700 | 0.035 | mg/kg | 379 | -- | 4.5E+00 | No | 800 | -- | 1.0 | 800 |
| 1,3-Dichlorobenzene | µg/L | -- | -- | 16 | 2 | -- | -- | 10 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 2 | -- | 1.0 | 2 |
| 1,4-Dichlorobenzene | µg/L | -- | -- | 580 | 200 | -- | -- | 900 | 22 | 3,300 | 49 | 17,000 | 0.11 | mg/kg | 616 | -- | 8.9E+00 | No | 22 | -- | 1.0 | 22 |
| 2,2'-Oxybis[1-chloropropane] | µg/L | -- | -- | -- | 900 | -- | -- | 4,000 | 37 | 42,000 | -- | -- | -- | -- | -- | -- | -- | No | 37 | -- | 1.0 | 37 |
| 2,4,5-Trichlorophenol | µg/L | -- | -- | -- | -- | -- | -- | 600 | -- | -- | -- | -- | -- | -- | 1597 | -- | -- | No | 600 | -- | 5.0 | 600 |
| 2,4,6-Trichlorophenol | µg/L | -- | -- | 0.28 | -- | -- | -- | 2.8 | 3.9 | 17 | -- | -- | -- | -- | 381 | -- | -- | No | 0.3 | -- | 5.0 | 5.0 |

| Analyte | Units | Criteria for Protection of Surface Water: Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Marine Aquatic Life: Acute | Criteria for Protection of Surface Water: Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Marine Aquatic Life: Chronic | Criteria for Protection of Surface Water: Water Quality Criteria[1] (Chapter 173-210A WAC): Protection of Human Health (Organisms Only) | Criteria for Protection of Surface Water: Federal Marine Water Quality Criteria for Washington[2] (40 CFR 131.45): Protection of Human Health (Organisms Only) | Criteria for Protection of Surface Water: Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Marine Aquatic Life: Acute | Criteria for Protection of Surface Water: Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Marine Aquatic Life: Chronic | Criteria for Protection of Surface Water: Federal Water Quality Criteria[3] (CWA §304(a)): Protection of Human Health (Organisms Only) | Criteria for Protection of Surface Water: MTCA Method B Surface Water Cleanup Level (Standard Formula Value): Carc. | Criteria for Protection of Surface Water: MTCA Method B Surface Water Cleanup Level (Standard Formula Value): Non-Carc. | Criteria for Protection of Vapor Intrusion: MTCA Method C Groundwater Screening Level: Carc. | Criteria for Protection of Vapor Intrusion: MTCA Method C Groundwater Screening Level: Non-Carc. | Criteria for Protection of Sediment: Sediment Cleanup Objective (SCO) Screening Level[4]: $C_{sed}$ | Criteria for Protection of Sediment: Sediment Cleanup Objective (SCO) Screening Level[4]: Units | Criteria for Protection of Sediment: Equilibrium Partition Coefficients[5] (L/kg): $K_{oc}$ (CLARC) | Criteria for Protection of Sediment: Equilibrium Partition Coefficients[5] (L/kg): $K_d$ (metals) | Criteria for Protection of Sediment: Groundwater Concentration Protective of Sediment[6] | Groundwater to Sediment Pathway Complete[7] (Yes/No) | Proposed Groundwater Cleanup Level | Adjustment Factors: Background Concentration[8] | Adjustment Factors: Practical Quantitation Limit9 (PQL) | Proposed Groundwater Cleanup Level[10] (After Adjustment for Background and PQL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,4-Dichlorophenol | µg/L | -- | -- | 34 | 10 | -- | -- | 60 | -- | 190 | -- | -- | -- | -- | 147 | -- | -- | No | 10 | -- | 5.0 | 10 |
| 2,4-Dimethylphenol | µg/L | -- | -- | 97 | -- | -- | -- | 3,000 | -- | 550 | -- | -- | 0.029 | mg/kg | 209 | -- | 6.3E+00 | No | 97 | -- | 1.0 | 97 |
| 2,4-Dinitrophenol | µg/L | -- | -- | 610 | 100 | -- | -- | 300 | -- | 3,500 | -- | -- | -- | -- | 0.01 | -- | -- | No | 100 | -- | 10 | 100 |
| 2,4-Dinitrotoluene | µg/L | -- | -- | 0.18 | -- | -- | -- | 1.7 | 5.5 | 1,400 | -- | -- | -- | -- | 95.5 | -- | -- | No | 0.18 | -- | 5.0 | 5.0 |
| 2,6-Dinitrotoluene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 69.2 | -- | -- | No | NE | -- | 5.0 | NE |
| 2-Chloronaphthalene | µg/L | -- | -- | 180 | 100 | -- | -- | 1,000 | -- | 1,000 | -- | -- | -- | -- | -- | -- | -- | No | 100 | -- | 1.0 | 100 |
| 2-Chlorophenol | µg/L | -- | -- | 17 | -- | -- | -- | 800 | -- | 97 | -- | -- | -- | -- | 388 | -- | -- | No | 17 | -- | 1.0 | 17 |
| 2-Nitroaniline | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| 2-Nitrophenol | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| 3,3'-Dichlorobenzidine | µg/L | -- | -- | 0.0033 | -- | -- | -- | 0.15 | 0.046 | -- | -- | -- | -- | -- | 724 | -- | -- | No | 0.003 | -- | 5.0 | 5.0 |
| 3-Nitroaniline | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| 4,6-Dinitro-2-methylphenol | µg/L | -- | -- | 25 | 7 | -- | -- | 30 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 7 | -- | 10.0 | 10 |
| 4-Bromophenyl-phenylether | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| 4-Chloro-3-methylphenol | µg/L | -- | -- | 36 | -- | -- | -- | 2000 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 36 | -- | 5.0 | 36 |
| 4-Chloroaniline | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 66.1 | -- | -- | No | NE | -- | 5.0 | NE |
| 4-Chlorophenyl-phenylether | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| 4-Nitroaniline | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| 4-Nitrophenol | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.0 | NE |
| Benzoic acid | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.65 | mg/kg | 0.6 | -- | 1.1E+03 | No | NE | -- | 10.0 | NE |
| Benzyl alcohol | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.057 | mg/kg | -- | -- | -- | No | NE | -- | 5.0 | NE |
| bis(2-Chloroethoxy)methane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.0 | NE |
| bis(2-chloroethyl)ether | µg/L | -- | -- | 0.06 | -- | -- | -- | 2.2 | 0.85 | -- | 259 | -- | -- | -- | 76 | -- | -- | No | 0.06 | -- | 1.0 | 1.0 |
| bis(2-Ethylhexyl)phthalate | µg/L | -- | -- | 0.25 | 0.05 | -- | -- | 0.37 | 3.6 | 400 | -- | -- | 0.3 | mg/kg | 111,123 | -- | 1.4E-01 | No | 0.05 | -- | 1.0 | 1.0 |
| Butylbenzylphthalate | µg/L | -- | -- | 0.58 | 0.013 | -- | -- | 0.10 | 8.2 | 1,300 | -- | -- | 0.063 | mg/kg | 13,746 | -- | 2.4E-01 | No | 0.013 | -- | 1.0 | 1.0 |
| Carbazole | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3390 | -- | -- | No | NE | -- | 1.0 | NE |
| Dibenzofuran | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.54 | mg/kg | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Diethylphthalate | µg/L | -- | -- | 5,000 | 200 | -- | -- | 600 | -- | 28,000 | -- | -- | 0.2 | mg/kg | 82 | -- | 9.3E+01 | No | 200 | -- | 1.0 | 200 |
| Dimethylphthalate | µg/L | -- | -- | 130,000 | 600 | -- | -- | 2,000 | -- | -- | -- | -- | 0.071 | mg/kg | -- | -- | -- | No | 600 | -- | 1.0 | 600 |
| Di-n-butylphthalate | µg/L | -- | -- | 510 | 8 | -- | -- | 30 | -- | 2,900 | -- | -- | 1.4 | mg/kg | 1,567 | -- | 4.6E+01 | No | 8 | -- | 1.0 | 8 |
| Di-n-octylphthalate | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.2 | mg/kg | 83,200,000 | -- | 3.9E-03 | No | NE | -- | 1.0 | NE |
| Hexachlorobenzene | µg/L | -- | -- | 0.000052 | 0.000005 | -- | -- | 0.000079 | 0.0005 | 0.24 | -- | -- | 0.003 | mg/kg | 80,000 | -- | 1.7E-03 | No | 0.000005 | -- | 1.0 | 1.0 |
| Hexachlorobutadiene | µg/L | -- | -- | 4.1 | 0.01 | -- | -- | 0.01 | 30 | 930 | 8 | -- | 0.011 | mg/kg | 53,700 | -- | 1.1E-02 | No | 0.01 | -- | 1.0 | 1.0 |
| Hexachlorocyclopentadiene | µg/L | -- | -- | 630 | 1 | -- | -- | 4 | -- | 3,600 | -- | -- | -- | -- | 200000 | -- | -- | No | 1 | -- | 5.0 | 5.0 |
| Hexachloroethane | µg/L | -- | -- | 0.13 | 0.02 | -- | -- | 0.1 | 1.90 | 21 | 31 | 414 | -- | -- | 1780 | -- | -- | No | 0.02 | -- | 2.0 | 2.0 |
| Isophorone | µg/L | -- | -- | 110 | -- | -- | -- | 1,800 | 1,600 | 120,000 | -- | -- | -- | -- | 46.8 | -- | -- | No | 110 | -- | 1.0 | 110 |
| Nitrobenzene | µg/L | -- | -- | 320 | 100 | -- | -- | 600 | -- | 1,800 | 1,600 | 23,000 | -- | -- | 119 | -- | -- | No | 100 | -- | 1.0 | 100 |
| n-Nitroso-di-n-propylamine | µg/L | -- | -- | 0.058 | -- | -- | -- | 0.51 | 0.82 | -- | -- | -- | -- | -- | 24 | -- | -- | No | 0.06 | -- | 5.0 | 5.0 |
| n-Nitrosodiphenylamine | µg/L | -- | -- | 0.69 | -- | -- | -- | 6.0 | 9.7 | -- | -- | -- | 0.028 | mg/kg | 1,290 | -- | 1.1E+00 | No | 0.7 | -- | 1.0 | 1.0 |
| o-Cresol (2-Methylphenol) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.063 | mg/kg | 91.2 | -- | 2.7E+01 | No | NE | -- | 1.0 | NE |
| p-Cresol (4-Methylphenol) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.67 | mg/kg | -- | -- | -- | No | NE | -- | 1.0 | NE |
| Pentachlorophenol | µg/L | 13 | 7.9 | 0.1 | 0.002 | 13 | 8 | 0.04 | 2 | 1,200 | -- | -- | 1.0E-01 | mg/kg | 592 | -- | 8.4E+00 | No | 0.002 | -- | 5.0 | 5 |
| Phenol | µg/L | -- | -- | 200000 | 70000 | -- | -- | 300,000.0 | -- | 560,000 | -- | -- | 4.2E-01 | mg/kg | 28.8 | -- | 3.7E+02 | No | 70,000 | -- | 1.0 | 70,000 |
| **Non-Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.01 | NE |
| 2-Methylnaphthalene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.67 | mg/kg | -- | -- | -- | Yes | NE | -- | 0.01 | NE |
| Acenaphthene | µg/L | -- | -- | 110 | 30 | -- | -- | 90 | -- | 640 | -- | -- | 0.5 | mg/kg | 4,898 | -- | 5.3E+00 | Yes | 5.3 | -- | 0.01 | 5.3 |
| Acenaphthylene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.3 | mg/kg | -- | -- | -- | Yes | NE | -- | 0.01 | NE |
| Anthracene | µg/L | -- | -- | 4,600 | 100 | -- | -- | 400 | -- | 26,000 | -- | -- | 0.96 | mg/kg | 23,493 | -- | 2.1E+00 | Yes | 2.1 | -- | 0.01 | 2.1 |
| Benzo[g,h,i]perylene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.67 | mg/kg | -- | -- | -- | Yes | NE | -- | 0.01 | NE |
| Fluoranthene | µg/L | -- | -- | 16 | 6 | -- | -- | 20 | -- | 90 | -- | -- | 2.1 | mg/kg | 49,096 | -- | 2.2E+00 | Yes | 2.2 | -- | 0.01 | 2.2 |
| Fluorene | µg/L | -- | -- | 610 | 10 | -- | -- | 70 | -- | 3,500 | -- | -- | 0.54 | mg/kg | 7,707 | -- | 3.7E+00 | Yes | 3.7 | -- | 0.01 | 3.7 |

| $k_{oc}$ = Soil organic carbon-water partitioning | Units | Criteria for Protection of Surface Water | | | | | | | | | Criteria for Protection of Vapor Intrusion | | Criteria for Protection of Sediment | | | | | | | Groundwater to Sediment Pathway Complete[7] (Yes/No) | Proposed Groundwater Cleanup Level | Adjustment Factors | | Proposed Groundwater Cleanup Level[10] (After Adjustment for Background and PQL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Water Quality Criteria[1] (Chapter 173-210A WAC) | | | Federal Marine Water Quality Criteria for Washington[2] (40 CFR 131.45) | Federal Water Quality Criteria[3] (CWA §304(a)) | | | MTCA Method B Surface Water Cleanup Level (Standard Formula Value) | | MTCA Method C Groundwater Screening Level | | Sediment Cleanup Objective (SCO) Screening Level[4] | | Equilibrium Partition Coefficients[5] (L/kg) | | Groundwater Concentration Protective of Sediment[6] | | | | | |
| | | Protection of Marine Aquatic Life | | Protection of Human Health (Organisms Only) | Protection of Human Health (Organisms Only) | Protection of Marine Aquatic Life | | Protection of Human Health (Organisms Only) | | | | | | | $K_{oc}$ (CLARC) | $K_d$ (metals) | | | | Background Concentration[8] | Practical Quantitation Limit9 (PQL) | |
| | | Acute | Chronic | | | Acute | Chronic | | Carc. | Non-Carc. | Carc. | Non-Carc. | $C_{sed}$ | Units | | | | | | | | |
| Naphthalene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | 4,900 | 89 | 360 | 2.1 | mg/kg | 1,191 | -- | 9.0E+01 | Yes | 89 | -- | 0.01 | 89 |
| Phenanthrene | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.5 | mg/kg | -- | -- | -- | Yes | NE | -- | 0.01 | NE |
| Pyrene | µg/L | -- | -- | 460 | 8 | -- | -- | 30 | -- | 2,600 | -- | -- | 2.6 | mg/kg | 67,992 | -- | 2.0E+00 | Yes | 2 | -- | 0.01 | 2 |
| **Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)** | | | | | | | | | | | | | | | | | | | | | | |
| Benzo[a]anthracene | µg/L | -- | -- | 0.021 | 0.00016 | -- | -- | 0.0013 | -- | -- | -- | -- | 1.3 | mg/kg | 357,537 | -- | 1.9E-01 | Yes | 0.00016 | -- | 0.01 | 0.01 |
| Benzo[a]pyrene | µg/L | -- | -- | 0.0021 | 0.000016 | -- | -- | 0.00013 | 0.04 | 26 | -- | -- | 1.2 | mg/kg | 968,774 | -- | 6.5E-02 | Yes | 0.000016 | -- | 0.01 | 0.01 |
| Benzo[b]fluoranthene | µg/L | -- | -- | 0.021 | 0.00016 | -- | -- | 0.0013 | -- | -- | -- | -- | 3.2 | mg/kg | 1,230,000 | -- | 1.4E-01 | Yes | 0.00016 | -- | 0.01 | 0.01 |
| Benzo[k]fluoranthene | µg/L | -- | -- | 0.21 | 0.0016 | -- | -- | 0.013 | -- | -- | -- | -- | 3.2 | mg/kg | 1,230,000 | -- | 1.4E-01 | Yes | 0.0016 | -- | 0.01 | 0.01 |
| Chrysene | µg/L | -- | -- | 2.1 | 0.016 | -- | -- | 0.13 | -- | -- | -- | -- | 1.4 | mg/kg | 398,000 | -- | 1.9E-01 | Yes | 0.016 | -- | 0.01 | 0.016 |
| Dibenz[a,h]anthracene | µg/L | -- | -- | 0.0021 | 0.000016 | -- | -- | 0.00013 | -- | -- | -- | -- | 0.012 | mg/kg | 1,789,101 | -- | 3.5E-04 | Yes | 0.000016 | -- | 0.01 | 0.01 |
| Indeno[1,2,3-c,d]pyrene | µg/L | -- | -- | 0.021 | 0.00016 | -- | -- | 0.0013 | -- | -- | -- | -- | 0.034 | mg/kg | 3,470,000 | -- | 5.2E-04 | Yes | 0.00016 | -- | 0.01 | 0.01 |
| cPAHs TEQ (ND = 0.5RL) | µg/L | -- | -- | 0.0021 | 0.000016 | -- | -- | 0.00013 | 0.04 | 26 | -- | -- | 0.021 | mg/kg | 968,774 | -- | 1.1E-03 | Yes | 0.000016 | -- | 0.01 | 0.01 |
| **Pesticides and Herbicides** | | | | | | | | | | | | | | | | | | | | | | |
| 4,4'-DDD | µg/L | -- | -- | 0.000036 | 0.0000079 | -- | -- | 0.00012 | 0.0005 | 0.0015 | -- | -- | -- | -- | 45,800 | -- | -- | No | 0.0000079 | -- | 0.10 | 0.1 |
| 4,4'-DDE | µg/L | -- | -- | 0.000051 | 0.00000088 | -- | -- | 0.000018 | 0.00036 | 0.015 | -- | -- | -- | -- | 86,405 | -- | -- | No | 0.00000088 | -- | 0.10 | 0.1 |
| 4,4'-DDT | µg/L | 0.13 | 0.001 | 0.000025 | 0.0000012 | 0.13 | 0.001 | 0.00003 | 0.00036 | 0.024 | -- | -- | -- | -- | 677,934 | -- | -- | No | 0.0000012 | -- | 0.10 | 0.1 |
| Aldrin | µg/L | 0.71 | 0.0019 | 0.0000058 | 0.000000041 | 1.3 | -- | 0.00000077 | 0.000082 | 0.017 | 3 | -- | -- | -- | 48,685 | -- | -- | No | 0.000000041 | -- | 0.05 | 0.05 |
| Alpha-BHC | µg/L | -- | -- | 0.00056 | 0.000048 | -- | -- | 0.00039 | 0.0079 | 160 | -- | -- | -- | -- | 1,762 | -- | -- | No | 0.000048 | -- | 0.05 | 0.05 |
| Alpha-Chlordane (cis) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.05 | NE |
| Beta-BHC | µg/L | -- | -- | 0.002 | 0.0014 | -- | -- | 0.014 | 0.028 | -- | -- | -- | -- | -- | 2,139 | -- | -- | No | 0.0014 | -- | 0.05 | 0.05 |
| Delta-BHC | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.05 | NE |
| Dieldrin | µg/L | 0.71 | 0.0019 | 0.0000061 | 0.00000007 | 0.71 | 0.0019 | 0.0000012 | 0.000087 | 0.028 | -- | -- | -- | -- | 25,546 | -- | -- | No | 0.00000007 | -- | 0.10 | 0.1 |
| Endosulfan I | µg/L | -- | -- | 10 | 7 | 0.034 | 0.0087 | 30 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 0.0087 | -- | 0.05 | 0.05 |
| Endosulfan II | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.10 | NE |
| Endosulfan Sulfate | µg/L | -- | -- | 10 | -- | -- | -- | 40 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 10 | -- | 0.10 | 10 |
| Endrin | µg/L | 0.037 | 0.0023 | 0.035 | 0.002 | 0.037 | 0.0023 | 0.03 | -- | 0.20 | -- | -- | -- | -- | 10,811 | -- | -- | No | 0.002 | -- | 0.10 | 0.1 |
| Endrin Aldehyde | µg/L | -- | -- | 0.035 | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 0.035 | -- | 0.10 | 0.1 |
| Endrin Ketone | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.10 | NE |
| Gamma-Chlordane | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.05 | NE |
| Heptachlor | µg/L | 0.053 | 0.0036 | 0.00001 | 0.00000034 | 0.053 | 0.0036 | 0.0000059 | 0.00013 | 0.12 | -- | -- | -- | -- | 9,528 | -- | -- | No | 0.00000034 | -- | 0.05 | 0.05 |
| Heptachlor Epoxide | µg/L | -- | -- | 0.0000074 | 0.0000024 | 0.053 | 0.0036 | 0.000032 | 0.000064 | 0.0030 | -- | -- | -- | -- | 83,200 | -- | -- | No | 0.0000024 | -- | 0.05 | 0.05 |
| Lindane (Gamma-BHC) | µg/L | 0.16 | -- | 17 | 0.43 | 0.16 | -- | 4.4 | 0.045 | 6.0 | -- | -- | -- | -- | 1,352 | -- | -- | No | 0.045 | -- | 0.05 | 0.05 |
| **Herbicides** | | | | | | | | | | | | | | | | | | | | | | |
| 2,4,5-T | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.25 | NE |
| 2,4-D | µg/L | -- | -- | -- | -- | -- | -- | 12,000 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 12,000 | -- | 1.00 | 12,000 |
| 2,4-DB | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 5.00 | NE |
| Dalapon (DPA) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.00 | NE |
| Dicamba | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.50 | NE |
| Dichlorprop | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 1.00 | NE |
| Dinoseb | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 0.25 | NE |
| MCPA | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 250 | NE |
| Mecoprop (MCPP) | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | -- | 250 | NE |
| Silvex (Fenoprop or 2,4,5-TP) | µg/L | -- | -- | -- | -- | -- | -- | 400 | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | 400 | -- | 0.25 | 400 |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | | | | | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | µg/L | 10 | 0.03 | 0.00017 | 0.000007 | -- | 0.03 | 0.000064 | 0.00010 | -- | -- | -- | 0.0035 | mg/kg | 309,000 | -- | 6.0E-04 | Yes | 0.000007 | -- | 0.01 | 0.01 |
| **Dioxins and Furans** | | | | | | | | | | | | | | | | | | | | | | |
| Total Dioxins/Furans - Human Health TEQ | pg/L | -- | -- | 0.064 | 0.014 | -- | -- | 0.0051 | 0.010 | 0.36 | -- | -- | 5 | ng/kg | -- | -- | -- | Yes | 0.0051 | -- | 5 | 5 |

**Notes:**

[1] Water quality criteria for protection of aquatic life from WAC 173-201A-240 (Water Quality Standards for Surface Waters of the State of Washington).

[2] EPA's Final Revision of Federal Human Health Criteria Applicable to Washington from 40 CFR 131.45; effective date of December 28, 2016.

[3] National Recommended Water Quality Criteria (http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm; accessed February 2019).

[4] Proposed sediment cleanup objective (SCO) values are the lowest sediment risk-based concentration protective of benthic organisms, human health and higher trophic level receptors adjusted for natural background, if available, and PQL (see Tables 1 and 2).

[5] Values for $K_{oc}$ and $K_d$ are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2019.

[6] Proposed groundwater cleanup levels protective of sediment were calculated for analytes that were detected in sediment at concentrations greater than their respective proposed SCOs. See text for equation and assumptions used.

[7] Groundwater to sediment pathway is not complete if analyte was not detected in sediment at a concentration greater that its corresponding proposed sediment cleanup level (Tables 1 and 2). Groundwater to Sediment pathway evaluation is presented in Tables 8 and 9.

[8] PTI, 1989. Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State.

[9] PQL is from the Remedial Investigation/Feasibility Study Work Plan (GeoEngineers 2008) and is the lowest available value from Analytical Resources Inc. (ARI) of Tukwila, Washington.

[10] Screening level is based on lowest of Federal and State marine surface water concentrations protective of aquatic life and human health from consumption of aquatic life including MTCA Method B standard formula values for carcinogens and non-carcinogen, and adjusted for background and the practical quantification limit (PQL) for all analytes with available surface water criteria.

[11] State Surface Water Quality Criteria, National Toxic Rule and Clean Water Act values are based on hexavalent chromium; trivalent chromium values are not available. MTCA Method B Surface Water Cleanup Levels are based on trivalent chromium.

[12] Clean Water Act [CWA 304(a)] for Protection of Human Health value for mercury is based on methylmercury.

[12] MTCA Method A groundwater cleanup level. Value for gasoline-range petroleum hydrocarbons if benzene is present. If benzene is not present, screening level is 1,000 µg/L.

$C_{sed}$ = Sediment cleanup level

$C_w$ = Groundwater/Surface water screening level

$f_{oc}$ = Sediment fraction of organic carbon

$k_d$ = Distribution coefficient

$k_{oc}$ = Soil organic carbon-water partitioning coefficient

θw = Water-filled porosity

pb = Dry sediment bulk density

MTCA = Model Toxics Control Act

µg/L = Microgram per liter

mg/kg = Milligrams per kilogram

ng/L = Nanogram per liter

NE = Not established

ND = Non-detect

RL = Reporting limit

TEQ = Toxic equivalent concentration

-- = No screening criteria available.

Blue shading identifies the basis for proposed groundwater cleanup level.

Green shading identifies the proposed groundwater cleanup level after adjustment for background and the PQL.

# Table 4

## Proposed Soil Cleanup Levels

Dakota Creek Industries

Anacortes, Washington

| Analyte | Units | Protection of Human Health and the Environment[1] (MTCA Method A Standard Table Value for Industrial Land Use) | Human Health Direct Contact Pathway (MTCA Method C Standard Formula Value for Industrial Land Use) | | Equilibrium Partition Coefficients[2] (L/kg) | | | Soil to Groundwater Protection Using Groundwater Proposed Screening Level (Table 3) per WAC 173-340-740(1)(d) EQ. 747-1/747-2 | | Soil to Groundwater Pathway Complete[3] (Yes/No) | Proposed Screening Level | | Adjustment Factors | | Proposed Soil Cleanup Level[6] (After adjustment for background and PQL) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Carcinogen | Non-Carcinogen | $K_{oc}$ (CLARC) | $K_d$ (metals) | H (Unitless) | Vadose Zone | Saturated Zone | | Vadose Zone | Saturated Zone | Background Concentration[4] | PQL[5] | Vadose Zone | Saturated Zone |
| **Metals** | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | -- | 88 | 1,100 | -- | 2.9E+01 | 0.0E+00 | 0.057 | 0.0029 | Yes | 0.057 | 0.0029 | 20[7] | 5 | 20 | 20 |
| Cadmium | mg/kg | -- | -- | 3,500 | -- | -- | 0.0E+00 | -- | -- | No | 3,500 | 3,500.000 | 1 | 0.2 | 3,500 | 3,500 |
| Total Chromium[8] | mg/kg | -- | -- | 5,300,000 | -- | 1.0E+03 | 0.0E+00 | 1,000 | 50 | No | 5,300,000 | 5,300,000 | 48 | 0.5 | 5,300,000 | 5,300,000 |
| Copper | mg/kg | -- | -- | 140,000 | -- | 2.2E+01 | 0.0E+00 | 1.4 | 0.069 | No | 140,000 | 140,000 | 36 | 0.2 | 140,000 | 140,000 |
| Lead | mg/kg | 1,000 | -- | -- | -- | 1.0E+04 | 0.0E+00 | 420 | 21 | No | 1,000 | 1,000 | 24 | 2 | 1,000 | 1,000 |
| Mercury | mg/kg | -- | -- | 1,100[9] | -- | 5.2E+01 | 4.7E-01 | 0.026 | 0.0013 | No | 1,100 | 1,100 | 0.07 | 0.05 | 1,100 | 1,100 |
| Nickel | mg/kg | -- | -- | 70,000 | -- | 6.5E+01 | 0.0E+00 | 11 | 0.53 | Yes | 11 | 0.53 | 48 | 1 | 48 | 48 |
| Silver | mg/kg | -- | -- | 18,000 | -- | 8.3E+00 | 0.0E+00 | 0.32 | 0.016 | No | 18,000 | 18,000 | -- | 0.3 | 18,000 | 18,000 |
| Zinc | mg/kg | -- | -- | 1,100,000 | -- | 6.2E+01 | 0.0E+00 | 101 | 5.0 | No | 1,100,000 | 1,100,000 | 85 | 1 | 1,100,000 | 1,100,000 |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | | | |
| Gasoline-Range | mg/kg | 100[10] | -- | -- | -- | -- | -- | -- | -- | No | 100 | 100 | -- | 5 | 100 | 100 |
| Diesel-Range | mg/kg | 2,000 | -- | -- | -- | -- | -- | -- | -- | No | 2,000 | 2,000 | -- | 5 | 2,000 | 2,000 |
| Heavy Oil-Range | mg/kg | 2,000 | -- | -- | -- | -- | -- | -- | -- | No | 2,000 | 2,000 | -- | 10 | 2,000 | 2,000 |
| **BETX Compounds** | | | | | | | | | | | | | | | | |
| Benzene | mg/kg | -- | 2,400 | 14,000 | 6.2E+01 | -- | 1.3E-01 | 2.0 | 0.10 | No | 2,400 | 2,400 | -- | 0.001 | 2,400 | 2,400 |
| Ethylbenzene | mg/kg | -- | -- | 350,000 | 2.0E+02 | -- | 1.6E-01 | 127 | 6 | No | 350,000 | 350,000 | -- | 0.001 | 350,000 | 350,000 |
| Toluene | mg/kg | -- | -- | 280,000 | 1.4E+02 | -- | 1.5E-01 | 365 | 18 | No | 280,000 | 280,000 | -- | 0.001 | 280,000 | 280,000 |
| Xylenes | mg/kg | -- | -- | 700,000 | 2.3E+02 | -- | 1.4E-01 | 2,938 | 147 | No | 700,000 | 700,000 | -- | 0.001 | 700,000 | 700,000 |
| **Volatile Organic Compounds (VOCs)** | | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | mg/kg | -- | 5,000 | 110,000 | -- | -- | 4.6E-02 | -- | -- | No | 5,000 | 5,000 | -- | 0.001 | 5,000 | 5,000 |
| 1,1,1-Trichloroethane | mg/kg | -- | -- | 7,000,000 | 1.4E+02 | -- | 4.2E-01 | 32,457 | 1,623 | No | 7,000,000 | 7,000,000 | -- | 0.001 | 7,000,000 | 7,000,000 |
| 1,1,2,2-Tetrachloroethane | mg/kg | -- | 660 | 70,000 | 7.9E+01 | -- | 7.0E-03 | 0.48 | 0.024 | No | 660 | 660 | -- | 0.002 | 660 | 660 |
| 1,1,2-trichloro-1,2,2-trifluoroethane (CFC113) | mg/kg | -- | -- | 110,000,000 | -- | -- | 1.3E+01 | -- | -- | No | 110,000,000 | 110,000,000 | -- | 0.002 | 110,000,000 | 110,000,000 |
| 1,1,2-Trichloroethane | mg/kg | -- | 2,300 | 14,000 | 7.5E+01 | -- | 2.0E-02 | 1.4 | 0.068 | No | 2,300 | 2,300 | -- | 0.001 | 2,300 | 2,300 |
| 1,1-Dichloroethane | mg/kg | -- | 23,000 | 700,000 | 5.3E+01 | -- | 1.4E-01 | 117 | 5.9 | No | 23,000 | 23,000 | -- | 0.001 | 23,000 | 23,000 |
| 1,1-Dichloroethene | mg/kg | -- | -- | 180,000 | 6.5E+01 | -- | 7.1E-01 | 365 | 18 | No | 180,000 | 180,000 | -- | 0.001 | 180,000 | 180,000 |
| 1,1-Dichloropropene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| 1,2,3-Trichlorobenzene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| 1,2,3-Trichloropropane | mg/kg | -- | 4.4 | 14,000 | -- | -- | 7.9E-03 | -- | -- | No | 4.4 | 4.4 | -- | 0.002 | 4.4 | 4.4 |
| 1,2,4-Trichlorobenzene | mg/kg | -- | 4,500 | 35,000 | 1.7E+03 | -- | 2.4E-02 | 1.2 | 0.061 | No | 4,500 | 4,500 | -- | 0.005 | 4,500 | 4,500 |
| 1,2,4-Trimethylbenzene | mg/kg | -- | -- | 35,000 | -- | -- | 1.1E-01 | -- | -- | No | 35,000 | 35,000 | -- | 0.001 | 35,000 | 35,000 |
| 1,2-Dibromo-3-chloropropane | mg/kg | -- | 160 | 700 | -- | -- | -- | -- | -- | No | 160 | 160 | -- | 0.005 | 160 | 160 |
| 1,2-Dibromoethane (EDB) | mg/kg | -- | 66 | 32,000 | 6.6E+01 | -- | 1.5E-02 | 3.6 | 0.18 | No | 66 | 66 | -- | 0.001 | 66 | 66 |
| 1,2-Dichlorobenzene | mg/kg | -- | -- | 320,000 | 3.8E+02 | -- | 3.5E-02 | 6,067 | 303 | No | 320,000 | 320,000 | -- | 0.001 | 320,000 | 320,000 |
| 1,2-Dichloroethane (EDC) | mg/kg | -- | 1,400 | 21,000 | 3.8E+01 | -- | 2.3E-02 | 32 | 1.6 | No | 1,400 | 1,400 | -- | 0.001 | 1,400 | 1,400 |
| 1,2-Dichloropropane | mg/kg | -- | 3,500 | 140,000 | 4.7E+01 | -- | 6.5E-02 | 2.9 | 0.15 | No | 3,500 | 3,500 | -- | 0.001 | 3,500 | 3,500 |
| 1,3,5-Trimethylbenzene | mg/kg | -- | -- | 35,000 | -- | -- | 1.1E-01 | -- | -- | No | 35,000 | 35,000 | -- | 0.001 | 35,000 | 35,000 |

| Analyte | Units | Protection of Human Health and the Environment[1] (MTCA Method A Standard Table Value for Industrial Land Use) | Human Health Direct Contact Pathway (MTCA Method C Standard Formula Value for Industrial Land Use) | | Equilibrium Partition Coefficients[2] (L/kg) | | | Soil to Groundwater Protection Using Groundwater Proposed Screening Level (Table 3) per WAC 173-340-740(1)(d) EQ. 747-1/747-2 | | Soil to Groundwater Pathway Complete[3] (Yes/No) | Proposed Screening Level | | Adjustment Factors | | Proposed Soil Cleanup Level[6] (After adjustment for background and PQL) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Carcinogen | Non-Carcinogen | $K_{oc}$ (CLARC) | $K_d$ (metals) | H (Unitless) | Vadose Zone | Saturated Zone | | Vadose Zone | Saturated Zone | Background Concentration[4] | PQL[5] | Vadose Zone | Saturated Zone |
| 1,3-Dichlorobenzene | mg/kg | -- | -- | -- | -- | -- | 6.0E-02 | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| 1,3-Dichloropropane | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| 1,4-Dichlorobenzene | mg/kg | -- | 24,000 | 250,000 | 6.2E+02 | -- | 4.6E-02 | 46,831,504 | 2,341,575 | No | 24,000 | 24,000 | -- | 0.067 | 24,000 | 24,000 |
| 2,2-Dichloropropane | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| 2-Butanone (MEK) | mg/kg | -- | -- | 2,100,000 | -- | -- | 1.3E-03 | -- | -- | No | 2,100,000 | 2,100,000 | -- | 0.005 | 2,100,000 | 2,100,000 |
| 2-Chloroethyl Vinyl Ether | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| 2-Chlorotoluene | mg/kg | -- | -- | 70,000 | -- | -- | -- | -- | -- | No | 70,000 | 70,000 | -- | 0.001 | 70,000 | 70,000 |
| 2-Hexanone | mg/kg | -- | -- | 18,000 | -- | -- | -- | -- | -- | No | 18,000 | 18,000 | -- | 0.001 | 18,000 | 18,000 |
| 4-Chlorotoluene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| 4-Methyl-2-Pentanone (Methyl Isobutyl Ketone) | mg/kg | -- | -- | 280,000 | -- | -- | 2.9E-03 | -- | -- | No | 280,000 | 280,000 | -- | 0.005 | 280,000 | 280,000 |
| Acetone | mg/kg | -- | -- | 3,200,000 | 5.8E-01 | -- | 9.7E-04 | 496,054 | 24,803 | No | 3,200,000 | 3,200,000 | -- | 0.005 | 3,200,000 | 3,200,000 |
| Acrolein | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.05 | NE | NE |
| Acrylonitrile | mg/kg | -- | 240 | 140,000 | -- | -- | 2.3E-03 | -- | -- | No | 240 | 240 | -- | 0.005 | 240 | 240 |
| Bromobenzene | mg/kg | -- | -- | 2.80E+04 | 2.3E+02 | -- | 4.3E-02 | -- | -- | No | 28,000 | 28,000 | -- | 0.001 | 28,000 | 28,000 |
| Bromochloromethane | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| Bromoform | mg/kg | -- | 17,000 | 70,000 | 1.3E+02 | -- | 1.2E-02 | 30 | 1.5 | No | 17,000 | 17,000 | -- | 0.001 | 17,000 | 17,000 |
| Bromomethane | mg/kg | -- | -- | 4,900 | 9.0E+00 | -- | 1.8E-01 | 5.2 | 0.26 | No | 4,900 | 4,900 | -- | 0.001 | 4,900 | 4,900 |
| Carbon Disulfide | mg/kg | -- | -- | 350,000 | 4.6E+01 | -- | 8.0E-01 | 800 | 40 | No | 350,000 | 350,000 | -- | 0.001 | 350,000 | 350,000 |
| Carbon Tetrachloride | mg/kg | -- | 1,900 | 14,000 | 1.5E+02 | -- | 7.4E-01 | 1.1 | 0.053 | No | 1,900 | 1,900 | -- | 0.001 | 1,900 | 1,900 |
| Chlorobenzene | mg/kg | -- | -- | 70,000 | 2.2E+02 | -- | 7.9E-02 | 897 | 45 | No | 70,000 | 70,000 | -- | 0.001 | 70,000 | 70,000 |
| Chloroethane | mg/kg | -- | -- | -- | -- | -- | 2.5E-01 | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| Chloroform | mg/kg | -- | 4,200 | 35,000 | 5.3E+01 | -- | 9.2E-02 | 13 | 0.63 | No | 4,200 | 4,200 | -- | 0.001 | 4,200 | 4,200 |
| Chloromethane | mg/kg | -- | -- | -- | 6.0E+00 | -- | 2.7E-01 | 42 | 2.1 | No | NE | NE | -- | 0.001 | NE | NE |
| Cis-1,2-Dichloroethene | mg/kg | -- | -- | 7,000 | 3.6E+01 | -- | 1.0E-01 | -- | -- | No | 7,000 | 7,000 | -- | 0.001 | 7,000 | 7,000 |
| Cis-1,3-Dichloropropene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| Dibromochloromethane | mg/kg | -- | 1,600 | 70,000 | 6.3E+01 | -- | 2.1E-02 | 2.8 | 0.14 | No | 1,600 | 1,600 | -- | 0.001 | 1,600 | 1,600 |
| Dibromomethane | mg/kg | -- | -- | 35,000 | -- | -- | 2.0E-02 | -- | -- | No | 35,000 | 35,000 | -- | 0.001 | 35,000 | 35,000 |
| Dichlorobromomethane | mg/kg | -- | 2,100 | 70,000 | 5.5E+01 | -- | 3.7E-02 | 3.1 | 0.15 | No | 2,100 | 2,100 | -- | 0.001 | 2,100 | 2,100 |
| Dichlorodifluoromethane (CFC 12) | mg/kg | -- | -- | 700,000 | -- | -- | 8.1E+00 | -- | -- | No | 700,000 | 700,000 | -- | 0.001 | 700,000 | 700,000 |
| Hexachlorobutadiene | mg/kg | -- | 1,700 | 3,500 | 5.4E+04 | -- | 1.4E-01 | 11 | 0.54 | No | 1,700 | 1,700 | -- | 0.005 | 1,700 | 1,700 |
| Isopropylbenzene | mg/kg | -- | -- | 350,000 | -- | -- | 2.6E-01 | -- | -- | No | 350,000 | 350,000 | -- | 0.001 | 350,000 | 350,000 |
| Methyl Iodide | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| Methyl t-Butyl Ether (MTBE) | mg/kg | -- | 73,000 | -- | 1.1E+01 | -- | 1.6E-02 | 1,354 | 68 | No | 73,000 | 73,000 | -- | 0.001 | 73,000 | 73,000 |
| Methylene Chloride | mg/kg | -- | 66,000 | 21,000 | 1.0E+01 | -- | 5.7E-02 | 20 | 1.020 | No | 21,000 | 21,000 | -- | 0.002 | 21,000 | 21,000 |
| Naphthalene | mg/kg | -- | -- | 70,000 | 1.2E+03 | -- | 8.2E-03 | 2,125 | 106 | No | 70,000 | 70,000 | -- | 0.005 | 70,000 | 70,000 |
| n-Butylbenzene | mg/kg | -- | -- | 180,000 | -- | -- | 2.4E-01 | -- | -- | No | 180,000 | 180,000 | -- | 0.001 | 180,000 | 180,000 |
| n-Propylbenzene | mg/kg | -- | -- | 350,000 | -- | -- | 2.0E-01 | -- | -- | No | 350,000 | 350,000 | -- | 0.001 | 350,000 | 350,000 |
| p-Isopropyltoluene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| sec-Butylbenzene | mg/kg | -- | -- | 350,000 | -- | -- | 2.6E-01 | -- | -- | No | 350,000 | 350,000 | -- | 0.001 | 350,000 | 350,000 |
| Styrene | mg/kg | -- | -- | 700,000 | 9.1E+02 | -- | 5.6E-02 | 328,394 | 16,420 | No | 700,000 | 700,000 | -- | 0.001 | 700,000 | 700,000 |
| tert-Butylbenzene | mg/kg | -- | -- | 350,000 | -- | -- | 2.6E-01 | -- | -- | No | 350,000 | 350,000 | -- | 0.001 | 350,000 | 350,000 |
| Tetrachloroethene (PCE) | mg/kg | -- | 63,000 | 21,000 | 2.7E+02 | -- | 4.0E-01 | 15 | 0.77 | No | 21,000 | 21,000 | -- | 0.001 | 21,000 | 21,000 |

| Analyte | Units | Protection of Human Health and the Environment[1] (MTCA Method A Standard Table Value for Industrial Land Use) | Human Health Direct Contact Pathway (MTCA Method C Standard Formula Value for Industrial Land Use) | | Equilibrium Partition Coefficients[2] (L/kg) | | | Soil to Groundwater Protection Using Groundwater Proposed Screening Level (Table 3) per WAC 173-340-740(1)(d) EQ. 747-1/747-2 | | Soil to Groundwater Pathway Complete[3] (Yes/No) | Proposed Screening Level | | Adjustment Factors | | Proposed Soil Cleanup Level[6] (After adjustment for background and PQL) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Carcinogen | Non-Carcinogen | $K_{oc}$ (CLARC) | $K_d$ (metals) | H (Unitless) | Vadose Zone | Saturated Zone | | Vadose Zone | Saturated Zone | Background Concentration[4] | PQL[5] | Vadose Zone | Saturated Zone |
| Trans-1,2-Dichloroethene | mg/kg | -- | -- | 70,000 | 3.8E+01 | -- | 2.4E-01 | 191 | 9.6 | No | 70,000 | 70,000 | -- | 0.001 | 70,000 | 70,000 |
| Trans-1,3-Dichloropropene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.001 | NE | NE |
| Trans-1,4-Dichloro-2-butene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| Trichloroethene (TCE) | mg/kg | -- | 2,800 | 1,800 | 9.4E+01 | -- | 2.4E-01 | 1.3 | 0.066 | No | 1,800 | 1,800 | -- | 0.001 | 1,800 | 1,800 |
| Trichlorofluoromethane (CFC 11) | mg/kg | -- | -- | 1,100,000 | -- | -- | 2.7E+00 | -- | -- | No | 1,100,000 | 1,100,000 | -- | 0.001 | 1,100,000 | 1,100,000 |
| Vinyl Acetate | mg/kg | -- | -- | 3,500,000 | 5.3E+00 | -- | 1.2E-02 | 1,853 | 93 | No | 3,500,000 | 3,500,000 | -- | 0.005 | 3,500,000 | 3,500,000 |
| Vinyl Chloride | mg/kg | -- | 88 | 11,000 | 1.9E+01 | -- | 8.1E-01 | 0.068 | 0.0034 | No | 88 | 88 | -- | 0.001 | 88 | 88 |
| **Semi-Volatile Organic Compounds (SVOCs)** | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg | -- | 4,500 | 35,000 | 1.7E+03 | -- | 2.4E-02 | 1.2 | 0.061 | No | 4,500 | 4,500 | -- | 0.067 | 4,500 | 4,500 |
| 1,2-Dichlorobenzene | mg/kg | -- | -- | 320,000 | 3.8E+02 | -- | 3.5E-02 | 6,067 | 303 | No | 320,000 | 320,000 | -- | 0.067 | 320,000 | 320,000 |
| 1,3-Dichlorobenzene | mg/kg | -- | -- | -- | -- | -- | 6.0E-02 | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |
| 1,4-Dichlorobenzene | mg/kg | -- | 24,000 | 250,000 | 6.2E+02 | -- | 4.6E-02 | 271 | 14 | No | 24,000 | 24,000 | -- | 0.067 | 24,000 | 24,000 |
| 2,2'-Oxybis[1-chloropropane] | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |
| 2,4,5-Trichlorophenol | mg/kg | -- | -- | 350,000 | 1.6E+03 | -- | 6.5E-05 | 19,166 | 958 | No | 350,000 | 350,000 | -- | 0.33 | 350,000 | 350,000 |
| 2,4,6-Trichlorophenol | mg/kg | -- | 12,000 | 3,500 | 3.8E+02 | -- | 1.1E-04 | 2.1 | 0.11 | No | 3,500 | 3,500 | -- | 0.33 | 3,500 | 3,500 |
| 2,4-Dichlorophenol | mg/kg | -- | -- | 11,000 | 1.5E+02 | -- | 3.4E-05 | 29 | 1.5 | No | 11,000 | 11,000 | -- | 0.33 | 11,000 | 11,000 |
| 2,4-Dimethylphenol | mg/kg | -- | -- | 70,000 | 2.1E+02 | -- | 3.0E-05 | 406 | 20.3 | No | 70,000 | 70,000 | -- | 0.067 | 70,000 | 70,000 |
| 2,4-Dinitrophenol | mg/kg | -- | -- | 7,000 | 1.0E-02 | -- | 1.5E-06 | 0.42 | 0.021 | No | 7,000 | 7,000 | -- | 0.67 | 7,000 | 7,000 |
| 2,4-Dinitrotoluene | mg/kg | -- | 420 | 7,000 | 9.6E+01 | -- | 1.0E-06 | 0.34 | 0.017 | No | 420 | 420 | -- | 0.33 | 420 | 420 |
| 2,6-Dinitrotoluene | mg/kg | -- | 88 | 1,100 | 6.9E+01 | -- | 8.8E-06 | -- | -- | No | 88 | 88 | -- | 0.33 | 88 | 88 |
| 2-Chloronaphthalene | mg/kg | -- | -- | 280,000 | -- | -- | -- | -- | -- | No | 280,000 | 280,000 | -- | 0.067 | 280,000 | 280,000 |
| 2-Chlorophenol | mg/kg | -- | -- | 18,000 | 3.9E+02 | -- | 7.3E-03 | 132 | 6.6 | No | 18,000 | 18,000 | -- | 0.067 | 18,000 | 18,000 |
| 2-Nitroaniline | mg/kg | -- | -- | 35,000 | -- | -- | -- | -- | -- | No | 35,000 | 35,000 | -- | 0.33 | 35,000 | 35,000 |
| 2-Nitrophenol | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.33 | NE | NE |
| 3,3'-Dichlorobenzidine | mg/kg | -- | 290 | -- | 7.2E+02 | -- | 2.2E-08 | 0.048 | 0.0024 | No | 290 | 290 | -- | 0.33 | 290 | 290 |
| 3-Nitroaniline | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.33 | NE | NE |
| 4,6-Dinitro-2-methylphenol | mg/kg | -- | -- | 280 | -- | -- | -- | -- | -- | No | 280 | 280 | -- | 0.67 | 280 | 280 |
| 4-Bromophenyl-phenylether | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |
| 4-Chloro-3-Methylphenol | mg/kg | -- | -- | 350,000 | -- | -- | -- | -- | -- | No | 350,000 | 350,000 | -- | 0.33 | 350,000 | 350,000 |
| 4-Chloroaniline | mg/kg | -- | 660 | 14,000 | 6.6E+01 | -- | 4.9E-06 | -- | -- | No | 660 | 660 | -- | 0.33 | 660 | 660 |
| 4-Chlorophenyl-phenylether | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |
| 4-Nitroaniline | mg/kg | -- | -- | 14,000 | -- | -- | -- | -- | -- | No | 14,000 | 14,000 | -- | 0.33 | 14,000 | 14,000 |
| 4-Nitrophenol | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.33 | NE | NE |
| Benzoic acid | mg/kg | -- | -- | 14,000,000 | 6.0E-01 | -- | 4.9E-06 | -- | -- | No | 14,000,000 | 14,000,000 | -- | 0.67 | 14,000,000 | 14,000,000 |
| Benzyl alcohol | mg/kg | -- | -- | 350,000 | -- | -- | -- | -- | -- | No | 350,000 | 350,000 | -- | 0.33 | 350,000 | 350,000 |
| bis(2-Chloroethoxy)methane | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |
| bis(2-chloroethyl)ether | mg/kg | -- | 120 | -- | 7.6E+01 | -- | 2.9E-04 | 0.091 | 0.0046 | No | 120 | 120 | -- | 0.067 | 120 | 120 |
| bis(2-Ethylhexyl)phthalate | mg/kg | -- | 9,400 | 70,000 | 1.1E+05 | -- | 6.6E-07 | 102 | 5.1 | No | 9,400 | 9,400 | -- | 0.067 | 9,400 | 9,400 |
| Butylbenzylphthalate | mg/kg | -- | 69,000 | 700,000 | 1.4E+04 | -- | 1.1E-05 | 3.6 | 0.18 | No | 69,000 | 69,000 | -- | 0.067 | 69,000 | 69,000 |
| Carbazole | mg/kg | -- | -- | -- | 3.4E+03 | -- | 1.6E-07 | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |
| Dibenzofuran | mg/kg | -- | -- | 3,500 | -- | -- | 1.7E-04 | -- | -- | No | 3,500 | 3,500 | -- | 0.067 | 3,500 | 3,500 |
| Diethylphthalate | mg/kg | -- | -- | 2,800,000 | 8.2E+01 | -- | 4.7E-06 | 329 | 16 | No | 2,800,000 | 2,800,000 | -- | 0.067 | 2,800,000 | 2,800,000 |
| Dimethylphthalate | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.067 | NE | NE |

| Analyte | Units | Protection of Human Health and the Environment[1] (MTCA Method A Standard Table Value for Industrial Land Use) | Human Health Direct Contact Pathway (MTCA Method C Standard Formula Value for Industrial Land Use) | | Equilibrium Partition Coefficients[2] (L/kg) | | | Soil to Groundwater Protection Using Groundwater Proposed Screening Level (Table 3) per WAC 173-340-740(1)(d) EQ. 747-1/747-2 | | Soil to Groundwater Pathway Complete[3] (Yes/No) | *(For NonIonic & Ionizir* | | Adjustment Factors | | Proposed Soil Cleanup Level[6] (After adjustment for background and PQL) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Carcinogen | Non-Carcinogen | $K_{oc}$ (CLARC) | $K_d$ (metals) | H (Unitless) | Vadose Zone | Saturated Zone | | Vadose Zone | Saturated Zone | Background Concentration[4] | PQL[5] | Vadose Zone | Saturated Zone |
| Di-n-butylphthalate | mg/kg | -- | -- | 350,000 | 1.6E+03 | -- | 8.2E-09 | 251 | 13 | No | 350,000 | 350,000 | -- | 0.067 | 350,000 | 350,000 |
| Di-n-octylphthalate | mg/kg | -- | -- | 35,000 | 8.3E+07 | -- | 5.2E-04 | -- | -- | No | 35,000 | 35,000 | -- | 0.067 | 35,000 | 35,000 |
| Hexachlorobenzene | mg/kg | -- | 82 | 2,800 | 8.0E+04 | -- | 1.4E-02 | 0.0080 | 0.00040 | No | 82 | 82 | -- | 0.067 | 82 | 82 |
| Hexachlorobutadiene | mg/kg | -- | 1,700 | 3,500 | 5.4E+04 | -- | 1.4E-01 | 11 | 0.54 | No | 1,700 | 1,700 | -- | 0.067 | 1,700 | 1,700 |
| Hexachlorocyclopentadiene | mg/kg | -- | -- | 21,000 | 2.0E+05 | -- | 4.2E-01 | 4,000 | 200 | No | 21,000 | 21,000 | -- | 0.067 | 21,000 | 21,000 |
| Hexachloroethane | mg/kg | -- | 3,300 | 2,500 | 1.8E+03 | -- | 7.2E-02 | 0.71 | 0.04 | No | 2,500 | 2,500 | -- | 0.067 | 2,500 | 2,500 |
| Isophorone | mg/kg | -- | 140,000 | 700,000 | 4.7E+01 | -- | 1.1E-04 | 103 | 5.2 | No | 140,000 | 140,000 | -- | 0.067 | 140,000 | 140,000 |
| Nitrobenzene | mg/kg | -- | -- | 7,000 | 1.2E+02 | -- | 4.0E-04 | 238 | 12 | No | 7,000 | 7,000 | -- | 0.067 | 7,000 | 7,000 |
| n-Nitroso-di-n-propylamine | mg/kg | -- | 19 | -- | 2.4E+01 | -- | 5.4E-05 | 0.028 | 0.0014 | No | 19 | 19 | -- | 0.067 | 19 | 19 |
| n-Nitrosodiphenylamine | mg/kg | -- | 27,000 | -- | 1.3E+03 | -- | 1.0E-04 | 18 | 0.89 | No | 27,000 | 27,000 | -- | 0.067 | 27,000 | 27,000 |
| o-Cresol (2-Methylphenol) | mg/kg | -- | -- | 180,000 | 9.1E+01 | -- | 2.0E-05 | -- | -- | No | 180,000 | 180,000 | -- | 0.067 | 180,000 | 180,000 |
| p-Cresol (4-Methylphenol) | mg/kg | -- | -- | 350,000 | -- | -- | -- | -- | -- | No | 350,000 | 350,000 | -- | 0.067 | 350,000 | 350,000 |
| Pentachlorophenol | mg/kg | -- | 330 | 18,000 | 5.9E+02 | -- | 2.1E-07 | 0.024 | 1.2E-03 | No | 330 | 330 | -- | 0.17 | 330 | 330 |
| Phenol | mg/kg | -- | -- | 1,100,000 | 2.9E+01 | -- | 6.5E-06 | 40,600 | 2,030 | No | 1,100,000 | 1,100,000 | -- | 0.033 | 1,100,000 | 1,100,000 |
| **Non-carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | mg/kg | -- | 4,500 | 250,000 | -- | -- | 1.6E-02 | -- | -- | No | 4,500 | 4,500 | -- | 0.005 | 4,500 | 4,500 |
| 2-Methylnaphthalene | mg/kg | -- | -- | 14,000 | -- | -- | 7.0E-03 | -- | -- | No | 14,000 | 14,000 | -- | 0.005 | 14,000 | 14,000 |
| Acenaphthene | mg/kg | -- | -- | 210,000 | 4.9E+03 | -- | 2.1E-03 | 523 | 26 | No | 210,000 | 210,000 | -- | 0.005 | 210,000 | 210,000 |
| Acenaphthylene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| Anthracene | mg/kg | -- | -- | 1,100,000 | 2.3E+04 | -- | 7.6E-04 | 1009 | 50 | No | 1,100,000 | 1,100,000 | -- | 0.005 | 1,100,000 | 1,100,000 |
| Benzo[g,h,i]perylene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| Fluoranthene | mg/kg | -- | -- | 140,000 | 4.9E+04 | -- | 1.7E-04 | 2209 | 110 | No | 140,000 | 140,000 | -- | 0.005 | 140,000 | 140,000 |
| Fluorene | mg/kg | -- | -- | 140,000 | 7.7E+03 | -- | 8.6E-04 | 566 | 28 | No | 140,000 | 140,000 | | 0.005 | 140,000 | 140,000 |
| Naphthalene | mg/kg | -- | -- | 70,000 | 1.2E+03 | -- | 8.2E-03 | 2,125 | 106 | No | 70,000 | 70,000 | -- | 0.005 | 70,000 | 70,000 |
| Phenanthrene | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.005 | NE | NE |
| Pyrene | mg/kg | -- | -- | 110,000 | 6.8E+04 | -- | 1.1E-04 | 2,736 | 137 | No | 110,000 | 110,000 | -- | 0.005 | 110,000 | 110,000 |
| **Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)** | | | | | | | | | | | | | | | | |
| Benzo[a]anthracene | mg/kg | -- | -- | -- | 3.6E+05 | -- | 2.8E-05 | 1.1 | 0.057 | Yes | 1.1 | 0.06 | -- | 0.01 | 1.1 | 0.06 |
| Benzo[a]pyrene | mg/kg | -- | 130 | 1,100 | 9.7E+05 | -- | 6.4E-06 | 0.31 | 0.016 | Yes | 0.31 | 0.016 | -- | 0.01 | 0.31 | 0.016 |
| Benzo[b]fluoranthene | mg/kg | -- | -- | -- | 1.2E+06 | -- | 7.7E-04 | 3.9 | 0.20 | Yes | 3.9 | 0.2 | -- | 0.01 | 3.9 | 0.2 |
| Benzo[k]fluoranthene | mg/kg | -- | -- | -- | 1.2E+06 | -- | 5.1E-06 | 39 | 1.97 | Yes | 39 | 2.0 | -- | 0.01 | 39 | 2.0 |
| Chrysene | mg/kg | -- | -- | -- | 4.0E+05 | -- | 7.1E-04 | 127 | 6.4 | Yes | 127 | 6.4 | -- | 0.01 | 127 | 6.4 |
| Dibenz[a,h]anthracene | mg/kg | -- | -- | -- | 1.8E+06 | -- | 6.0E-07 | 0.57 | 0.029 | Yes | 0.57 | 0.029 | -- | 0.01 | 0.57 | 0.029 |
| Indeno[1,2,3-c,d]pyrene | mg/kg | -- | -- | -- | 3.5E+06 | -- | 8.4E-06 | 11 | 0.56 | Yes | 11 | 0.56 | -- | 0.01 | 11 | 0.56 |
| cPAHs TEQ (ND = 0.5RL) | mg/kg | -- | 130 | 1,100 | 9.7E+05 | -- | 6.4E-06 | 0.31 | 0.016 | Yes | 0.31 | 0.016 | -- | 0.01 | 0.31 | 0.016 |
| **Pesticides** | | | | | | | | | | | | | | | | |
| 4,4'-DDD | mg/kg | -- | 550 | 110 | 4.6E+04 | -- | 2.9E-05 | 0.0072 | 0.00036 | No | 110 | 110 | -- | 0.003 | 110 | 110 |
| 4,4'-DDE | mg/kg | -- | 390 | 1,100 | 8.6E+04 | -- | 1.9E-04 | 0.0015 | 0.000076 | No | 390 | 390 | -- | 0.003 | 390 | 390 |
| 4,4'-DDT | mg/kg | 4 | 390 | 1,800 | 6.8E+05 | -- | 3.8E-05 | 0.016 | 0.00081 | No | 4 | 4 | -- | 0.003 | 4 | 4 |
| Aldrin | mg/kg | -- | 7.7 | 110 | 4.9E+04 | -- | 1.6E-03 | 0.00004 | 0.000002 | No | 7.7 | 7.7 | -- | 0.002 | 7.7 | 7.7 |
| Alpha-BHC | mg/kg | -- | 21 | 28,000 | 1.8E+03 | -- | 1.0E-04 | 0.0017 | 0.000085 | No | 21 | 21 | -- | 0.002 | 21 | 21 |
| Alpha-Chlordane (cis) | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.002 | NE | NE |
| Beta-BHC | mg/kg | -- | 73 | -- | 2.1E+03 | -- | 4.8E-06 | 0.06 | 0.003 | No | 73 | 73 | -- | 0.002 | 73 | 73 |

| Analyte | Units | Protection of Human Health and the Environment[1] (MTCA Method A Standard Table Value for Industrial Land Use) | Human Health Direct Contact Pathway (MTCA Method C Standard Formula Value for Industrial Land Use) | | Equilibrium Partition Coefficients[2] (L/kg) | | | Soil to Groundwater Protection Using Groundwater Proposed Screening Level (Table 3) per WAC 173-340-740(1)(d) EQ. 747-1/747-2 | | Soil to Groundwater Pathway Complete[3] (Yes/No) | Proposed Screening Level | | Adjustment Factors | | Proposed Soil Cleanup Level[6] (After adjustment for background and PQL) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Carcinogen | Non-Carcinogen | $K_{oc}$ (CLARC) | $K_d$ (metals) | H (Unitless) | Vadose Zone | Saturated Zone | | Vadose Zone | Saturated Zone | Background Concentration[4] | PQL[5] | Vadose Zone | Saturated Zone |
| Delta-BHC | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.002 | NE | NE |
| Dieldrin | mg/kg | -- | 8 | 180 | 2.6E+04 | -- | 1.1E-04 | 0.000036 | 0.0000018 | No | 8.2 | 8.2 | -- | 0.003 | 8.2 | 8.2 |
| Endosulfan I | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.002 | NE | NE |
| Endosulfan II | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.003 | NE | NE |
| Endosulfan Sulfate | mg/kg | -- | -- | 21,000 | -- | -- | -- | -- | -- | No | 21,000 | 21,000 | -- | 0.003 | 21,000 | 21,000 |
| Endrin | mg/kg | -- | -- | 1,100 | 1.1E+04 | -- | 6.6E-05 | 0.43 | 0.022 | No | 1,100 | 1,100 | -- | 0.003 | 1,100 | 1,100 |
| Endrin Aldehyde | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.003 | NE | NE |
| Endrin Ketone | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.003 | NE | NE |
| Gamma-Chlordane | mg/kg | -- | -- | -- | -- | -- | -- | -- | -- | No | NE | NE | -- | 0.002 | NE | NE |
| Heptachlor | mg/kg | -- | 29 | 1,800 | 9.5E+03 | -- | 1.3E-02 | 0.000065 | 0.0000032 | No | 29 | 29 | -- | 0.002 | 29 | 29 |
| Heptachlor Epoxide | mg/kg | -- | 14 | 46 | 8.3E+04 | -- | 8.0E-05 | 0.004 | 0.0002 | No | 14 | 14 | -- | 0.002 | 14 | 14 |
| Lindane (Gamma-BHC) | mg/kg | 0.01 | 120 | 1,100 | 1.4E+03 | -- | 1.3E-04 | 0.54 | 0.027 | No | 0.01 | 0.01 | -- | 0.002 | 0.01 | 0.01 |
| Methoxychlor | mg/kg | -- | -- | 18,000 | 8.0E+04 | -- | 1.2E-04 | 0.051 | 0.0026 | No | 18,000 | 18,000 | -- | 0.002 | 18,000 | 18,000 |
| Toxaphene | mg/kg | -- | 120 | 320 | 9.6E+04 | -- | 5.2E-05 | 86 | 4.3 | No | 120 | 120 | -- | 0.002 | 120 | 120 |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | | | | | | | | |
| Total PCBs (sum of Aroclors) | mg/kg | 10 | 66.0 | -- | 3.1E+05 | -- | 1.2E-02 | 0.043 | 0.002 | No | 10 | 10 | -- | 0.05 | 10 | 10 |
| **Dioxins and Furans** | | | | | | | | | | | | | | | | |
| Total Dioxins/Furans - Human Health TEQ | ng/kg | -- | 1,700 | 4,100 | -- | -- | -- | -- | -- | No | 1,700 | 1,700 | 5.2 | 5 | 1,700 | 1,700 |

**Notes:**

[1] The MTCA A screening value is shown for those chemicals for which Method C values are not available (e.g., petroleum hydrocarbons and lead). The MTCA Method A value for total PCBs is also included in the table because it captures the chemical-specific level mandated in the Federal Toxic Substance Control Act.

[2] For ionizing and non-ionizing organics, $K_d = K_{oc} \times f_{oc}$ and uses the MTCA default $f_{oc}$ of 0.1% in upland soil. Values for Kd and/or Koc and/or Henry's Law Constant are from Ecology's "CLARC Master Spreadsheet.xlsx" dated May 2019 where available.

[3] Soil to groundwater pathway is not complete if analyte was not detected in groundwater at a concentration greater that its corresponding proposed groundwater cleanup level (Table 3). Soil to groundwater pathway evaluation is presented in Table 9.

[4] Metals background values (Puget Sound Region 90th percentile values) are from *Natural Background Soil Metals Concentrations in Washington State* (Ecology Publication #94-115, 1994).

[5] PQL is from the Remedial Investigation/Feasibility Study Work Plan (GeoEngineers 2008) and is the lowest available value from Analytical Resources Inc. (ARI) of Tukwila, Washington.

[6] Screening level is based on lowest of soil concentrations protective of human health and the environment (MTCA Method A table value for industrial sites), human health - direct contact (MTCA Method C standard formula values for carcinogens and non-carcinogens), and protection of groundwater, adjusted for background and PQL. Calculated concentrations protective of groundwater as marine surface water assume unsaturated and saturated soil, and are calculated based on proposed groundwater cleanup levels before adjustment for background and PQLs.

[7] Background for arsenic as established in the MTCA A Table 745-1 (WAC 173-340-900).

[8] Based on chromium (III).

[9] Based on mercuric chloride.

[10] Value for gasoline-range petroleum hydrocarbons if benzene is not present. If benzene is present, screening level is 30 mg/kg.

MTCA = Washington State Model Toxics Control Act

$K_{oc}$ = Soil organic carbon-water partitioning coefficient (L/kg)

$K_d$ = Distribution coefficient for metals (L/kg)

H = Henrys Law constant (unitless)

PQL = Practical quantitation limit

mg/kg = Milligrams per kilogram

ng/kg = Nanogram per kilogram

-- = No screening criteria available.

NE = not established

ND = Non-detect

RL = Reporting limit

TEQ = toxic equivalent concentration (toxicity equivalency factor [TEF] values are presented in Table 4).

Blue shading identifies the basis for proposed soil cleanup level.

Green shading identifies the proposed soil cleanup level after adjustment for background and the PQL.

# Table 5

## Schedule of Laboratory Analysis for Sediment Investigations

Dakota Creek Industries

Anacortes, Washington

| Sample Location[1] | Date Sampled | Sample Interval | Conventional Analyses[2] | | | | | | Chemical Analyses[2] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total Organic Carbon (TOC) | Total Volatile Solids (TVS) | Total Solids (TS) | Total Ammonia | Total Sulfides | Grain Size | TBT | Metals | LPAHs | HPAHs | cPAHs | Chlorinated Hydrocarbons | Phthalates | Miscellaneous Extractables | Phenols | Pesticides | PCB Aroclors | Dioxins and Furans |
| **Phase 2 Environmental Assessment[3] (Otten Engineering 1997)** | | | | | | | | | | | | | | | | | | | | |
| DC-SED-01[3] | 07/03/97 | 0-10 cm | ■ | | ■ | | | | | ■ | | | | | | | | | | |
| DC-SED-02[3] | 07/03/97 | 0-10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | | | | | | ■ | |
| DC-SED-03[3] | 07/03/97 | 0-10 cm | ■ | | ■ | | | | ■ | ■ | ■ | ■ | ■ | | | | | | ■ | |
| DC-SED-05[3] | 08/06/97 | 0-10 cm | ■ | | ■ | | | | ■ | ■ | | | | | | | | | | |
| DC-SED-06[3] | 08/06/97 | 0-10 cm | ■ | | ■ | | | | ■ | ■ | | | | | | | | | | |
| DC-SED-08[3] | 08/06/97 | 0-10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | | | | | | ■ | |
| DC-SED-09 | 08/06/97 | 0-10 cm | ■ | | ■ | | | | | ■ | | | | | | | | | | |
| **Dredged Material Characterization (Hart Crowser 2000)** | | | | | | | | | | | | | | | | | | | | |
| DMMU-D1-Comp-A[3] | 04/25/00 | 0-10 cm | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| DMMU-D2-Comp-A[3] | 04/25/00 | 0-10 cm | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| **Supplemental Dredged Material Characterization (Anchor 2004)** | | | | | | | | | | | | | | | | | | | | |
| AN-P1-2 | 07/15/04 | 1-3 ft | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| AN-DCI-1A/B[3] | 07/15/04 | 1-3 ft | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| AN-DCI-2[3] | 07/15/04 | 1-3 ft | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| **DCI Basin Surface Sediment Dioxin Study (Floyd\|Snider 2007)** | | | | | | | | | | | | | | | | | | | | |
| DCI06-1A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-2A | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-2D | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-3A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-4A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-4B[3] | N/A | 10-20 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-5A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-5B[3] | N/A | 10-20 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |

| Sample Location[1] | Date Sampled | Sample Interval | Conventional Analyses[2] | | | | | | Chemical Analyses[2] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total Organic Carbon (TOC) | Total Volatile Solids (TVS) | Total Solids (TS) | Total Ammonia | Total Sulfides | Grain Size | TBT | Metals | LPAHs | HPAHs | cPAHs | Chlorinated Hydrocarbons | Phthalates | Miscellaneous Extractables | Phenols | Pesticides | PCB Aroclors | Dioxins and Furans |
| DCI06-6A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-7A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-7B[3] | N/A | 10-20 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-8A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| DCI06-9A[3] | N/A | 0-10 cm | ■ | | ■ | | | | | | | | | | | | | | | ■ |
| **Fidalgo Bay Sediment Study (SAIC 2008)** | | | | | | | | | | | | | | | | | | | | |
| FB-A4-14 | 09/06/07 | 0-10 CM | ■ | ■ | ■ | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| FB-A4-15 | 09/06/07 | 0-10 CM | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ |
| FB-A4-17[3] | 09/06/07 | 0-10 CM | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ |
| **Sediment Remedial Investigation (GeoEngineers 2008)** | | | | | | | | | | | | | | | | | | | | |
| G-1(s)[3] | 03/13/08 | 0-20 CM | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| G-2 (s)[3] | 03/13/08 | 0-20 CM | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| G-3-0-1[3] | 03/14/08 | 0-1 ft | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| G-4-2-3[3] | 03/14/08 | 2-3 ft | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| G-5-0-1[3] | 03/14/08 | 0-1 ft | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| G-6-2-3[3] | 03/14/08 | 2-3 ft | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| G-7(s)[3] | 03/13/08 | 0-20 cm | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **Interim Action Confirmation Sampling (GeoEngineers 2008)** | | | | | | | | | | | | | | | | | | | | |
| SMA 1-1 | 09/30/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| SMA 2-1 | 09/30/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| SMA 3-2 | 08/28/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| DCI 4-1 | 10/10/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| DCI 4-1A | 10/10/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| SMA 5-2 | 08/26/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| SMA 5-3 | 08/26/08 | 0 - 10 cm | ■ | | ■ | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |

Notes:

[1] Sediment sampling locations are shown on Figure 12.

[2] Laboratory results are summarized in Appendix C.

[3] Sediment represented by this sample was subsequently removed from the Marine Area during redevelopment of the Property in 2008.

cm = centimeters

ft = feet

TBT = Tributyltin

LPAHs = Low Molecular Weight Polycyclic Aromatic Hydrocarbons

HPAHs = High Molecular Weight Polycyclic Aromatic Hydrocarbons

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

PCBs = Polychlorinated Biphenyls

■ = Selected sample submitted for chemical analysis.

# Table 6

## Schedule of Laboratory Analysis for Groundwater Investigations

### Dakota Creek Industries

### Anacortes, Washington

| Sample Location[1] | Date Sampled | Well Location | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total Metals | Dissolved Metals | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| **Remedial Investigation Study[3] (Landau 2002b)** | | | | | | | | | | | | | | | |
| MW-1 | 09/04/01 | Shoreline | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | 10/24/01 | | | ■ | ■ | ■ | ■ | | | | | | | | |
| MW-2 | 09/04/01 | Shoreline | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | 10/24/01 | | | ■ | ■ | ■ | ■ | | | | | | | | |
| MW-3 | 09/04/01 | Shoreline | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | 10/24/01 | | | ■ | ■ | ■ | ■ | | | | | | | | |
| MW-4 | 09/04/01 | Upland | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | 10/24/01 | | | ■ | ■ | ■ | ■ | | | | | | | | |
| **Independent Cleanup Action (Landau 2002c)** | | | | | | | | | | | | | | | |
| MW-1 | 06/05/02 | Shoreline | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | |
| | 08/19/02 | | ■ | | ■ | ■ | ■ | | | | ■ | | | | |
| MW-2 | 06/05/02 | Shoreline | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | |
| | 08/19/02 | | ■ | | ■ | ■ | ■ | | | | ■ | | | | |
| MW-3 | 06/05/02 | Shoreline | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | |
| | 08/19/02 | | ■ | | ■ | ■ | ■ | | | | ■ | | | | |
| MW-4 | 06/05/02 | Upland | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | |
| | 08/19/02 | | ■ | | ■ | ■ | ■ | | | | ■ | | | | |
| **Groundwater Characterization Study (Floyd\|Snider 2007)** | | | | | | | | | | | | | | | |
| MW-1 | 11/17/06 | Shoreline | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| MW-2 | 11/17/06 | Shoreline | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| MW-3 | 11/17/06 | Shoreline | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| MW-4 | 11/17/06 | Upland | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |

| Sample Location[1] | Date Sampled | Well Location | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total Metals | Dissolved Metals | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| **Groundwater Remedial Investigation[4] (GeoEngineers 2010)** | | | | | | | | | | | | | | | |
| MW-1 | 06/17/08 | Shoreline | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ |
| MW-2 | 06/17/08 | Shoreline | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| MW-3 | 06/17/08 | Shoreline | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| MW-4 | 06/17/08 | Upland | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| MW-5 | 06/17/08 | Upland | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| **Groundwater Remedial Investigation[5] (GeoEngineers 2013)** | | | | | | | | | | | | | | | |
| MW-1 | 05/23/12 | Shoreline | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 08/16/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 11/13/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 02/13/13 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| MW-2A | 05/23/12 | Shoreline | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 08/16/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 11/13/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 02/13/13 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| MW-3A | 05/23/12 | Shoreline | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 08/16/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 11/13/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 02/13/13 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| MW-4 | 05/23/12 | Upland | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 08/16/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 11/13/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| | 02/13/13 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | |
| MW-6 | 05/23/12 | Shoreline | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 08/16/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 11/13/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 02/13/13 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |

| Sample Location[1] | Date Sampled | Well Location | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total Metals | Dissolved Metals | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| MW-7 | 05/23/12 | Upland | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 08/16/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 11/13/12 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| | 02/13/13 | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ | | ■ |
| Groundwater Remedial Investigation[6] (GeoEngineers 2017) | | | | | | | | | | | | | | | |
| MW-1 | 02/10/16 | Shoreline | ■ | ■ | | | | | | | | | | | |
| | 08/18/16 | | ■ | ■ | | | | | | | | | | | |
| | 02/15/17 | | ■ | ■ | | | | | | | | | | | |
| | 08/23/17 | | ■ | ■ | | | | | | | | | | | |
| MW-2A | 02/10/16 | Shoreline | --[7] | --[7] | | | | | | | | | | | |
| MW-2B | 08/19/16 | | ■ | ■ | | | | | | | | | | | |
| | 02/15/17 | | ■ | ■ | | | | | | | | | | | |
| | 08/23/17 | | ■ | ■ | | | | | | | | | | | |
| MW-3A | 02/11/16 | Shoreline | ■ | ■ | | | | | | | | | | | |
| | 08/19/16 | | ■ | ■ | | | | | | | | | | | |
| | 02/16/17 | | ■ | ■ | | | | | | | | | | | |
| | 08/24/17 | | ■ | ■ | | | | | | | | | | | |
| MW-4 | 02/11/16 | Upland | ■ | ■ | | | | | | | ■ | | | | |
| | 08/18/16 | | ■ | ■ | | | | | | | ■ | | | | |
| | 02/15/17 | | ■ | ■ | | | | | | | ■ | | | | |
| | 08/24/17 | | ■ | ■ | | | | | | | ■ | | | | |
| MW-6 | 02/11/16 | Shoreline | ■ | ■ | | | | | | | | | | | |
| | 08/19/16 | | ■ | ■ | | | | | | | | | | | |
| | 02/16/17 | | ■ | ■ | | | | | | | | | | | |
| | 08/24/17 | | ■ | ■ | | | | | | | | | | | |
| MW-7 | 02/10/16 | Upland | ■ | ■ | | | | | | | | | | | |
| | 08/19/16 | | ■ | ■ | | | | | | | | | | | |
| | 02/16/17 | | ■ | ■ | | | | | | | | | | | |
| | 08/23/17 | | ■ | ■ | | | | | | | | | | | |

| Sample Location[1] | Date Sampled | Well Location | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total Metals | Dissolved Metals | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| MW-8 | 02/10/16 | Shoreline[8] | ■ | ■ | | | | | | | | | | | |
| | 08/18/16 | | ■ | ■ | | | | | | | | | | | |
| | 02/15/17 | | ■ | ■ | | | | | | | | | | | |
| | 08/23/17 | | ■ | ■ | | | | | | | | | | | |

**Notes:**

[1] Groundwater sampling locations are shown on Figure 13.

[2] Laboratory results are summarized in Appendix F.

[3] Groundwater monitoring activities completed prior to the 2002 independent cleanup action completed at the Site.

[4] Remedial investigation activities were completed to evaluate groundwater conditions in accordance with the RI/FS Work Plan (GeoEngineers 2008).

[5] Additional groundwater monitoring activities were completed on a quarterly basis between May 2012 and February 2013 as directed by Ecology to further evaluate groundwater conditions at the Site.

[6] Due to inconclusive evidence linking contaminant exceedances in soil to contaminant exceedances in groundwater, Ecology required that four additional rounds of groundwater monitoring be completed on a semi-annual basis at the Site (Ecology 2015).

[7] Monitoring well was damaged. In August 2016, a replacement monitoring well (MW-2B) was installed for evaluating groundwater conditions.

[8] Ecology has determined that the location of MW-1 was not an appropriate location for evaluation of the conditional point of compliance and that a new monitoring well (MW-8) be installed north of MW-1 to serve as the point of compliance (Ecology 2015).

BETX = Benzene, Ethylbenzene, Toluene and Xylenes

VOCs = Volatile Organic Compounds

SVOCs = Semi-Volatile Organic Compounds

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

PCBs = Polychlorinated Biphenyls

■ = Selected sample submitted for chemical analysis.

# Table 7

## Laboratory Analysis for Soil Investigations

### Dakota Creek Industries

### Anacortes, Washington

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| **UST Removal and Closure (A-1 1991)** | | | | | | | | | | | | | | | | |
| #2 | North Wall | 10/02/91 | N/A | | | ■ | | | ■ | | | | | | | |
| #4 | South Wall | 10/02/91 | N/A | | | ■ | | | ■ | | | | | | | |
| #6 | West Wall | 10/02/91 | N/A | | | | ■ | | ■ | | | | | | | |
| #7 | North Wall | 10/02/91 | N/A | | | ■ | ■ | | ■ | | | | | | | |
| #8 | East Wall | 10/02/91 | N/A | | | | ■ | | ■ | | | | | | | |
| #9 | South Wall | 10/02/91 | N/A | | | ■ | ■ | | ■ | | | | | | | |
| #10 | Base Center | 10/02/91 | N/A | | | | ■ | | ■ | | | | | | | |
| #1A | Tank Hole | 10/02/91 | N/A | | | | ■ | | ■ | | | | | | | |
| #3A | Tank Hole | 10/02/91 | N/A | | | ■ | ■ | | ■ | | | | | | | |
| #5A | Tank Hole | 10/02/91 | N/A | | | ■ | ■ | | ■ | | | | | | | |
| **Phase 2 Environmental Site Assessment (Otten 1997)** | | | | | | | | | | | | | | | | |
| S-1 | DC-B-1 | 07/14/97 | 4.5 ft | ■ | | | | | | | | | | | | |
| S-1 | DC-B-1B | 07/14/97 | 4.5 ft | ■ | | | | | | | | | | | | |
| S-2 | DC-B-2 | 07/14/97 | 4.5 ft | ■ | | | | | | | | | | | | |
| S-2 | DC-B-2A | 07/14/97 | 2.5 ft | ■ | | | | | | | | | | | | |
| SS-1A | DC-UPLD SS-1A | 07/03/97 | 0-1 ft | ■ | | | | | | | | | | | | |
| SS-1B | DC-UPLD SS-1B | 07/03/97 | 0-1 ft | ■ | | | | | | | | | | | | |
| SS-2A | DC-UPLD SS-2A | 07/03/97 | 0-1 ft | ■ | | | | | | | | | | | | |
| SS-2B | DC-UPLD SS-2B | 07/03/97 | 0-1 ft | ■ | | | | | | | | | | | | |
| SS-3 | DC-UPLD SS-3 | 07/30/97 | 0-1 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| SS-4 | DC-UPLD SS-4 | 07/30/97 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | | | | | | | |
| SS-6 | DC-UPLD SS-6 | 07/30/97 | 0-1 ft | | | ■ | ■ | ■ | ■ | | | | | | | |
| SS-9 | DC-UPLD SS-9 | 07/30/97 | 0-1 ft | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| SS-11 | DC-UPLD SS-11[3] | 07/30/97 | 0-1 ft | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| SS-13A | DC-UPLD SS-13A[3] | 07/30/97 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | | | | | | | |
| SS-14A | DC-UPLD SS-14A[3] | 07/30/97 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| SS-14B | DC-UPLD SS-14B[3] | 07/30/97 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| **EPA Site Inspection (Landau 2001)** | | | | | | | | | | | | | | | | | |
| DCI-SB-UL01 | 0020-LAI | 07/17/01 | 2 ft | ■ | ■ | | | | | | ■ | ■ | ■ | | ■ | |
| DCI-SB-UL01 | 0040-LAI | 07/17/01 | 4 ft | ■ | ■ | | | | | | ■ | ■ | ■ | | ■ | |
| DCI-SB-UL01 | 0070-LAI | 07/17/01 | 7 ft | ■ | ■ | | | | | | ■ | ■ | ■ | | ■ | |
| DCI-SB-UL03 | 0020-LAI | 07/17/01 | 2 ft | ■ | ■ | | | | | | ■ | ■ | ■ | | ■ | |
| DCI-SB-UL03 | 0060-LAI | 07/17/01 | 6 ft | ■ | ■ | | | | | | ■ | ■ | ■ | | ■ | |
| **Marine Railway Hydraulic Winch Soil Excavation (Landau 2001)** | | | | | | | | | | | | | | | | | |
| VS-1 | VS-1 DH66A | 06/28/01 | 5 ft | | | | ■ | ■ | | | | | | | | |
| VS-2 | VS-2 DH66B | 06/28/01 | 2.5 ft | | | | ■ | ■ | | | | | | | | |
| VS-3 | VS-3 DH66C | 06/28/01 | 2.5 ft | | | | ■ | ■ | | | | | | | | |
| VS-6 | VS-6 DL 19A | 07/03/01 | 2.5 ft | | | | ■ | ■ | | | | | | | | |
| VS-7 | VS-7 DL 19B | 07/03/01 | 2.5 ft | | | | ■ | ■ | | | | | | | | |
| VS-8 | VS-8 DL 19C | 07/03/01 | 2.5 ft | | | | ■ | ■ | | | | | | | | |
| **Remedial Investigation Study (Landau 2002b)** | | | | | | | | | | | | | | | | | |
| S-1-WS | S-1-WS-0 | 08/22/01 | 0.5-1 ft | ■ | | | | | | | | | | | | |
| | S-1-WS-1 | 08/22/01 | 1-4 ft | ■ | | | | | | | | | | | | |
| | S-1-WS-2 | 08/22/01 | 4-7 ft | ■ | | | | | | | | | | | | |
| | S-1-WS-3 | 08/22/01 | 7-10 ft | ■ | | | | | | | | | | | | |
| S-2-MS | S-2-MS-0 | 08/22/01 | 0.5-1 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| | S-2-MS-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| | S-2-MS-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| S-3-EFA | S-3-EFA-0 | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-3-EFA-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-3-EFA-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-3-EFA-3 | 08/22/01 | 10-13 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| S-4-EFA | S-4-EFA-0 | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-4-EFA-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-4-EFA-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| S-5-EFA | S-5-EFA-0 | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-5-EFA-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-5-EFA-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-5-EFA-3 | 08/22/01 | 7-10 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| | S-5-EFA-4 | 08/22/01 | 10-13 ft | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| S-6-UST | S-6-TPH-0 | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| | S-6-TPH-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| | Dup (S-6-TPH-1) | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| | S-6-TPH-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| S-7-UST | S-7-TPH-0[3] | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| | S-7-TPH-1[3] | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| | S-7-TPH-2[3] | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| | S-7-TPH-3[3] | 08/22/01 | 7-10 ft | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | | |
| S-8-UST | S-8-TPH-0[3] | 08/22/01 | 0-1 ft | | | ■ | ■ | ■ | ■ | | | | | | | |
| | S-8-TPH-1[3] | 08/22/01 | 1-4 ft | | | ■ | ■ | ■ | ■ | | | | | | | |
| | S-8-TPH-2[3] | 08/22/01 | 4-7 ft | | | ■ | ■ | ■ | ■ | | | | | | | |
| | S-8-TPH-3[3] | 08/22/01 | 7-10 ft | | | ■ | ■ | ■ | ■ | | | | | | | |
| S-9-CPH | S-9-CPH-0 | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | Dup (S-9-CPH-0) | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-9-CPH-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-9-CPH-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-9-CPH-3 | 08/22/01 | 7-9 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-9-CPH-3A | 08/22/01 | 9-10 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| S-10-MR | S-10-MR-0 | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-10-MR-1 | 08/22/01 | 1-4 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-10-MR-2 | 08/22/01 | 4-7 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | S-10-MR-3 | 08/22/01 | 7-10 ft | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| S-11-MR | S-11-MR[3] | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| S-12-MR | S-12-MR-0[3] | 08/22/01 | 0-1 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| | Dup (S-12-MR-0)[3] | 08/22/01 | 0.7 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| S-13-MR | S-13-MR[3] | 08/22/01 | 0-0.5 ft | ■ | | ■ | ■ | ■ | | | | | | | | |
| S-14-TPH | S-14-TPH-1 | 10/24/01 | 1-3.1 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-14-TPH-4 | 10/24/01 | 4-6.4 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-14-TPH-7 | 10/24/01 | 7-10 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-15-TPH | S-15-TPH-1 | 10/24/01 | 1-3.8 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-15-TPH-4 | 10/24/01 | 4-6.1 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-15-TPH-7 | 10/24/01 | 7-9.9 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-16-TPH | S-16-TPH-1[3] | 10/24/01 | 1-3.7 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-16-TPH-4[3] | 10/24/01 | 4-6.3 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-16-TPH-7[3] | 10/24/01 | 7-10 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-17-TPH | S-17-TPH-1 | 10/24/01 | 1-3.7 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-17-TPH-4A | 10/24/01 | 4-4.4 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-17-TPH-4B | 10/24/01 | 4.4-6.3 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-17-TPH-7 | 10/24/01 | 7-9.8 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-18-TPH | S-18-TPH-1 | 10/24/01 | 1-3.4 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-18-TPH-4 | 10/24/01 | 4-6.7 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-18-TPH-7 | 10/24/01 | 7-9.9 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-19-TPH | S-19-TPH-1 | 10/24/01 | 1-3.6 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-19-TPH-4 | 10/24/01 | 4-6.4 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-19-TPH-7 | 10/24/01 | 7-9.9 ft | | | ■ | ■ | ■ | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| S-20-TPH | S-20-TPH-1[3] | 10/24/01 | 1-3.9 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-20-TPH-4[3] | 10/24/01 | 4-6.5 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-20-TPH-7[3] | 10/24/01 | 7-10 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-21-TPH | S-21-TPH-1[3] | 10/24/01 | 1-2.2 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-21-TPH-4[3] | 10/24/01 | 4-4.1 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-21-TPH-7[3] | 10/24/01 | 7-9.4 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-22-TPH | S-22-TPH-1A[3] | 10/24/01 | 1-2.5 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-22-TPH-1B[3] | 10/24/01 | 2.5-4 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-22-TPH-4[3] | 10/24/01 | 4-5 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-22-TPH-7[3] | 10/24/01 | 7-9.5 ft | | | ■ | ■ | ■ | | | | | | | | |
| S-23-TPH | S-23-TPH-1[3] | 10/24/01 | 1-3.4 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-23-TPH-4[3] | 10/24/01 | 4-6.7 ft | | | ■ | ■ | ■ | | | | | | | | |
| | S-23-TPH-7[3] | 10/24/01 | 7-9.6 ft | | | ■ | ■ | ■ | | | | | | | | |
| Independent Cleanup Action (Landau 2002c) | | | | | | | | | | | | | | | | |
| CS-1 | CS-1 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-2 | CS-2 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-3 | CS-3 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-4 | CS-4 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-5 | CS-5 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-6 | CS-6 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-7 | CS-7 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-8 | CS-8 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-9 | CS-9 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-10 | CS-10 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-11 | CS-11 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-12 | CS-12 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-13 | CS-13 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-14 | CS-14 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-15 | CS-15 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| CS-16 | CS-16 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-17 | CS-17 8-20[3] | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-18 | CS-18 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-19 | CS-19 8-20[3] | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-20 | CS-20 8-20[3] | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-21 | CS-21 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-22 | CS-22 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-23 | CS-23 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-24 | CS-24 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-25 | CS-25 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-26 | CS-26 8-20[3] | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-27 | CS-27 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-28 | CS-28 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-29 | CS-29 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-30 | CS-30 8-20 | 08/20/02 | N/A | ■ | | ■ | ■ | ■ | | | | ■ | | | ■ | |
| CS-31 | CS-31 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-32 | CS-32 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-33 | CS-33 8-20 | 08/20/02 | N/A | ■ | | ■ | ■ | ■ | | | | ■ | | | ■ | |
| CS-34 | CS-34 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-35 | CS-35 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-36 | CS-36 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-37 | CS-37 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-38 | CS-38 8-20[3] | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-39 | CS-39 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-40 | CS-40 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-41 | CS-41 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-42 | CS-42 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-43 | CS-43 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-44 | CS-44 8-20 | 08/20/02 | N/A | ■ | | ■ | ■ | ■ | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| CS-45 | CS-45 8-20 | 08/20/02 | N/A | ■ | | ■ | ■ | ■ | | | | | | | | |
| CS-46 | CS-46 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-47 | CS-47 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-48 | CS-48 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-49 | CS-49 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-50 | CS-50 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-51 | CS-51 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-52 | CS-52 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-53 | CS-53 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-54 | CS-54 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-55 | CS-55 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| CS-56 | CS-56 8-20 | 08/20/02 | N/A | | | ■ | ■ | ■ | | | | | | | | |
| Remedial Investigation[4] (GeoEngineers 2010) | | | | | | | | | | | | | | | | |
| SS-1 | SS-1-1 | 06/16/08 | 1-1.5 ft | ■ | | | | | | | | | | | | |
| SS-2 | SS-2-1 | 06/16/08 | 1-1.5 ft | ■ | | | | | | | | | | | | |
| SS-3 | SS-3-1 | 06/16/08 | 1-1.5 ft | ■ | | | | | | | | | | | | |
| SS-4 | SS-4-0.5 | 06/16/08 | 0.5 -1 ft | ■ | | | | | | | | | | | | |
| MW-5 | MW-5-5.0 | 05/27/08 | 5-6.5 ft | | | ■ | ■ | ■ | ■ | ■ | | ■ | | | | |
| | MW-5-10.0 | 05/27/08 | 10-11.5 ft | | | ■ | ■ | ■ | ■ | ■ | | ■ | | | | |
| SB-1 | SB-1-2.0 | 06/16/08 | 2-3 ft | ■ | | | | | | | | | | | | |
| | SB-1-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-2 | SB-2-2.0 | 06/16/08 | 2-3 ft | ■ | | | | | | | | | | | | |
| | SB-2-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-4 | SB-4-3.0 | 06/16/08 | 3-4 ft | | | | ■ | ■ | | ■ | | ■ | | | | ■ |
| | SB-4-9.0 | 06/16/08 | 9-10 ft | | | | | | | | | | | | | ■ |
| SB-5 | SB-5-3.0 | 06/16/08 | 3-4 ft | | | | ■ | ■ | | ■ | | ■ | | | | ■ |
| | SB-5-9.0 | 06/16/08 | 9-10 ft | | | | | | | | | | | | | ■ |
| SB-7 | SB-7-3.0 | 06/16/08 | 3-4 ft | | | | ■ | ■ | | ■ | | ■ | | | | ■ |
| | SB-7-9.0 | 06/16/08 | 9-10 ft | | | | | | | | | | | | | ■ |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| SB-8 | SB-8-0.5 | 06/17/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-8-4.0 | 06/17/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-9 | SB-9-0.5 | 06/16/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-9-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-10 | SB-10-0.5 | 06/17/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-10-4.0 | 06/17/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-11 | SB-11-0.5 | 06/17/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-11-4.0 | 06/17/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-12 | SB-12-0.5 | 06/16/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-12-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-13 | SB-13-0.5 | 06/16/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-13-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-14 | SB-14-0.5 | 06/16/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-14-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| SB-15 | SB-15-0.5 | 06/16/08 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | SB-15-4.0 | 06/16/08 | 4-5 ft | ■ | | | | | | | | | | | | |
| TP-3 | TP-3-6 | 09/05/08 | 6-6.5 ft | ■ | | | | | | | | | | | | |
| TP-4 | TP-4-6 | 09/08/08 | 6-6.5 ft | ■ | | | | | | | | | | | | |
| TP-5 | TP-5-2 | 09/08/08 | 2-2.5 ft | ■ | | | | | | | | | | | | |
| | TP-5-4 | 09/08/08 | 4-4.5 ft | ■ | | | | | | | | | | | | |
| TP-10 | TP-10-4 | 09/08/08 | 4-4.5 ft | ■ | | | | | | | | | | | | |
| | TP-10-6 | 09/08/08 | 6-6.5 ft | ■ | | | | | | | | | | | | |
| TP-11 | TP-11-6 | 09/08/08 | 6-6.5 ft | ■ | | | | | | | | | | | | |
| TP-12 | TP-12-3 | 09/08/08 | 3-3.5 ft | ■ | | | | | | | | | | | | |
| TP-13 | TP-13-2 | 09/08/08 | 2-2.5 ft | ■ | | | | | | | | | | | | |
| | TP-13-4 | 09/08/08 | 4-4.5 ft | ■ | | | | | | | | | | | | |
| TP-14 | TP-14-0-2 | 09/18/08 | 0-2 ft | ■ | | | | | | | | | | | | |
| TP-15 | TP-15-2-4 | 09/18/08 | 2-4 ft | ■ | | | | | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| TP-16 | TP-16-0-2 | 09/18/08 | 0-2 ft | ■ | | | | | | | | | | | | |
| | TP-16-4-6 | 09/18/08 | 4-6 ft | ■ | | | | | | | | | | | | |
| Remedial Investigation[5] (GeoEngineers 2014) | | | | | | | | | | | | | | | | |
| GEI-1 | GEI-01_3-4_092914 | 09/29/2014 | 3-4 ft | ■ | | | | | | | | | | | | |
| | GEI-02_1-2_092914 | 09/29/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| GEI-2 | GEI-02_4-5_092914 | 09/29/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-02_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-3 | GEI-03_2.5-3.5_092914 | 09/29/2014 | 2.5-3.5 ft | ■ | | | | | | | | | | | | |
| | GEI-03_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-4 | GEI-04_1-2_092914 | 09/29/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-04_3-4_092914 | 09/29/2014 | 3-4 ft | ■ | | | | | | | | | | | | |
| | GEI-04_6-7_092914 | 09/29/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| GEI-5 | GEI-05_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-6 | GEI-06_1.5-2.5_092914 | 09/29/2014 | 1.5-2.5 ft | ■ | | | | | | | | | | | | |
| | GEI-06_4-5_092914 | 09/29/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-06_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-7 | GEI-07_1.5-2.5_092914 | 09/29/2014 | 1.5-2.5 ft | ■ | | | | | | | | | | | | |
| | GEI-07_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-8 | GEI-08_1.5-2.5_092914 | 09/29/2014 | 1.5-2.5 ft | ■ | | | | | | | | | | | | |
| | GEI-08_4-5_092914 | 09/29/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-08_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-9 | GEI-09_0.5-1.5_092914 | 09/29/2014 | 0.5-1.5 ft | ■ | | | | | | | | | | | | |
| | GEI-09_3-4_092914 | 09/29/2014 | 3-4 ft | ■ | | | | | | | | | | | | |
| | GEI-09_6-7_092914 | 09/29/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| GEI-10 | GEI-10_2-3_092914 | 09/29/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-10_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-11 | GEI-11_2-3_092914 | 09/29/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-11_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| | GEI-11_9-10_092914 | 09/29/2014 | 9-10 ft | ■ | | | | | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| GEI-12 | GEI-12_2-3_092914 | 09/29/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-12_4-5_092914 | 09/29/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-12_7-8_092914 | 09/29/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-13 | GEI-13_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-13_5-6_093014 | 09/30/2014 | 5-6 ft | ■ | | | | | | | | | | | | |
| | GEI-13_7-8_093014 | 09/30/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| GEI-14 | GEI-14_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-14_3.5-4.5_093014 | 09/30/2014 | 3.5-4.5 ft | ■ | | | | | | | | | | | | |
| | GEI-14_7-8_093014 | 09/30/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| | GEI-14_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-15 | GEI-15_10-11_093014 | 09/30/2014 | 10-11 ft | ■ | | | | | | | | | | | | |
| | GEI-15_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-15_5.5-6.5_093014 | 09/30/2014 | 5.5-6.5 ft | ■ | | | | | | | | | | | | |
| GEI-16 | GEI-16_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-16_6-7_093014 | 09/30/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| | GEI-16_8-9_093014 | 09/30/2014 | 8-9 ft | ■ | | | | | | | | | | | | |
| GEI-17 | GEI-17_1-2_093014 | 09/30/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-17_4-5_093014 | 09/30/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-17_7-8_093014 | 09/30/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| | GEI-17_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-18 | GEI-18_1-2_093014 | 09/30/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-18_4-5_093014 | 09/30/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-18_8-9_093014 | 09/30/2014 | 8-9 ft | ■ | | | | | | | | | | | | |
| | GEI-18_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-19 | GEI-19_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-19_4-5_093014 | 09/30/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-19_7-8_093014 | 09/30/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| | GEI-19_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| GEI-20 | GEI-20_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-20_4-5_093014 | 09/30/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-20_6-7_093014 | 09/30/2014 | 6-7 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-20_8-9_093014 | 09/30/2014 | 8-9 ft | ■ | | | | | | | | | | | | |
| GEI-21 | GEI-21_1-2_093014 | 09/30/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-21_5-6_093014 | 09/30/2014 | 5-6 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-21_7.5-8.5_093014 | 09/30/2014 | 7.5-8.5 ft | ■ | | | | | | | | ■ | | | | |
| GEI-22 | GEI-22_2-3_100114 | 10/01/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-22_5-6_100114 | 10/01/2014 | 5-6 ft | ■ | | | | | | | | | | | | |
| | GEI-22_7.5-8.5_100114 | 10/01/2014 | 7.5-8.5 ft | ■ | | | | | | | | | | | | |
| GEI-23 | GEI-23_1-2_093014 | 09/30/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-23_5-6_093014 | 09/30/2014 | 5-6 ft | ■ | | | | | | | | | | | | |
| | GEI-23_7.5-8.5_093014 | 09/30/2014 | 7.5-8.5 ft | ■ | | | | | | | | ■ | | | | |
| GEI-24 | GEI-24_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-24_4-5_093014 | 09/30/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-24_6-7_093014 | 09/30/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| | GEI-24_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-25 | GEI-25_1-2_093014 | 09/30/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-25_4-5_093014 | 09/30/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-25_7-8_093014 | 09/30/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| | GEI-25_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-26 | GEI-26_2 -3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-26_6-7_093014 | 09/30/2014 | 6-8 ft | ■ | | | | | | | | | | | | |
| GEI-27 | GEI-27_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-27_5-6_100114 | 10/01/2014 | 5-6 ft | ■ | | | | | | | | | | | | |
| | GEI-27_9-10_100114 | 10/01/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-28 | GEI-28_10-11_100114 | 10/01/2014 | 10-11 ft | ■ | | | | | | | | | | | | |
| | GEI-28_2-3_100114 | 10/01/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-28_5-6_100114 | 10/01/2014 | 5-6 ft | ■ | | | | | | | | ■ | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| GEI-29 | GEI-29_2-3_093014 | 09/30/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| | GEI-29_5-6_093014 | 09/30/2014 | 5-6 ft | ■ | | | | | | | | | | | | |
| | GEI-29_8-9_093014 | 09/30/2014 | 8-9 ft | ■ | | | | | | | | | | | | |
| | GEI-29_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-30 | GEI-30_3-4_093014 | 09/30/2014 | 3-4 ft | ■ | | | | | | | | | | | | |
| | GEI-30_7-8_093014 | 09/30/2014 | 7-8 ft | ■ | | | | | | | | | | | | |
| | GEI-30_9-10_093014 | 09/30/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-31 | GEI-31_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-31_4-5_100114 | 10/01/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-31_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| | GEI-31_9-10_100114 | 10/01/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-32 | GEI-32_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-32_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| GEI-33 | GEI-33_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| GEI-34 | GEI-34_2.5-3.5_100114 | 10/01/2014 | 2.5-3.5 ft | ■ | | | | | | | | | | | | |
| | GEI-34_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| | GEI-34_9-10_100114 | 10/01/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-35 | GEI-35_3-4_100114 | 10/01/2014 | 3-4 ft | ■ | | | | | | | | | | | | |
| | GEI-35_4-5_100114 | 10/01/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-35_8-9_100114 | 10/01/2014 | 8-9 ft | ■ | | | | | | | | | | | | |
| | GEI-35_9-10_100114 | 10/01/2014 | 9-10 ft | ■ | | | | | | | | | | | | |
| GEI-36 | GEI-36_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-36_5-6_100114 | 10/01/2014 | 5-6 ft | ■ | | | | | | | | | | | | |
| GEI-37 | GEI-37_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-37_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| GEI-38 | GEI-38_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-38_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |

| Sample Location[1] | Sample Identification | Date Sampled | Sample Interval | Chemical Analyses[2] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Metals | TBT | Gasoline-Range Hydrocarbons | Diesel-Range Hydrocarbons | Heavy Oil-Range Hydrocarbons | BETX | Other VOCs | SVOCs | PAHs | Pesticides | Herbicides | PCB Aroclors | Dioxins and Furans |
| GEI-39 | GEI-39_1.5-2.5_100114 | 10/01/2014 | 1.5-2.5 ft | ■ | | | | | | | | | | | | |
| | GEI-39_4-5_100114 | 10/01/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-39_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| GEI-40 | GEI-40_2-3_100114 | 10/01/2014 | 2-3 ft | ■ | | | | | | | | | | | | |
| GEI-41 | GEI-41_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-41_4-5_100114 | 10/01/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-41_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| | GEI-41_8-9_100114 | 10/01/2014 | 8-9 ft | ■ | | | | | | | | | | | | |
| GEI-42 | GEI-42_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-42_4-5_100114 | 10/01/2014 | 4-5 ft | ■ | | | | | | | | | | | | |
| | GEI-42_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| GEI-43 | GEI-43_1-2_100114 | 10/01/2014 | 1-2 ft | ■ | | | | | | | | | | | | |
| | GEI-43_6-7_100114 | 10/01/2014 | 6-7 ft | ■ | | | | | | | | | | | | |
| **Remedial Investigation[6] (GeoEngineers 2018)** | | | | | | | | | | | | | | | | |
| GEI-44 | GEI-44_1.5-2 | 07/23/18 | 1.5-2 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-44_7.5-10 | 07/23/18 | 7.5-10 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-44_16-17.5 | 07/23/18 | 16-17.5 ft | ■ | | | | | | | | ■ | | | | |
| GEI-45 | GEI-45_1-3 | 07/23/18 | 1-3 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-45_9-10 | 07/23/18 | 9-10 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-45_17-20 | 07/23/18 | 17-20 ft | ■ | | | | | | | | ■ | | | | |
| GEI-46 | GEI-46_7-8.5 | 07/23/18 | 1-2 ft | ■ | | | | | | | | ■ | | | | |
| | GEI-46_13.5-15 | 07/23/18 | 4-5 ft | ■ | | | | | | | | ■ | | | | |

**Notes:**

[1] Soil sampling locations are shown on Figure 14.

[2] Laboratory results are summarized in Appendix G.

[3] Soil represented by this sample was subsequently removed from the Upland Area during the 2002 independent cleanup action completed at the Site.

[4] Remedial investigation activities were completed to evaluate soil conditions in accordance with the RI/FS Work Plan (GeoEngineers 2008a).

[5] Additional soil investigation activities were completed as directed by Ecology to fill identified data gaps. Soil investigation activities were completed in accordance with the Ecology-approved RI/FS Work Plan (GeoEngineers 2008a).

[6] Additional soil investigation activities were completed as directed by Ecology based on semi-annual groundwater monitoring results at MW-8. Soil investigation activities were completed in accordance with the Ecology-approved RI/FS Work Plan Addendum (GeoEngineers, 2018).

BETX = Benzene, Ethylbenzene, Toluene and Xylenes

VOCs = Volatile Organic Compounds

SVOCs = Semi-Volatile Organic Compounds

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

PCBs = Polychlorinated Biphenyls

■ = Selected sample submitted for chemical analysis.

# Table 8

## Summary Statistics and Evaluation of Sediment Contaminants of Concern - Protection of Benthic Organisms

Dakota Creek Industries

Anacortes, Washington

| Contaminant of Potential Concern[1] (COPC) | Proposed Sediment Cleanup Level[2] SCO/ LAET | Proposed Sediment Cleanup Level[2] CSL/ 2LAET | Units | Evaluation of RI Data Results[3] Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | RL Exceedance Evaluation Frequency of RL Exceedance[4] (%) | RL Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | SCO/AET Exceedance Evaluation Frequency of PCUL Exceedance[4] (%) | SCO/AET Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | CSL/2AET Exceedance Evaluation Frequency of PCUL Exceedance[4] (%) | CSL/2AET Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | Contaminant of Concern (COC) Selection Considerations Initial COC Selection Criteria Met[6] (Yes/No) | Groundwater COC[7] (Yes/No) | Proposed Sediment COC (Yes/No) | Comments/Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | | | | | | | | |
| Arsenic | 57 | 73 | mg/kg | 18 | 16 | 89% | 10 | 300 | No Exceedance | 0.2 | **11%** | **5.3** | **6%** | **4.1** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Cadmium | 5.1 | 6.7 | mg/kg | 18 | 13 | 72% | 0.6 | 1.2 | No Exceedance | 0.1 | No Exceedance | 0.2 | No Exceedance | 0.2 | No | No | No | None |
| Chromium | 260 | 270 | mg/kg | 18 | 18 | 100% | -- | 55 | No Exceedance | -- | No Exceedance | 0.2 | No Exceedance | 0.2 | No | No | No | None |
| Copper | 390 | 390 | mg/kg | 18 | 18 | 100% | -- | 3,870 | No Exceedance | -- | **28%** | **9.9** | **28%** | **9.9** | **Yes** | No | **Yes** | Retained as a COC |
| Lead | 450 | 530 | mg/kg | 18 | 18 | 100% | -- | 939 | No Exceedance | -- | **11%** | **2.1** | **11%** | 1.8 | **Yes** | No | **Yes** | Retained as a COC |
| Mercury | 0.41 | 0.59 | mg/kg | 18 | 11 | 61% | -- | 17.8 | No Exceedance | -- | **28%** | **43.4** | **22%** | **30.2** | **Yes** | No | **Yes** | Retained as a COC |
| Nickel | NE | NE | mg/kg | 9 | 9 | 100% | -- | 35.5 | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | **Yes** | No | None |
| Silver | 6.1 | 6.1 | mg/kg | 18 | 11 | 61% | 0.9 | 0.5 | No Exceedance | 0.1 | No Exceedance | 0.1 | No Exceedance | 0.1 | No | No | No | None |
| Zinc | 410 | 960 | mg/kg | 18 | 18 | 100% | -- | 974 | No Exceedance | -- | **17%** | **2.4** | **6%** | 1.0 | **Yes** | No | **Yes** | Retained as a COC |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| Sum of LPAHs[7] | 5,200 | 5,200 | µg/kg | 3 | 3 | 100% | -- | 10,290 | No Exceedance | -- | **33%** | 2.0 | **33%** | 2.0 | **Yes** | No | **Yes** | LPAHs are retained as a COC based on one or more analytes meeting the initial selection criteria. |
| 2-Methylnaphthalene | 670 | 670 | µg/kg | 3 | 1 | 33% | 59 | 4,100 | No Exceedance | <0.1 | **33%** | **6.1** | **33%** | **6.1** | **Yes** | No | **Yes** | |
| Acenaphthene | 500 | 500 | µg/kg | 3 | 1 | 33% | 20 | 230 | No Exceedance | <0.1 | No Exceedance | 0.5 | No Exceedance | 0.5 | No | No | **Yes** | |
| Acenaphthylene | 1,300 | 1,300 | µg/kg | 3 | 0 | 0% | 59 | 250 | No Exceedance | <0.1 | No Exceedance | 0.2 | No Exceedance | 0.2 | No | No | **Yes** | |
| Anthracene | 960 | 960 | µg/kg | 3 | 3 | 100% | 9 | 1,420 | No Exceedance | -- | **33%** | 1.5 | **33%** | 1.5 | **Yes** | No | **Yes** | |
| Fluorene | 540 | 540 | µg/kg | 3 | 3 | 100% | 20 | 742 | No Exceedance | <0.1 | **33%** | 1.4 | **33%** | 1.4 | **Yes** | No | **Yes** | |
| Naphthalene | 2,100 | 2,100 | µg/kg | 3 | 1 | 33% | 59 | 3,060 | No Exceedance | <0.1 | **33%** | 1.5 | **33%** | 1.5 | **Yes** | No | **Yes** | |
| Phenanthrene | 1,500 | 1,500 | µg/kg | 3 | 3 | 100% | 9 | 5,070 | No Exceedance | -- | **33%** | **3.4** | **33%** | **3.4** | **Yes** | No | **Yes** | |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)** | | | | | | | | | | | | | | | | | | |
| Sum of LPAHs[7] | 370 | 780 | mg/kg OC | 10 | 10 | 100% | -- | 263.0 | No Exceedance | -- | No Exceedance | 0.7 | No Exceedance | 0.3 | No | No | **Yes** | LPAHs are retained as a COC based on one or more analytes meeting the initial selection criteria for dry weight evaluation. |
| 2-Methylnaphthalene | 38 | 64 | mg/kg OC | 10 | 7 | 70% | 0.36 | 6.4 | No Exceedance | <0.1 | No Exceedance | 0.2 | No Exceedance | 0.1 | No | No | **Yes** | |
| Acenaphthene | 16 | 57 | mg/kg OC | 10 | 8 | 80% | 0.36 | 16.5 | No Exceedance | <0.1 | 10% | 1.0 | No Exceedance | 0.3 | No | No | **Yes** | |
| Acenaphthylene | 66 | 66 | mg/kg OC | 10 | 9 | 90% | 3.3 | 15.6 | No Exceedance | 0.1 | No Exceedance | 0.2 | No Exceedance | 0.2 | No | No | **Yes** | |
| Anthracene | 220 | 1,200 | mg/kg OC | 10 | 10 | 100% | -- | 118.8 | No Exceedance | -- | No Exceedance | 0.5 | No Exceedance | 0.1 | No | No | **Yes** | |
| Fluorene | 23 | 79 | mg/kg OC | 10 | 9 | 90% | 3.3 | 19.4 | No Exceedance | 0.1 | No Exceedance | 0.8 | No Exceedance | 0.2 | No | No | **Yes** | |
| Naphthalene | 99 | 170 | mg/kg OC | 10 | 8 | 80% | 3.3 | 11 | No Exceedance | <0.1 | No Exceedance | 0.1 | No Exceedance | 0.1 | No | No | **Yes** | |
| Phenanthrene | 100 | 480 | mg/kg OC | 10 | 10 | 100% | -- | 122 | No Exceedance | -- | 10% | 1.2 | No Exceedance | 0.3 | No | No | **Yes** | |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| Sum of HPAHs[8] | 12,000 | 17,000 | µg/kg | 3 | 3 | 100% | -- | 28,020 | No Exceedance | -- | **33%** | **2.3** | **33%** | 1.6 | **Yes** | No | **Yes** | Retained as a COC based on the frequency of initial selection criteria exceedances for HPAHs. |
| Benzo(a)anthracene | 1,300 | 1,600 | µg/kg | 3 | 3 | 100% | -- | 1,420 | No Exceedance | -- | **33%** | 1.1 | No Exceedance | 0.9 | **Yes** | **Yes** | **Yes** | |
| Benzo(a)pyrene | 1,600 | 1,600 | µg/kg | 3 | 3 | 100% | -- | 4,100 | No Exceedance | -- | **33%** | **2.6** | **33%** | **2.6** | **Yes** | **Yes** | **Yes** | |
| Total Benzofluoranthenes[9] | 3,200 | 3,600 | µg/kg | 3 | 3 | 100% | -- | 2,990 | No Exceedance | -- | No Exceedance | 0.9 | No Exceedance | 0.8 | **Yes** | **Yes** | **Yes** | |
| Benzo(g,h,i)perylene | 670 | 720 | µg/kg | 3 | 3 | 100% | -- | 4,850 | No Exceedance | -- | **33%** | **7.2** | **33%** | **6.7** | **Yes** | No | **Yes** | |
| Chrysene | 1,400 | 2,800 | µg/kg | 3 | 3 | 100% | -- | 4,150 | No Exceedance | -- | **33%** | **3.0** | **33%** | 1.5 | **Yes** | **Yes** | **Yes** | |
| Dibenzo(a,h)anthracene | 230 | 230 | µg/kg | 3 | 2 | 67% | 6.1 | 3,060 | No Exceedance | <0.1 | **33%** | **13.3** | **33%** | **13.3** | **Yes** | No | **Yes** | |
| Fluoranthene | 1,700 | 2,500 | µg/kg | 3 | 3 | 100% | -- | 2,100 | No Exceedance | -- | **67%** | 1.2 | No Exceedance | 0.8 | **Yes** | No | **Yes** | |
| Indeno(1,2,3-c,d)pyrene | 600 | 690 | µg/kg | 3 | 3 | 100% | -- | 2,050 | No Exceedance | -- | **33%** | **3.4** | **33%** | **3.0** | **Yes** | **Yes** | **Yes** | |
| Pyrene | 2,600 | 3,300 | µg/kg | 3 | 3 | 100% | -- | 3,300 | No Exceedance | -- | **33%** | 1.3 | No Exceedance | 1.0 | **Yes** | No | **Yes** | |

| Contaminant of Potential Concern[1] (COPC) | Proposed Sediment Cleanup Level[2] SCO/ LAET | Proposed Sediment Cleanup Level[2] CSL/ 2LAET | Units | Evaluation of RI Data Results[3] Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | RL Exceedance Evaluation Frequency of RL Exceedance[4] (%) | RL Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | SCO/AET Exceedance Evaluation Frequency of PCUL Exceedance[4] (%) | SCO/AET Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | CSL/2AET Exceedance Evaluation Frequency of PCUL Exceedance[4] (%) | CSL/2AET Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | Contaminant of Concern (COC) Selection Considerations Initial COC Selection Criteria Met[6] (Yes/No) | Groundwater COC[7] (Yes/No) | Proposed Sediment COC (Yes/No) | Comments/Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)** | | | | | | | | | | | | | | | | | | |
| Sum of HPAHs[8] | 960 | 5,300 | mg/kg OC | 10 | 10 | 100% | -- | 1,888.1 | No Exceedance | -- | **30%** | 2.0 | No Exceedance | 0.4 | **Yes** | No | **Yes** | Retained as a COC based on the frequency of initial selection criteria exceedances for HPAHs. |
| Benzo(a)anthracene | 110 | 270 | mg/kg OC | 10 | 10 | 100% | -- | 166.7 | No Exceedance | -- | **20%** | 1.5 | No Exceedance | 0.6 | **Yes** | **Yes** | **Yes** | |
| Benzo(a)pyrene | 99 | 210 | mg/kg OC | 10 | 10 | 100% | -- | 135.9 | No Exceedance | -- | **30%** | 1.4 | No Exceedance | 0.6 | **Yes** | **Yes** | **Yes** | |
| Total Benzofluoranthenes[9] | 230 | 450 | mg/kg OC | 10 | 10 | 100% | -- | 281.6 | No Exceedance | -- | **20%** | 1.2 | No Exceedance | 0.6 | **Yes** | **Yes** | **Yes** | |
| Benzo(g,h,i)perylene | 31 | 78 | mg/kg OC | 10 | 8 | 80% | 0.56 | 70.9 | No Exceedance | <0.1 | **30%** | **2.3** | No Exceedance | 0.9 | **Yes** | No | **Yes** | |
| Chrysene | 110 | 460 | mg/kg OC | 10 | 10 | 100% | -- | 193.8 | No Exceedance | -- | **40%** | 1.8 | No Exceedance | 0.4 | **Yes** | **Yes** | **Yes** | |
| Dibenzo(a,h)anthracene | 12 | 33 | mg/kg OC | 10 | 8 | 80% | 0.56 | 17.3 | No Exceedance | <0.1 | **30%** | 1.4 | No Exceedance | 0.5 | **Yes** | No | **Yes** | |
| Fluoranthene | 160 | 1,200 | mg/kg OC | 10 | 10 | 100% | -- | 687.5 | No Exceedance | -- | **50%** | **4.3** | No Exceedance | 0.6 | **Yes** | No | **Yes** | |
| Indeno(1,2,3-c,d)pyrene | 34 | 88 | mg/kg OC | 10 | 10 | 100% | -- | 70.9 | No Exceedance | -- | **30%** | **2.1** | No Exceedance | 0.8 | **Yes** | **Yes** | **Yes** | |
| Pyrene | 1,000 | 1,400 | mg/kg OC | 10 | 10 | 100% | -- | 468.8 | No Exceedance | -- | No Exceedance | 0.5 | No Exceedance | 0.3 | No | No | **Yes** | |
| **Chlorinated Hydrocarbons (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 31 | 51 | µg/kg | 1 | 0 | 0% | 6.2 | -- | No Exceedance | 0.2 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,2-Dichlorobenzene | 35 | 50 | µg/kg | 1 | 0 | 0% | 6.2 | -- | No Exceedance | 0.2 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,4-Dichlorobenzene | 110 | 110 | µg/kg | 1 | 0 | 0% | 6.2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Hexachlorobenzene | 22 | 70 | µg/kg | 1 | 0 | 0% | 6.2 | -- | No Exceedance | 0.3 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| **Chlorinated Hydrocarbons (OC Normalized)** | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 0.81 | 1.8 | mg/kg OC | 9 | 0 | 0% | 0.6 | -- | No Exceedance | 0.7 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,2-Dichlorobenzene | 2.3 | 2.3 | mg/kg OC | 9 | 3 | 33% | 0.6 | 1.3 | No Exceedance | 0.3 | No Exceedance | 0.6 | No Exceedance | 0.6 | No | No | No | None |
| 1,4-Dichlorobenzene | 3.1 | 9 | mg/kg OC | 9 | 2 | 22% | 0.6 | 1 | No Exceedance | 0.2 | No Exceedance | 0.3 | No Exceedance | 0.1 | No | No | No | None |
| Hexachlorobenzene | 0.38 | 2.3 | mg/kg OC | 9 | 0 | 0% | 0.6 | -- | No Exceedance | 1.6 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| **Phthalates (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | 1,300 | 1,900 | µg/kg | 1 | 1 | 100% | -- | 400 | No Exceedance | -- | No Exceedance | 0.3 | No Exceedance | 0.2 | No | No | No | None |
| Butyl benzyl Phthalate | 63 | 900 | µg/kg | 1 | 0 | 0% | 15 | -- | No Exceedance | 0.2 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dibutyl Phthalate | 1,400 | 1,400 | µg/kg | 1 | 0 | 0% | 59 | -- | No Exceedance | <0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Diethyl Phthalate | 200 | 200 | µg/kg | 1 | 0 | 0% | 59 | -- | No Exceedance | 0.3 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dimethyl Phthalate | 71 | 160 | µg/kg | 1 | 0 | 0% | 59 | -- | No Exceedance | 0.8 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Di-N-Octyl Phthalate | 6,200 | 6,200 | µg/kg | 1 | 0 | 0% | 59 | -- | No Exceedance | <0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| **Phthalates (OC Normalized)** | | | | | | | | | | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | 47 | 78 | mg/kg OC | 9 | 7 | 78% | 5.6 | 36.7 | No Exceedance | 0.1 | No Exceedance | 0.8 | No Exceedance | 0.5 | No | No | No | None |
| Butyl benzyl Phthalate | 5 | 64 | mg/kg OC | 9 | 1 | 11% | 5.6 | 0.45 | No Exceedance | 1.1 | No Exceedance | 0.1 | No Exceedance | <0.1 | No | No | No | None |
| Dibutyl Phthalate | 220 | 1,700 | mg/kg OC | 9 | 0 | 0% | 4.2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Diethyl Phthalate | 61 | 110 | mg/kg OC | 9 | 0 | 0% | 4.2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dimethyl Phthalate | 53 | 53 | mg/kg OC | 9 | 0 | 0% | 4.2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Di-N-Octyl Phthalate | 58 | 4,500 | mg/kg OC | 9 | 0 | 0% | 4.2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| **Phenols (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| 2,4-Dimethylphenol | 29 | 29 | µg/kg | 10 | 2 | 20% | 20 | 40 | No Exceedance | 0.7 | 10% | 1.4 | 10% | 1.4 | -- | No | No | None |
| 2-methylphenol (o-Cresol) | 63 | 63 | µg/kg | 10 | 0 | 0% | 60 | -- | No Exceedance | 1.0 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-methylphenol (p-Cresol) | 670 | 670 | µg/kg | 10 | 4 | 40% | 58 | 59 | No Exceedance | 0.1 | No Exceedance | 0.1 | No Exceedance | 0.1 | No | No | No | None |
| Pentachlorophenol | 360 | 690 | µg/kg | 10 | 3 | 30% | 31 | 70 | No Exceedance | 0.1 | No Exceedance | 0.2 | No Exceedance | 0.1 | No | No | No | None |
| Phenol | 420 | 1,200 | µg/kg | 10 | 4 | 40% | 58 | 76 | No Exceedance | 0.1 | No Exceedance | 0.2 | No Exceedance | 0.1 | No | No | No | None |
| **Miscellaneous Extractables (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| Dibenzofuran | 540 | 540 | µg/kg | 1 | 0 | 0% | 59 | -- | No Exceedance | <0.1 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Hexachlorobutadiene | 11 | 120 | µg/kg | 1 | 0 | 0% | 6.2 | -- | No Exceedance | 0.6 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| N-Nitrosodiphenylamine | 28 | 40 | µg/kg | 1 | 0 | 0% | 6.2 | -- | No Exceedance | 0.2 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Benzoic Acid | 650 | 650 | µg/kg | 10 | 1 | 10% | 600 | 200 | No Exceedance | 0.9 | No Exceedance | 0.3 | No Exceedance | 0.3 | No | No | No | None |
| Benzyl Alcohol | 57 | 73 | µg/kg | 10 | 1 | 10% | 50 | 6.9 | No Exceedance | 0.9 | No Exceedance | 0.1 | No Exceedance | 0.1 | No | No | No | None |

| Contaminant of Potential Concern[1] (COPC) | Proposed Sediment Cleanup Level[2] SCO/ LAET | CSL/ 2LAET | Units | Evaluation of RI Data Results[3] Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | RL Exceedance Evaluation Frequency of RL Exceedance[4] (%) | RL Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | SCO/AET Exceedance Evaluation Frequency of PCUL Exceedance[4] (%) | SCO/AET Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | CSL/2AET Exceedance Evaluation Frequency of PCUL Exceedance[4] (%) | CSL/2AET Exceedance Evaluation Maximum Exceedance Ratio[5] (ER) | Contaminant of Concern (COC) Selection Considerations Initial COC Selection Criteria Met[6] (Yes/No) | Groundwater COC[7] (Yes/No) | Proposed Sediment COC (Yes/No) | Comments/Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Miscellaneous Extractables (OC Normalized)** | | | | | | | | | | | | | | | | | | |
| Dibenzofuran | 15 | 58 | mg/kg OC | 9 | 5 | 56% | 5.6 | 9.4 | No Exceedance | 0.4 | No Exceedance | 0.6 | No Exceedance | 0.2 | No | No | No | None |
| Hexachlorobutadiene | 3.9 | 6.2 | mg/kg OC | 9 | 0 | 0% | 0.6 | -- | No Exceedance | 0.2 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| N-Nitrosodiphenylamine | 11 | 11 | mg/kg OC | 9 | 1 | 11% | 0.6 | 1 | No Exceedance | 0.1 | No Exceedance | 0.1 | No Exceedance | 0.1 | No | No | No | None |
| **Pesticides** | | | | | | | | | | | | | | | | | | |
| 4,4'-DDD | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4,4'-DDE | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4,4'-DDT | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Total DDT (4,4 isomers) | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Aldrin | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Total Chlordane[10] | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dieldrin | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Heptachlor | NE | NE | µg/kg | 2 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| **Polychlorinated Biphenyls (PCBs) (Dry Weight)** | | | | | | | | | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | 0.13 | 1 | mg/kg | 3 | 2 | 67% | 0.021 | 0.168 | No Exceedance | 0.2 | **33%** | **1.3** | No Exceedance | 0.2 | **Yes** | -- | **Yes** | Retained as a COC |
| **Polychlorinated Biphenyls (PCBs) (OC Normalized)** | | | | | | | | | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | 12 | 65 | mg/kg OC | 10 | 5 | 50% | 3 | 37 | No Exceedance | 0.3 | **40%** | **3.1** | No Exceedance | 0.6 | **Yes** | -- | **Yes** | Retained as a COC |

**Notes:**

[1] Contaminants of potential concern (COPCs) were established for the RI based on a review of previous environmental studies. Previous sediment study results are summarized in Table C-1 (Appendix C).

[2] Proposed sediment cleanup levels for the protection of benthic organisms are referenced from Table 1.

[3] The sediment data used for this RI consists of samples obtained by GeoEngineers in 2008 in general accordance with the RI/FS Work Plan (GeoEngineers 2008a) as well as data collected by others to support dredge material suitability determination. Sediment characterization results are summarized in Table C-1 (Appendix C).

[4] Number of samples with analyte detected or non-detect at a concentration greater than PCUL / total number of samples analyzed for analyte.

[5] Exceedance Ratio (max) = ratio of maximum detected or non-detect concentration divided by the Screening Level

[6] Initial contaminant of concern (COC) selection criteria is met if exceedance frequency is greater or equal to 10 percent or if the exceedance ratio is greater than 2.

[7] Total LPAHs are the total of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene and anthracene; 2-methylnapthalene is not included in the sum of LPAHs.

[8] Total HPAHs are the total of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c-d)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene.

[9] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[10] Total chlordane represents the sum of concentrations of alpha-Chlordane (cis), gamma-Chlordane (trans), cis-nonachlor, trans-nonachlor and oxychlordane.

RL = Reporting Limit

NE = Not Established

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

OC = organic carbon normalized

-- = not applicable

Bold indicate satisfaction of initial COC selection criteria or consideration of other selection criteria.

Yellow shading indicates analyte is identified as a COC based on both satisfaction of initial selection criteria and consideration of other selection criteria, or on consideration of other selection criteria alone.

# Table 9

## Summary Statistics and Evaluation of Sediment Contaminants of Concern - Protection of Human Health and Higher Trophic Level Ecological Receptors

Dakota Creek Industries
Anacortes, Washington

| Contaminant of Potential Concern[1] (COPC) | Proposed Sediment Cleanup Level[2] | Units | Evaluation of RI Data Results[3] | | | | | | | | | Contaminant of Concern (COC) Selection Considerations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | | |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Initial COC Selection Criteria Met[6] (Yes/No) | Proposed Sediment COC (Yes/No) | Comments/Rationale |
| **Metals** | | | | | | | | | | | | | | |
| Arsenic | 11 | mg/kg | 17 | 15 | 88% | 10 | 300 | No Exceedance | 0.9 | **29%** | **27.3** | **Yes** | **Yes** | Retained as a COC |
| Cadmium | 0.8 | mg/kg | 17 | 11 | 65% | 0.6 | 1 | No Exceedance | 0.8 | 6% | 1.5 | No | No | None |
| Chromium | 6,900,000 | mg/kg | 17 | 17 | 100% | -- | 55 | No Exceedance | -- | No Exceedance | <0.1 | No | No | None |
| Copper | 180,000 | mg/kg | 17 | 17 | 100% | -- | 3,870 | No Exceedance | -- | No Exceedance | <0.1 | No | No | None |
| Lead | 21 | mg/kg | 17 | 17 | 100% | -- | 939 | No Exceedance | -- | **29%** | **44.7** | **Yes** | **Yes** | Retained as a COC |
| Mercury | 0.2 | mg/kg | 17 | 10 | 59% | -- | 17.8 | No Exceedance | -- | **35%** | **89.0** | **Yes** | **Yes** | Retained as a COC |
| Nickel | NE | mg/kg | 9 | 9 | 100% | -- | 36 | No Exceedance | -- | No Exceedance | -- | No | No | None |
| Silver | 23,000 | mg/kg | 17 | 10 | 59% | 0.9 | 1 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Zinc | 1,400,000 | mg/kg | 17 | 17 | 100% | -- | 974 | No Exceedance | -- | No Exceedance | <0.1 | No | No | None |
| **Organometallic Compounds** | | | | | | | | | | | | | | |
| Tributyltin, bulk | 73 | µg/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | None |
| Interstitial Tributyltin, porewater | 0.15 | µg/L | 5 | 4 | 80% | 0.08 | 0.45 | No Exceedance | 0.5 | **20%** | **3.0** | **Yes** | **Yes** | Retained as a COC |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)** | | | | | | | | | | | | | | |
| 2-Methylnaphthalene | 16,000,000 | µg/kg | 13 | 8 | 62% | 20 | 4,100 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | **Yes** | Retained as a COC based on the results of the benthic organism evaluation (Table 8). |
| Acenaphthene | 240,000,000 | µg/kg | 13 | 9 | 69% | 20 | 230 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | **Yes** | |
| Acenaphthylene | 240,000,000 | µg/kg | 13 | 9 | 69% | 20 | 250 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | **Yes** | |
| Anthracene | 1,200,000,000 | µg/kg | 13 | 13 | 100% | -- | 1,900 | No Exceedance | -- | No Exceedance | <0.1 | No | **Yes** | |
| Fluorene | 160,000,000 | µg/kg | 13 | 12 | 92% | 20 | 742 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | **Yes** | |
| Naphthalene | 79,000,000 | µg/kg | 13 | 12 | 92% | 20 | 3,060 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | **Yes** | |
| Phenanthrene | 1,200,000,000 | µg/kg | 13 | 13 | 100% | -- | 5,070 | No Exceedance | -- | No Exceedance | <0.1 | No | **Yes** | |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)** | | | | | | | | | | | | | | |
| Benzo(a)anthracene | NE | µg/kg | 13 | 13 | 100% | -- | 2,600 | No Exceedance | -- | No Exceedance | -- | No | **Yes** | Retained as a COC based on the results of the benthic organism evaluation (Table 8). |
| Benzo(a)pyrene | cPAH TEQ | µg/kg | 13 | 13 | 100% | -- | 4,100 | No Exceedance | -- | **cPAH TEQ** | **cPAH TEQ** | **Yes** | **Yes** | |
| Total Benzofluoranthenes[8] | NE | µg/kg | 13 | 13 | 100% | -- | 3,300 | No Exceedance | -- | No Exceedance | -- | No | **Yes** | |
| Benzo(g,h,i)perylene | 120,000,000 | µg/kg | 13 | 11 | 85% | 20 | 4,850 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | **Yes** | |
| Chrysene | NE | µg/kg | 13 | 13 | 100% | -- | 4,150 | No Exceedance | -- | No Exceedance | -- | No | **Yes** | |
| Dibenzo(a,h)anthracene | NE | µg/kg | 13 | 10 | 77% | 6.1 | 3,060 | No Exceedance | <0.1 | No Exceedance | -- | No | **Yes** | |
| Fluoranthene | 160,000,000 | µg/kg | 13 | 13 | 100% | -- | 11,000 | No Exceedance | -- | No Exceedance | <0.1 | No | **Yes** | |
| Indeno(1,2,3-c,d)pyrene | NE | µg/kg | 13 | 13 | 100% | -- | 2,050 | No Exceedance | -- | No Exceedance | -- | No | **Yes** | |
| Pyrene | 120,000,000 | µg/kg | 13 | 13 | 100% | -- | 7,500 | No Exceedance | -- | No Exceedance | <0.1 | No | **Yes** | |
| **Carcinogenic PAHs (cPAHs)** | | | | | | | | | | | | | | |
| Total cPAH TEQ[9] (ND=0.5 RL) | 21 | µg/kg | 13 | 13 | 100% | -- | 5,094 | No Exceedance | -- | **92%** | **242.5** | **Yes** | **Yes** | Retained as a COC |
| **Chlorinated Hydrocarbons** | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 140,000 | µg/kg | 10 | 0 | 0% | 9.9 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |
| 1,2-Dichlorobenzene | 370,000,000 | µg/kg | 10 | 3 | 30% | 9.9 | 18 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| 1,4-Dichlorobenzene | 780,000 | µg/kg | 10 | 2 | 20% | 9.9 | 14 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Hexachlorobenzene | 2,500 | µg/kg | 10 | 0 | 0% | 12 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |

| Contaminant of Potential Concern[1] (COPC) | Proposed Sediment Cleanup Level[2] | Units | Evaluation of RI Data Results[3] | | | | | | | | | Contaminant of Concern (COC) Selection Considerations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | | |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Initial COC Selection Criteria Met[6] (Yes/No) | Proposed Sediment COC (Yes/No) | Comments/Rationale |
| **Phthalates** | | | | | | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | 290,000 | µg/kg | 10 | 8 | 80% | 200 | 510 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Butyl benzyl Phthalate | 2,100,000 | µg/kg | 10 | 1 | 10% | 20 | 12 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Dibutyl Phthalate | 410,000,000 | µg/kg | 10 | 0 | 0% | 59 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |
| Diethyl Phthalate | 3,100,000,000 | µg/kg | 10 | 0 | 0% | 59 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |
| Dimethyl Phthalate | NE | µg/kg | 10 | 0 | 0% | 59 | -- | No Exceedance | -- | No Exceedance | -- | No | No | None |
| Di-N-Octyl Phthalate | 41,000,000 | µg/kg | 10 | 0 | 0% | 59 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |
| **Phenols** | | | | | | | | | | | | | | |
| 2,4-Dimethylphenol | 82,000,000 | µg/kg | 10 | 2 | 20% | 20 | 40 | No Exceedance | <0.1 | No Exceedance | <0.1 | -- | No | None |
| 2-methylphenol (o-Cresol) | 200,000,000 | µg/kg | 10 | 0 | 0% | 60 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |
| 4-methylphenol (p-Cresol) | 390,000,000 | µg/kg | 10 | 4 | 40% | 58 | 59 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Pentachlorophenol | 10,000,000 | µg/kg | 10 | 3 | 30% | 31 | 70 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Phenol | 1,200,000,000 | µg/kg | 10 | 4 | 40% | 58 | 76 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| **Miscellaneous Extractables** | | | | | | | | | | | | | | |
| Dibenzofuran | 4,100,000 | µg/kg | 10 | 5 | 50% | 20 | 130 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Hexachlorobutadiene | 52,000 | µg/kg | 10 | 0 | 0% | 20 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | None |
| N-Nitrosodiphenylamine | 830,000 | µg/kg | 10 | 1 | 10% | 20 | 6.1 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Benzoic Acid | 16,000,000,000 | µg/kg | 10 | 1 | 10% | 600 | 200 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| Benzyl Alcohol | 410,000,000 | µg/kg | 10 | 1 | 10% | 50 | 6.9 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | None |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | 0.0035 | mg/kg | 13 | 7 | 54% | 0.021 | 0.362 | **38%** | 6.0 | **54%** | **103.4** | **Yes** | **Yes** | Retained as a COC |
| **Dioxins and Furans** | | | | | | | | | | | | | | |
| Total Dioxin/Furan TEQ[10] (ND=0.5 RL) | 5 | mg/kg OC | 18 | 18 | 100% | -- | 148.94 | No Exceedance | -- | **33%** | **29.8** | **Yes** | **Yes** | Retained as a COC |



**Notes:**

[1] Contaminants of potential concern (COPCs) were established for the RI based on a review of previous environmental studies. Previous sediment study results are summarized in Table C-2 (Appendix C).

[2] Proposed sediment cleanup levels for the protection of human health and higher trophic level ecological receptors are referenced from Table 2.

[3] The sediment data used for this RI consists of samples obtained by GeoEngineers in 2008 in general accordance with the RI/FS Work Plan (GeoEngineers 2008a) as well as data collected by others to support dredge material suitability determination. Sediment characterization results are summarized in Table C-1 (Appendix C).

[4] Number of samples with analyte detected or non-detect at a concentration greater than PCUL / total number of samples analyzed for analyte.

[5] Exceedance Ratio (max) = ratio of maximum detected or non-detect concentration divided by the Screening Level

[6] Initial contaminant of concern (COC) selection criteria is met if exceedance frequency is greater or equal to 10 percent or if the exceedance ratio is greater than 2.

[7] Groundwater contaminants of concern (COCs) are presented in Table 10.

[8] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[9] Total cPAH Toxic Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) values referenced from MTCA Table 708.2 (WAC 173-340-900).

[10] Total dioxin and furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

RL = Reporting Limit

NE = Not Established

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

OC = organic carbon normalized

-- = not applicable

Bold indicate satisfaction of initial COC selection criteria or consideration of other selection criteria.

Yellow shading indicates analyte is identified as a COC based on both satisfaction of initial selection criteria and consideration of other selection criteria, or on consideration of other selection criteria alone.

# Table 10

## Summary Statistics and Evaluation of Groundwater Contaminants of Concern

Dakota Creek Industries

Anacortes, Washington

| Contaminant of Potential Concern[1] (COPC) | Proposed Groundwater Cleanup Level[2] (PCUL) | Units | Evaluation of RI Data Results[3] | | | | | | | | | Proposed Sediment COC[6] (Yes/No) | Contaminant of Concern (COC) Selection Considerations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | Initial Groundwater COC Selection Criteria Met[7] (Yes/No) | Proposed Groundwater COC (Yes/No) | Comments/Rationale |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | | | | |
| **Total Metals** | | | | | | | | | | | | | | | |
| Arsenic | 8 | µg/L | 53 | 28 | 53% | 16 | 153 | **11%** | 2.0 | **38%** | **19.1** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Cadmium | 7.9 | µg/L | 18 | 0 | 0% | 8 | -- | **22%** | 1.0 | No Exceedance | -- | No | No | No | RL for non-detect only slightly exceeded the PCUL and was not detected in other samples analyzed. |
| Total Chromium | 50 | µg/L | 18 | 6 | 33% | 20 | 16 | No Exceedance | 0.4 | No Exceedance | 0.3 | No | No | No | None |
| Copper | 20 | µg/L | 30 | 12 | 40% | 20 | 20 | No Exceedance | 1.0 | No Exceedance | 1.0 | No | No | No | None |
| Lead | 10 | µg/L | 18 | 2 | 11% | 5 | 2 | No Exceedance | 0.5 | No Exceedance | 0.2 | Yes | No | No | None |
| Mercury | 0.025 | µg/L | 30 | 14 | 47% | 0.2 | 0.037 | **53%** | **8.0** | 7% | 1.5 | **Yes** | No | No | RL for non-detect only slightly exceeded the PCUL and was not detected in other samples analyzed. |
| Nickel | 8.2 | µg/L | 53 | 28 | 53% | 20 | 27 | 8% | **2.4** | **25%** | **3.3** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Silver | 10 | µg/L | 24 | 0 | 0% | 10 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Zinc | 160 | µg/L | 45 | 5 | 11% | 50 | 30 | No Exceedance | 0.3 | No Exceedance | 0.2 | No | No | No | None |
| **Dissolved Metals** | | | | | | | | | | | | | | | |
| Arsenic | 8 | µg/L | 47 | 20 | 43% | 16 | 143 | **15%** | 2.0 | **16%** | **17.9** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Cadmium | 7.9 | µg/L | 12 | 0 | 0% | 8 | -- | **25%** | 1.0 | No Exceedance | -- | No | No | No | RL for non-detect only slightly exceeded the PCUL and was not detected in other samples analyzed. |
| Total Chromium | 50 | µg/L | 12 | 0 | 0% | 20 | 12 | No Exceedance | 0.4 | No Exceedance | 0.2 | No | No | No | None |
| Copper | 20 | µg/L | 24 | 4 | 17% | 20 | 17 | No Exceedance | 1.0 | No Exceedance | 0.9 | No | No | No | None |
| Lead | 10 | µg/L | 12 | 0 | 0% | 5 | -- | No Exceedance | 0.5 | No Exceedance | -- | Yes | No | No | None |
| Mercury | 0.025 | µg/L | 24 | 0 | 0% | 0.13 | -- | **67%** | **5.2** | No Exceedance | -- | **Yes** | No | No | RL for non-detect only slightly exceeded the PCUL and was not detected in other samples analyzed. |
| Nickel | 8.2 | µg/L | 47 | 18 | 38% | 10 | 27 | 9% | 1.2 | **14%** | **3.3** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Silver | 10 | µg/L | 24 | 0 | 0% | 10 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Zinc | 160 | µg/L | 24 | 1 | 4% | 50 | 28 | No Exceedance | 0.3 | No Exceedance | 0.2 | No | No | No | None |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | | |
| Gasoline-Range | 800 | µg/L | 29 | 0 | 0% | 100 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| Diesel-Range | 500 | µg/L | 29 | 1 | 3% | 256 | 180 | No Exceedance | 0.5 | No Exceedance | 0.4 | No | No | No | None |
| Heavy Oil-Range | 500 | µg/L | 29 | 0 | 0% | 500 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| **BETX Compounds** | | | | | | | | | | | | | | | |
| Benzene | 2 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 1.3 | No Exceedance | -- | No | No | No | Benzene not historically detected and RL for previous events below the PCUL. |
| Ethylbenzene | 31 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| Toluene | 130 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Xylenes | 630 | µg/L | 6 | 0 | 0% | 4 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |

| Contaminant of Potential Concern[1] (COPC) | Proposed Groundwater Cleanup Level[2] (PCUL) | Units | Evaluation of RI Data Results[3] | | | | | | | | | Contaminant of Concern (COC) Selection Considerations | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | | | |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Proposed Sediment COC[6] (Yes/No) | Initial Groundwater COC Selection Criteria Met[7] (Yes/No) | Proposed Groundwater COC (Yes/No) | Comments/Rationale |
| **Volatile Organic Compounds (VOCs)** | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 74 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,1,1-Trichloroethane | 12,000 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,1,2,2-Tetrachloroethane | 1 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | Other VOCs either were not detected or detected at concentrations greater than the PCUL. |
| 1,1,2-trichloro-1,2,2- trifluoroethane (CFC113) | 2,400 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,1,2-Trichloroethane | 1 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | Other VOCs either were not detected or detected at concentrations greater than the PCUL. |
| 1,1-Dichloroethane | 110 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,1-Dichloroethene | 280 | µg/L | 6 | 0 | 0% | 1 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,1-Dichloropropene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,2,3-Trichlorobenzene | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,2,3-Trichloropropane | NE | µg/L | 6 | 0 | 0% | 3 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,2,4-Trichlorobenzene | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 1,2,4-Trimethylbenzene | 61.0 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,2-Dibromo-3-chloropropane | NE | µg/L | 6 | 0 | 0% | 10 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,2-Dibromoethane (EDB) | 2.7 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.7 | No Exceedance | -- | No | No | No | None |
| 1,2-Dichlorobenzene | 800 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,2-Dichloroethane (EDC) | 42 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,2-Dichloropropane | 3.1 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.6 | No Exceedance | -- | No | No | No | None |
| 1,3,5-Trimethylbenzene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,3-Dichlorobenzene | 2 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 1,3-Dichloropropane | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 1,4-Dichlorobenzene | 22 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| 2,2-Dichloropropane | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 2-Butanone (MEK) | 3,800,000 | µg/L | 6 | 0 | 0% | 10 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 2-Chloroethyl Vinyl Ether | NE | µg/L | 6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | None |
| 2-Chlorotoluene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 2-Hexanone | NE | µg/L | 6 | 0 | 0% | 10 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-Chlorotoluene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-Methyl-2-Pentanone (Methyl Isobutyl Ketone) | 1,000,000 | µg/L | 6 | 0 | 0% | 10 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Acetone | 32,000,000 | µg/L | 6 | 0 | 0% | 25 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Acrolein | 50 | µg/L | 6 | 0 | 0% | 50 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Acrylonitrile | 1.0 | µg/L | 6 | 0 | 0% | 1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Bromobenzene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Bromochloromethane | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Bromoform | 12 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.2 | No Exceedance | -- | No | No | No | None |
| Bromomethane | 28 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| Carbon Disulfide | 870 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Carbon Tetrachloride | 1.00 | µg/L | 6 | 0 | 0% | 1 | -- | No Exceedance | 1.4 | No Exceedance | -- | No | No | No | None |
| Chlorobenzene | 200 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Chloroethane | 40,400 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Chloroform | 12 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.2 | No Exceedance | -- | No | No | No | None |
| Chloromethane | 340.0 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Cis-1,2-Dichloroethene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |

| Contaminant of Potential Concern[1] (COPC) | Proposed Groundwater Cleanup Level[2] (PCUL) | Units | Evaluation of RI Data Results[3] | | | | | | | | | Contaminant of Concern (COC) Selection Considerations | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | | | |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Proposed Sediment COC[6] (Yes/No) | Initial Groundwater COC Selection Criteria Met[7] (Yes/No) | Proposed Groundwater COC (Yes/No) | Comments/Rationale |
| Cis-1,3-Dichloropropene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dibromochloromethane | 2.2 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.9 | No Exceedance | -- | No | No | No | None |
| Dibromomethane | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dichlorobromomethane | 2.8 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.7 | No Exceedance | -- | No | No | No | None |
| Dichlorodifluoromethane (CFC 12) | 12 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | Not a COC. Other VOCs either were not detected or detected at concentrations greater than the PCUL. |
| Hexachlorobutadiene | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Isopropylbenzene | 1,600 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Methyl Iodide | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Methyl t-Butyl Ether (MTBE) | 6,100 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Methylene Chloride | 100 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| Naphthalene | 89 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| n-Butylbenzene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| n-Propylbenzene | 4,900 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| p-Isopropyltoluene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| sec-Butylbenzene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Styrene | 18,000 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| tert-Butylbenzene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Tetrachloroethene (PCE) | 2.9 | µg/L | 6 | 0 | 0% | 1 | -- | No Exceedance | 0.3 | No Exceedance | -- | No | No | No | None |
| Trans-1,2-Dichloroethene | 250 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Trans-1,3-Dichloropropene | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Trans-1,4-Dichloro-2-butene | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Trichloroethene (TCE) | 1.0 | µg/L | 6 | 0 | 0% | 1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Trichlorofluoromethane (CFC 11) | 260 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Vinyl Acetate | 17,000 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Vinyl Chloride | 1.0 | µg/L | 6 | 0 | 0% | 1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| **Semi-Volatile Organic Compounds (SVOCs)** | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 1.0 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 2.0 | No Exceedance | -- | No | No | No | None |
| 1,2-Dichlorobenzene | 800 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 1,3-Dichlorobenzene | 2 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 1,4-Dichlorobenzene | 22 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| 2,2'-Oxybis[1-chloropropane] | 37 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| 2,4,5-Trichlorophenol | 600 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 2,4,6-Trichlorophenol | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 2,4-Dichlorophenol | 10 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 0.5 | No Exceedance | -- | No | No | No | None |
| 2,4-Dimethylphenol | 97 | µg/L | 6 | 0 | 0% | 3 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 2,4-Dinitrophenol | 100 | µg/L | 6 | 0 | 0% | 25 | -- | No Exceedance | 0.3 | No Exceedance | -- | No | No | No | None |
| 2,4-Dinitrotoluene | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 2,6-Dinitrotoluene | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 2-Chloronaphthalene | 100 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| 2-Chlorophenol | 17 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| 2-Nitroaniline | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 2-Nitrophenol | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 3,3'-Dichlorobenzidine | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 3-Nitroaniline | NE | µg/L | 6 | 0 | 0% | 6 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |

| Contaminant of Potential Concern[1] (COPC) | Proposed Groundwater Cleanup Level[2] (PCUL) | Units | Evaluation of RI Data Results[3] | | | | | | | | | Contaminant of Concern (COC) Selection Considerations | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | | | |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Proposed Sediment COC[6] (Yes/No) | Initial Groundwater COC Selection Criteria Met[7] (Yes/No) | Proposed Groundwater COC (Yes/No) | Comments/Rationale |
| 4,6-Dinitro-2-methylphenol | 10 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.2 | No Exceedance | -- | No | No | No | None |
| 4-Bromophenyl-phenylether | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-Chloro-3-methylphenol | 36 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 0.1 | No Exceedance | -- | No | No | No | None |
| 4-Chloroaniline | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-Chlorophenyl-phenylether | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-Nitroaniline | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 4-Nitrophenol | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Benzoic acid | NE | µg/L | 6 | 0 | 0% | 50 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Benzyl alcohol | NE | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| bis(2-Chloroethoxy)methane | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| bis(2-chloroethyl)ether | 1.0 | µg/L | 6 | 0 | 0% | 0.54 | -- | No Exceedance | 0.5 | No Exceedance | -- | No | No | No | None |
| bis(2-Ethylhexyl)phthalate | 1.0 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | Other VOCs either were not detected or detected at concentrations greater than the PCUL. |
| Butylbenzylphthalate | 1.0 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | |
| Carbazole | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dibenzofuran | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Diethylphthalate | 200 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Dimethylphthalate | 600 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Di-n-butylphthalate | 8 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 0.3 | No Exceedance | -- | No | No | No | None |
| Di-n-octylphthalate | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Hexachlorobenzene | 1.0 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | Other VOCs either were not detected or detected at concentrations greater than the PCUL. |
| Hexachlorobutadiene | 1.0 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | |
| Hexachlorocyclopentadiene | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Hexachloroethane | 2.0 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Isophorone | 110 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| Nitrobenzene | 100 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| n-Nitroso-di-n-propylamine | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| n-Nitrosodiphenylamine | 1.0 | µg/L | 6 | 0 | 0% | 2 | -- | **100%** | 2.0 | No Exceedance | -- | No | No | No | Other VOCs either were not detected or detected at concentrations greater than the PCUL. |
| o-Cresol (2-Methylphenol) | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| p-Cresol (4-Methylphenol) | NE | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Pentachlorophenol | 5.0 | µg/L | 6 | 0 | 0% | 5 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Phenol | 70,000 | µg/L | 6 | 0 | 0% | 2 | -- | No Exceedance | <0.1 | No Exceedance | -- | No | No | No | None |
| **Non-Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | NE | µg/L | 30 | 0 | 0% | 0.095 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| 2-Methylnaphthalene | NE | µg/L | 30 | 0 | 0% | 0.095 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Acenaphthene | 5 | µg/L | 30 | 2 | 7% | 0.095 | 0.03 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | No | None |
| Acenaphthylene | NE | µg/L | 30 | 2 | 7% | 0.095 | 0.3 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Anthracene | 2 | µg/L | 30 | 3 | 10% | 0.095 | 0.05 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | No | None |
| Benzo[g,h,i]perylene | NE | µg/L | 30 | 4 | 13% | 0.095 | 0.02 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Fluoranthene | 2.2 | µg/L | 30 | 2 | 7% | 0.095 | 0.07 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | No | None |
| Fluorene | 4 | µg/L | 30 | 2 | 7% | 0.095 | 0.09 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | No | None |
| Naphthalene | 89 | µg/L | 30 | 2 | 7% | 0.100 | 0.03 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | No | None |
| Phenanthrene | NE | µg/L | 30 | 3 | 10% | 0.095 | 0.14 | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Pyrene | 2 | µg/L | 30 | 4 | 13% | 0.095 | 0.07 | No Exceedance | <0.1 | No Exceedance | <0.1 | No | No | No | None |

| Contaminant of Potential Concern[1] (COPC) | Proposed Groundwater Cleanup Level[2] (PCUL) | Units | Evaluation of RI Data Results[3] | | | | | | | | | Proposed Sediment COC[6] (Yes/No) | Contaminant of Concern (COC) Selection Considerations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | RL Exceedance Evaluation | | PCUL Exceedance Evaluation | | | | | |
| | | | Number Samples | Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Maximum Detected Concentration (µg/L) | Frequency of RL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | Frequency of PCUL Exceedance[4] (%) | Maximum Exceedance Ratio[5] (ER) | | Initial Groundwater COC Selection Criteria Met[7] (Yes/No) | Proposed Groundwater COC (Yes/No) | Comments/Rationale |
| **Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)** | | | | | | | | | | | | | | | |
| Benzo[a]anthracene | 0.01 | µg/L | 42 | 8 | 19% | 0.018 | 0.10 | 10% | 1.8 | 8% | **10** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Benzo[a]pyrene | 0.01 | µg/L | 42 | 4 | 10% | 0.018 | 0.12 | 10% | 1.8 | 3% | **12** | **Yes** | **Yes** | **Yes** | |
| Benzo[b]fluoranthene | 0.01 | µg/L | 42 | 4 | 10% | 0.018 | 0.18 | 10% | 1.8 | 5% | **18** | **Yes** | **Yes** | **Yes** | |
| Benzo[k]fluoranthene | 0.01 | µg/L | 42 | 4 | 10% | 0.018 | 0.07 | 10% | 1.8 | 5% | **6.8** | **Yes** | **Yes** | **Yes** | |
| Chrysene | 0.016 | µg/L | 42 | 5 | 12% | 0.018 | 0.14 | 10% | 1.1 | 3% | **8.8** | **Yes** | **Yes** | **Yes** | |
| Dibenz[a,h]anthracene | 0.01 | µg/L | 42 | 1 | 2% | 0.018 | 0.02 | 10% | 1.8 | 1% | 1.8 | **Yes** | No | **Yes** | |
| Indeno[1,2,3-c,d]pyrene | 0.01 | µg/L | 42 | 3 | 7% | 0.018 | 0.09 | 10% | 1.8 | 3% | **9.4** | **Yes** | **Yes** | **Yes** | |
| cPAHs TEQ[8] (ND = 0.5RL) | 0.01 | µg/L | 42 | 9 | 21% | 0.01 | 0.17 | 10% | 1.3 | 7% | **16.7** | **Yes** | **Yes** | **Yes** | |
| **Pesticides and Herbicides** | | | | | | | | | | | | | | | |
| 4,4'-DDD | 0.1 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 4,4'-DDE | 0.1 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| 4,4'-DDT | 0.1 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Aldrin | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Alpha-BHC | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Alpha-Chlordane (cis) | NE | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Beta-BHC | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Delta-BHC | NE | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Dieldrin | 0.1 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Endosulfan I | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Endosulfan II | NE | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Endosulfan Sulfate | 10 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 0.0 | No Exceedance | -- | No | No | No | None |
| Endrin | 0.1 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Endrin Aldehyde | 0.1 | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Endrin Ketone | NE | µg/L | 18 | 0 | 0% | 0.1 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Gamma-Chlordane | NE | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | -- | No Exceedance | -- | No | No | No | None |
| Heptachlor | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Heptachlor Epoxide | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| Lindane (Gamma-BHC) | 0.05 | µg/L | 18 | 0 | 0% | 0.052 | -- | No Exceedance | 1.0 | No Exceedance | -- | No | No | No | None |
| **Herbicides** | | | | | | | | | | | | | | | |
| 2,4,5-T | NE | µg/L | 18 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| 2,4-D | 12,000 | µg/L | 18 | 0 | 0% | 1.5 | -- | No Exceedance | <0.1 | No Exceedance | -- | -- | No | No | None |
| 2,4-DB | NE | µg/L | 18 | 0 | 0% | 10 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| Dalapon (DPA) | NE | µg/L | 18 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| Dicamba | NE | µg/L | 18 | 0 | 0% | 1 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| Dichlorprop | NE | µg/L | 18 | 0 | 0% | 3 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| Dinoseb | NE | µg/L | 18 | 0 | 0% | 2 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| MCPA | NE | µg/L | 18 | 0 | 0% | 260 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| Mecoprop (MCPP) | NE | µg/L | 18 | 0 | 0% | 250 | -- | No Exceedance | -- | No Exceedance | -- | -- | No | No | None |
| Silvex (Fenoprop or 2,4,5-TP) | 400 | µg/L | 18 | 0 | 0% | 1 | -- | No Exceedance | <0.1 | No Exceedance | -- | -- | No | No | None |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | | | | | | | |
| Total PCBs (Sum of Aroclors or Congeners) | 0.01 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | None |
| **Dioxins and Furans** | | | | | | | | | | | | | | | |
| Total Dioxins/Furans - Human Health TEQ[9] | 5 | pg/L | 13 | 8 | 62% | 2 | 2.18 | No Exceedance | 0.39 | No Exceedance | 0.4 | No | No | No | None |

**Notes:**

[1] Contaminants of potential concern (COPCs) were established for the RI based on a review of previous environmental studies. Previous sediment study results are summarized in Table F-1 (Appendix F).

[2] Proposed groundwater cleanup levels are referenced from Table 3.

[3] The groundwater data used for this RI consists of samples obtained by GeoEngineers between June 2008 and August 2017 in general accordance with the RI/FS Work Plan (GeoEngineers 2008a) and in coordination with Ecology. Groundwater results are summarized in Table F-1 (Appendix F).

[4] Number of samples with analyte detected or non-detect at a concentration greater than PCUL / total number of samples analyzed for analyte.

[5] Exceedance Ratio (max) = ratio of maximum detected or non-detect concentration divided by the Screening Level

[6] Sediment contaminants of concern (COCs) are presented in Tables 8 and 9.

[7] Initial contaminant of concern (COC) selection criteria is met if exceedance frequency is greater or equal to 10 percent or if the exceedance ratio is greater than 2.

[8] Total cPAH Toxic Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) values referenced from MTCA Table 708.2 (WAC 173-340-900).

[9] Total dioxin and furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

NE = Not Established

µg/L = micrograms per liter

ng/L = nanograms per liter

ND = Non-detect

RL = reporting limit

TEQ = toxicity equivalency concentration

Bold indicated satisfaction of initial COC or consideration of other selection criteria.

Yellow shading indicates analyte is identified as a COC based on both satisfaction of initial selection criteria and consideration of other selection criteria, or on consideration of other selection criteria alone.

# Table 11

## Summary Statistics and Evaluation of Soil Contaminants of Concern

Dakota Creek Industries
Anacortes, Washington

| Analyte | Proposed Soil Cleanup Level[1] | | Units | Evaluation of RI Data Results[2] | | | | | | | | | | | | | COC Selection Considerations | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | RL Exceedance Evaluation | | | Vadose Zone Exceedance Evaluation | | | Saturated Zone Exceedance Evaluation | | | | | | | |
| | Vadose Zone | Saturated Zone | | Total Number Samples | Total Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Frequency of RL Exceedance[3] (%) | Maximum Non-Detect Exceedance Ratio[4] | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | Proposed Groundwater COC[5] (Yes/No) | Initial Soil COC Selection Criteria Met[6] (Yes/No) | Proposed Soil COC (Yes/No) | Comments/Rationale |
| **Metals** | | | | | | | | | | | | | | | | | | | | |
| Arsenic | 20 | 20 | µg/L | 133 | 33 | 25% | 6.9 | No Exceedance | 0.3 | 910 | **27%** | **45.5** | 92 | 10% | **4.6** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Cadmium | 3,500 | 3,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Total Chromium | 5,300,000 | 5,300,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Copper | 140,000 | 140,000 | µg/L | 22 | 22 | 100% | -- | No Exceedance | -- | 1,100 | No Exceedance | -- | 2,000.0 | No Exceedance | -- | No | -- | No | None |
| Lead | 1,000 | 1,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Mercury | 1,100 | 1,100 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Nickel | 48 | 48 | µg/L | 85 | 25 | 29% | 48 | No Exceedance | 1.0 | 150 | **60%** | **3.1** | 200 | **21%** | **4.2** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Silver | 18,000 | 18,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Zinc | 1,100,000 | 1,100,000 | µg/L | 33 | 33 | 100% | 0 | No Exceedance | <0.1 | 2,800 | No Exceedance | -- | 720 | No Exceedance | -- | No | -- | No | None |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | | | | | | | |
| Gasoline-Range | 100 | 100 | µg/L | 2 | 0 | 0% | 3 | No Exceedance | -- | -- | No Exceedance | -- | - | No Exceedance | -- | No | No | **Yes** | Cleanup actions were previously completed to remove petroleum hydrocarbons in soil exceeding PCULs. However, the data used to confirm the removal of soil in these areas cannot be verified. Additional soil investigation activities will be performed within the footprints of the previously completed remedial excavations to verify the completeness of the previously completed cleanup actions, |
| Diesel-Range | 2,000 | 2,000 | µg/L | 5 | 3 | 60% | 25 | No Exceedance | <0.1 | -- | No Exceedance | -- | 420 | No Exceedance | 0.2 | No | No | **Yes** | |
| Heavy Oil-Range | 2,000 | 2,000 | µg/L | 5 | 3 | 60% | 50 | No Exceedance | <0.1 | -- | No Exceedance | -- | 330 | No Exceedance | 0.2 | No | No | **Yes** | |
| **BETX Compounds** | | | | | | | | | | | | | | | | | | | | |
| Benzene | 2,400 | 2,400 | µg/L | 2 | 0 | 0% | 0.030 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| Ethylbenzene | 350,000 | 350,000 | µg/L | 2 | 0 | 0% | 0.050 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| Toluene | 280,000 | 280,000 | µg/L | 2 | 0 | 0% | 0.050 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| Xylenes | 700,000 | 700,000 | µg/L | 2 | 0 | 0% | 0.02 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| **Volatile Organic Compounds (VOCs)** | | | | | | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 5,000 | 5,000 | µg/L | -- | -- | -- | -- | -- | <0.1 | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1,1-Trichloroethane | 7,000,000 | 7,000,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1,2,2-Tetrachloroethane | 660 | 660 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1,2-trichloro-1,2,2- trifluoroethane (CFC113) | 110,000,000 | 110,000,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1,2-Trichloroethane | 2,300 | 2,300 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1-Dichloroethane | 23,000 | 23,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1-Dichloroethene | 180,000 | 180,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,1-Dichloropropene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2,3-Trichlorobenzene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2,3-Trichloropropane | 4.4 | 4.4 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2,4-Trichlorobenzene | 4,500 | 4,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2,4-Trimethylbenzene | 35,000 | 35,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2-Dibromo-3-chloropropane | 160 | 160 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2-Dibromoethane (EDB) | 66 | 66 | µg/L | 5 | 0 | 0% | 0.005 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| 1,2-Dichlorobenzene | 320,000 | 320,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2-Dichloroethane (EDC) | 1400 | 1400 | µg/L | 5 | 0 | 0% | 0.01 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| 1,2-Dichloropropane | 3,500 | 3,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,3,5-Trimethylbenzene | 35,000 | 35,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,3-Dichlorobenzene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,3-Dichloropropane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,4-Dichlorobenzene | 24000 | 24000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,2-Dichloropropane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Butanone (MEK) | 2,100,000 | 2,100,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |

| Analyte | Proposed Soil Cleanup Level[1] | | Units | Evaluation of RI Data Results[2] | | | | | | | | | | | | | Proposed Groundwater COC[5] (Yes/No) | COC Selection Considerations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | RL Exceedance Evaluation | | | Vadose Zone Exceedance Evaluation | | | Saturated Zone Exceedance Evaluation | | | | | | | |
| | Vadose Zone | Saturated Zone | | Total Number Samples | Total Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Frequency of RL Exceedance[3] (%) | Maximum Non-Detect Exceedance Ratio[4] | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | | Initial Soil COC Selection Criteria Met[6] (Yes/No) | Proposed Soil COC (Yes/No) | Comments/Rationale |
| 2-Chloroethyl Vinyl Ether | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Chlorotoluene | 70,000 | 70,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Hexanone | 18,000 | 18,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Chlorotoluene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Methyl-2-Pentanone (Methyl Isobutyl Ketone) | 280,000 | 280,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Acetone | 3,200,000 | 3,200,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Acrolein | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Acrylonitrile | 240 | 240 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Bromobenzene | 28,000 | 28,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Bromochloromethane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Bromoform | 17,000 | 17,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Bromomethane | 4,900 | 4,900 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Carbon Disulfide | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Carbon Tetrachloride | 1,900 | 1,900 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Chlorobenzene | 70,000 | 70,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Chloroethane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Chloroform | 4200 | 4200 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Chloromethane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Cis-1,2-Dichloroethene | 7,000 | 7,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Cis-1,3-Dichloropropene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dibromochloromethane | 1,600 | 1,600 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dibromomethane | 35,000 | 35,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dichlorobromomethane | 2,100 | 2,100 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dichlorodifluoromethane (CFC 12) | 700,000 | 700,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Hexachlorobutadiene | 1,700 | 1,700 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Isopropylbenzene | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Methyl Iodide | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Methyl t-Butyl Ether (MTBE) | 73,000 | 73,000 | µg/L | 5 | 0 | 0% | 0 | No Exceedance | <0.1 | -- | No Exceedance | -- | -- | No Exceedance | -- | No | No | No | None |
| Methylene Chloride | 21,000 | 21,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Naphthalene | 70,000 | 70,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| n-Butylbenzene | 180,000 | 180,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| n-Propylbenzene | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| p-Isopropyltoluene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| sec-Butylbenzene | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Styrene | 700,000 | 700,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| tert-Butylbenzene | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Tetrachloroethene (PCE) | 21,000 | 21,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Trans-1,2-Dichloroethene | 70,000 | 70,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Trans-1,3-Dichloropropene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Trans-1,4-Dichloro-2-butene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Trichloroethene (TCE) | 1,800 | 1,800 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Trichlorofluoromethane (CFC 11) | 1,100,000 | 1,100,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Vinyl Acetate | 3,500,000 | 3,500,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Vinyl Chloride | 88 | 88 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| **Semi-Volatile Organic Compounds (SVOCs)** | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | 4,500 | 4,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,2-Dichlorobenzene | 320,000 | 320,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |

| Analyte | Proposed Soil Cleanup Level[1] | | Units | Evaluation of RI Data Results[2] | | | | | | | | | | | | | Proposed Groundwater COC[5] (Yes/No) | COC Selection Considerations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | RL Exceedance Evaluation | | | Vadose Zone Exceedance Evaluation | | | Saturated Zone Exceedance Evaluation | | | | | | | |
| | Vadose Zone | Saturated Zone | | Total Number Samples | Total Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Frequency of RL Exceedance[3] (%) | Maximum Non-Detect Exceedance Ratio[4] | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | | Initial Soil COC Selection Criteria Met[6] (Yes/No) | Proposed Soil COC (Yes/No) | Comments/Rationale |
| 1,3-Dichlorobenzene | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 1,4-Dichlorobenzene | 24,000 | 24,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,2'-Oxybis[1-chloropropane] | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,4,5-Trichlorophenol | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,4,6-Trichlorophenol | 3,500 | 3,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,4-Dichlorophenol | 11,000 | 11,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,4-Dimethylphenol | 70,000 | 70,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,4-Dinitrophenol | 7,000 | 7,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,4-Dinitrotoluene | 420 | 420 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2,6-Dinitrotoluene | 88 | 88 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Chloronaphthalene | 280,000 | 280,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Chlorophenol | 18,000 | 18,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Nitroaniline | 35,000 | 35,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 2-Nitrophenol | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 3,3'-Dichlorobenzidine | 290 | 290 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 3-Nitroaniline | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4,6-Dinitro-2-methylphenol | 280 | 280 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Bromophenyl-phenylether | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Chloro-3-methylphenol | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Chloroaniline | 660 | 660 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Chlorophenyl-phenylether | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Nitroaniline | 14,000 | 14,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4-Nitrophenol | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Benzoic acid | 14,000,000 | 14,000,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Benzyl alcohol | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| bis(2-Chloroethoxy)methane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| bis(2-chloroethyl)ether | 120 | 120 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| bis(2-Ethylhexyl)phthalate | 9,400 | 9,400 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Butylbenzylphthalate | 69,000 | 69,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Carbazole | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dibenzofuran | 3,500 | 3,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Diethylphthalate | 2,800,000 | 2,800,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dimethylphthalate | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Di-n-butylphthalate | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Di-n-octylphthalate | 35,000 | 35,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Hexachlorobenzene | 82 | 82 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Hexachlorobutadiene | 1,700 | 1,700 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Hexachlorocyclopentadiene | 21,000 | 21,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Hexachloroethane | 2,500 | 2,500 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Isophorone | 140,000 | 140,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Nitrobenzene | 7,000 | 7,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| n-Nitroso-di-n-propylamine | 19 | 19 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| n-Nitrosodiphenylamine | 27,000 | 27,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| o-Cresol (2-Methylphenol) | 180,000 | 180,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| p-Cresol (4-Methylphenol) | 350,000 | 350,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Pentachlorophenol | 330 | 330 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Phenol | 1,100,000 | 1,100,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| **Non-Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 4,500 | 4,500 | µg/L | 11 | 4 | 36% | 0.06 | No Exceedance | <0.1 | 0.06 | No Exceedance | -- | 0.28 | No Exceedance | -- | No | No | No | None |
| 2-Methylnaphthalene | 14,000 | 14,000 | µg/L | 11 | 4 | 36% | 0.03 | No Exceedance | <0.1 | 0.05 | No Exceedance | -- | 0.032 | No Exceedance | -- | No | No | No | None |
| Acenaphthene | 210,000 | 210,000 | µg/L | 11 | 2 | 18% | 0.02 | No Exceedance | <0.1 | 0.015 | No Exceedance | -- | 0.041 | No Exceedance | -- | No | No | No | None |

| Analyte | Proposed Soil Cleanup Level[1] | | Units | Evaluation of RI Data Results[2] | | | | | | | | | | | | | COC Selection Considerations | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | RL Exceedance Evaluation | | | Vadose Zone Exceedance Evaluation | | | Saturated Zone Exceedance Evaluation | | | | | | | |
| | Vadose Zone | Saturated Zone | | Total Number Samples | Total Number of Detections | Detection Frequency (%) | Maximum Non-Detect Concentration (µg/L) | Frequency of RL Exceedance[3] (%) | Maximum Non-Detect Exceedance Ratio[4] | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | Maximum Detected Concentration (µg/L) | Frequency of PCUL Exceedance[3] (%) | Maximum Exceedance Ratio[4] (ER) | Proposed Groundwater COC[5] (Yes/No) | Initial Soil COC Selection Criteria Met[6] (Yes/No) | Proposed Soil COC (Yes/No) | Comments/Rationale |
| Acenaphthylene | NE | NE | µg/L | 11 | 2 | 18% | 0.02 | No Exceedance | -- | 0.12 | No Exceedance | -- | 0.02 | No Exceedance | -- | No | No | No | None |
| Anthracene | 1,100,000 | 1,100,000 | µg/L | 11 | 4 | 36% | 0.02 | No Exceedance | <0.1 | 0.12 | No Exceedance | -- | 0.04 | No Exceedance | -- | No | No | No | None |
| Benzo[g,h,i]perylene | NE | NE | µg/L | 11 | 6 | 55% | 0.02 | No Exceedance | -- | 0.56 | No Exceedance | -- | 0.11 | No Exceedance | -- | No | No | No | None |
| Fluoranthene | 140,000 | 140,000 | µg/L | 11 | 6 | 55% | 0.05 | No Exceedance | <0.1 | 2.0 | No Exceedance | -- | 0.29 | No Exceedance | -- | No | No | No | None |
| Fluorene | 140,000 | 140,000 | µg/L | 11 | 4 | 36% | 0.03 | No Exceedance | <0.1 | 0.56 | No Exceedance | -- | 0.04 | No Exceedance | -- | No | No | No | None |
| Naphthalene | 70,000 | 70,000 | µg/L | 11 | 4 | 36% | 0.08 | No Exceedance | <0.1 | 0.56 | No Exceedance | -- | 0.08 | No Exceedance | -- | No | No | No | None |
| Phenanthrene | NE | NE | µg/L | 11 | 6 | 55% | 0.07 | No Exceedance | -- | 0.62 | No Exceedance | -- | 0.16 | No Exceedance | -- | No | No | No | None |
| Pyrene | 110,000 | 110,000 | µg/L | 11 | 6 | 55% | 0.05 | No Exceedance | <0.1 | 1.80 | No Exceedance | -- | 0.27 | No Exceedance | -- | No | No | No | None |
| **Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)** | | | | | | | | | | | | | | | | | | | | |
| Benzo[a]anthracene | 1.1 | 0.06 | µg/L | 19 | 7 | 37% | 0.02 | 26% | **0.3** | 0.94 | No Exceedance | **16** | 0.13 | 11% | **2.3** | **Yes** | **Yes** | **Yes** | Retained as a COC |
| Benzo[a]pyrene | 0.31 | 0.016 | µg/L | 19 | 7 | 37% | 0.02 | No Exceedance | **1** | 1.00 | **60%** | **65** | 0.13 | **22%** | **9.2** | **Yes** | **Yes** | **Yes** | |
| Benzo[b]fluoranthene | 3.9 | 0.20 | µg/L | 19 | 7 | 37% | 0.02 | No Exceedance | **0.1** | 0.92 | No Exceedance | **4.7** | 0.12 | No Exceedance | 0.7 | **Yes** | **Yes** | **Yes** | |
| Benzo[k]fluoranthene | 39 | 2.0 | µg/L | 19 | 6 | 32% | 0.02 | No Exceedance | 0.0 | 1.10 | No Exceedance | 0.6 | 0.12 | No Exceedance | <0.1 | **Yes** | **Yes** | **Yes** | |
| Chrysene | 127 | 6.4 | µg/L | 19 | 7 | 37% | 0.02 | No Exceedance | 0.0 | 1.10 | No Exceedance | 0.2 | 0.15 | No Exceedance | <0.1 | **Yes** | **Yes** | **Yes** | |
| Dibenz[a,h]anthracene | 0.6 | 0.029 | µg/L | 19 | 3 | 16% | 0.02 | No Exceedance | **1** | 0.56 | No Exceedance | **20** | 0.04 | 11% | **6.5** | **Yes** | **Yes** | **Yes** | |
| Indeno[1,2,3-c,d]pyrene | 11 | 0.56 | µg/L | 19 | 6 | 32% | 0.02 | No Exceedance | 0.0 | 0.64 | No Exceedance | 1.2 | 0.09 | No Exceedance | 0.2 | **Yes** | **Yes** | **Yes** | |
| cPAHs TEQ (ND = 0.5RL) | 0.31 | 0.016 | µg/L | 19 | 7 | 37% | 0.02 | 11% | **2** | 1.38 | 40% | **89** | 0.18 | **33%** | **12.7** | **Yes** | **Yes** | **Yes** | |
| **Pesticides and Herbicides** | | | | | | | | | | | | | | | | | | | |
| 4,4'-DDD | 110 | 110 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4,4'-DDE | 390 | 390 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| 4,4'-DDT | 4 | 4 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Aldrin | 7.7 | 7.7 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Alpha-BHC | 21 | 21 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Alpha-Chlordane (cis) | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Beta-BHC | 73 | 73 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Delta-BHC | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Dieldrin | 8.2 | 8.2 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Endosulfan I | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Endosulfan II | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Endosulfan Sulfate | 21,000 | 21,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Endrin | 1,100 | 1,100 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Endrin Aldehyde | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Endrin Ketone | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Gamma-Chlordane | NE | NE | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Heptachlor | 29 | 29 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Heptachlor Epoxide | 14 | 14 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Lindane (Gamma-BHC) | 0.01 | 0.01 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Methoxychlor | 18,000 | 18,000 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| Toxaphene | 120 | 120 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | | | | | | | | | | | |
| Total PCBs (Sum of Aroclors or Congeners) | 10 | 10 | µg/L | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No | -- | No | Not identified as a COPC |
| **Dioxins and Furans** | | | | | | | | | | | | | | | | | | | |
| Total Dioxins/Furans - Human Health TEQ | 1,700 | 1,700 | ng/L | 6 | 6 | 100% | -- | No Exceedance | -- | 4.27 | No Exceedance | <1 | 0.22 | No Exceedance | <1 | No | No | No | None |

**Notes:**

[1] Proposed soil cleanup levels are referenced from Table 4.

[2] Data used to evaluate Site soil conditions are presented in Table G-1 (Appendix G).

[3] Number of samples with analyte detected or non-detect at a concentration greater than PCUL / total number of samples analyzed for analyte.

[4] Exceedance Ratio (max) = ratio of maximum detected or non-detect concentration divided by the Screening Level

[5] Groundwater contaminants of concern (COCs) are presented in Table 10.

[6] Initial contaminant of concern (COC) selection criteria is met if exceedance frequency is greater or equal to 10 percent or if the exceedance ratio is greater than 2.

NE = Not Established

µg/L = micrograms per liter

ng/L = nanograms per liter

ND = Non-detect

RL = reporting limit

TEQ = toxicity equivalency concentration

Bold indicated satisfaction of initial COC or consideration of other selection criteria.

Yellow shading indicates analyte is identified as a COC based on both satisfaction of initial selection criteria and consideration of other selection criteria, or on consideration of other selection criteria alone.

# Table 12

## Sediment Contaminant of Concern Chemical Analytical Data – Protection of Benthic Organisms

Dakota Creek Industries

Anacortes, Washington

| Sample Location ID[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level[2] | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A | DCI06-2-D | FB-A4-14 | FB-A4-15 | SMA 1-1 | | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | | |
| **Conventionals** | | | | | | | | | | |
| Total Organic Carbon (TOC) | % | **0.167** | **0.64** | **0.641** | **1.15** | **0.95 J** | **0.26** | 0.12 | NE | NE |
| Total Volatile Solids (TVS) | % | -- | -- | -- | -- | **2.46 J** | **2.35** | -- | NE | NE |
| Total Solids (TS) | % | N/A | **78.2** | **78.3** | **78.2** | **79.1 J** | **76.8** | 78.1 | NE | NE |
| Total Ammonia | mg-N/kg | -- | -- | -- | -- | **13.6 J** | **5.9** | -- | NE | NE |
| Total Sulfide | mg/kg | -- | -- | -- | -- | **0.07 J** | 6.7 UJ | -- | NE | NE |
| **Grain Size** | | | | | | | | | | |
| Gravel *(>2,000 µm)* | % | -- | -- | -- | -- | -- | **59.9** | -- | NE | NE |
| *µm)* | % | | -- | -- | -- | -- | **7.29** | -- | NE | NE |
| Coarse Sand *(1,000 to 500 µm)* | % | | -- | -- | -- | -- | | -- | NE | NE |
| Medium Sand *(500 to 250 µm)* | % | -- | -- | -- | -- | | | -- | NE | NE |
| Fine Sand *(250 to 125 µm)* | % | | -- | -- | -- | | | -- | NE | NE |
| Very Fine Sand *(125 to 62.5 µm)* | % | | -- | -- | -- | | | -- | NE | NE |
| Coarse Silt *(62.5 to 31 µm)* | % | | -- | -- | -- | -- | **3.52** | -- | NE | NE |
| Medium Silt *(31 to 15.6 µm)* | % | | -- | -- | -- | | | -- | NE | NE |
| Fine Silt *(15.6 to 7.8 µm)* | % | -- | -- | -- | -- | | | -- | NE | NE |
| Very Fine Silt *(7.8 to 3.9 µm)* | % | | -- | -- | -- | | | -- | NE | NE |
| Clay *(3.9 to <1 µm)* | % | -- | -- | -- | -- | -- | **1.25** | -- | NE | NE |
| Total Fines *(<62.5 µm)* | % | -- | -- | -- | -- | -- | **4.77** | -- | NE | NE |
| **Metals** | | | | | | | | | | |
| Arsenic | mg/kg | **2.1 J** | -- | -- | -- | **2.37** | **2.1** | -- | 57 | 73 |
| Cadmium | mg/kg | ND | -- | -- | -- | **0.09** | 0.08 U | **0.054** | 5.1 | 6.7 |
| Chromium | mg/kg | **13.4** | -- | -- | -- | **12.3** | **13.5** | **26.2** | 260 | 270 |
| Copper | mg/kg | **15.3** | -- | -- | -- | **10.4** | **9.49** | **27.4** | 390 | 390 |
| Lead | mg/kg | **6.23 J** | -- | -- | -- | **2.23 J** | **1.63** | **4.08** | 450 | 530 |
| Mercury | mg/kg | ND | -- | -- | -- | **0.01 J** | **0.01** | **0.033** | 0.41 | 0.59 |
| Silver | mg/kg | **0.0582** | -- | -- | -- | 0.02 U | **0.03** | **0.07** | 6.1 | 6.1 |
| Zinc | mg/kg | **21.3** | -- | -- | -- | **20.9** | **19.1** | **43.9** | 410 | 960 |

| Sample Location ID[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level[2] | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A | DCI06-2-D | FB-A4-14 | FB-A4-15 | SMA 1-1 | | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | | |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)** | | | | | | | | | | |
| Sum of LPAHs[3] | µg/kg | -- | -- | -- | -- | 9.6 | 9.1 U | **4.40** | 5,200 | 5,200 |
| 2-Methylnaphthalene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.85 J** | 670 | 670 |
| Acenaphthene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.91 J** | 500 | 500 |
| Acenaphthylene | µg/kg | -- | -- | -- | -- | **1.4 J** | 9.1 U | 0.24 U | 1,300 | 1,300 |
| Anthracene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.5 J** | 960 | 960 |
| Fluorene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **1.1 J** | 540 | 540 |
| Naphthalene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **2.5** | 2,100 | 2,100 |
| Phenanthrene | µg/kg | -- | -- | -- | -- | **8.2 J** | 9.1 U | **2.9** | 1,500 | 1,500 |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)** | | | | | | | | | | |
| Sum of LPAHs[3] | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **6.03 J** | 370 | 780 |
| 2-Methylnaphthalene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **0.71 J** | 38 | 64 |
| Acenaphthene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **0.76 J** | 16 | 57 |
| Acenaphthylene | mg/kg OC | -- | -- | -- | -- | **0.15 J** | 3.5 U | 0.2 U | 66 | 66 |
| Anthracene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **0.42 J** | 220 | 1,200 |
| Fluorene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **0.92 J** | 23 | 79 |
| Naphthalene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **2.1 J** | 99 | 170 |
| Phenanthrene | mg/kg OC | -- | -- | -- | -- | **0.86 J** | 3.5 U | **2.4 J** | 100 | 480 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)** | | | | | | | | | | |
| Sum of HPAHs[4] | µg/kg | -- | -- | -- | -- | **121 J** | **2.2 J** | **9.35 J** | 12,000 | 17,000 |
| Benzo(a)anthracene | µg/kg | -- | -- | -- | -- | **4.1 J** | 9.1 U | **1.3 J** | 1,300 | 1,600 |
| Benzo(a)pyrene | µg/kg | -- | -- | -- | -- | **2.6 J** | 9.1 U | **0.86 J** | 1,600 | 1,600 |
| Total Benzofluoranthenes[5] | µg/kg | -- | -- | -- | -- | **9.9 J** | 9.1 U | **1.87 J** | 3,200 | 3,600 |
| Benzo(g,h,i)perylene | µg/kg | -- | -- | -- | -- | **2 J** | 9.1 U | **0.94 J** | 670 | 720 |
| Chrysene | µg/kg | -- | -- | -- | -- | **18** | 9.1 U | **1.1 J** | 1,400 | 2,800 |
| Dibenzo(a,h)anthracene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 0.28 U | 230 | 230 |
| Fluoranthene | µg/kg | -- | -- | -- | -- | **50** | **2.2 J** | **3** | 1,700 | 2,500 |
| Indeno(1,2,3-c,d)pyrene | µg/kg | -- | -- | -- | -- | **1.8 J** | 9.1 U | **0.83 J** | 600 | 690 |
| Pyrene | µg/kg | -- | -- | -- | -- | **33** | 9.1 U | **4.0** | 2,600 | 3,300 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)** | | | | | | | | | | |
| Sum of HPAHs[4] | mg/kg OC | -- | -- | -- | -- | **12.7 J** | **0.85 J** | **7.79 J** | 960 | 5,300 |
| Benzo(a)anthracene | mg/kg OC | -- | -- | -- | -- | **0.43 J** | 3.5 U | **1.08 J** | 110 | 270 |
| Benzo(a)pyrene | mg/kg OC | -- | -- | -- | -- | **0.27 J** | 3.5 U | **0.72 J** | 99 | 210 |
| Total Benzofluoranthenes[5] | mg/kg OC | -- | -- | -- | -- | **1.04 J** | 3.5 U | **1.56 J** | 230 | 450 |
| Benzo(g,h,i)perylene | mg/kg OC | -- | -- | -- | -- | **0.21 J** | 3.5 U | **0.78 J** | 31 | 78 |
| Chrysene | mg/kg OC | -- | -- | -- | -- | **1.89 J** | 3.5 U | **0.92 J** | 110 | 460 |
| Dibenzo(a,h)anthracene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 0.23 U | 12 | 33 |
| Fluoranthene | mg/kg OC | -- | -- | -- | -- | **5.26 J** | **0.85 J** | **2.5** | 160 | 1,200 |
| Indeno(1,2,3-c,d)pyrene | mg/kg OC | -- | -- | -- | -- | **0.19 J** | 3.5 U | **0.69 J** | 34 | 88 |
| Pyrene | mg/kg OC | -- | -- | -- | -- | **3.47 J** | 3.5 U | **3.3** | 1,000 | 1,400 |

| Sample Location ID[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level[2] | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A | DCI06-2-D | FB-A4-14 | FB-A4-15 | SMA 1-1 | | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | | |
| **Chlorinated Hydrocarbons (Dry Weight)** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.6 U | 31 | 51 |
| 1,2-Dichlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.9 U | 35 | 50 |
| 1,4-Dichlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.9 U | 110 | 110 |
| Hexachlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 1.2 U | 22 | 70 |
| **Chlorinated Hydrocarbons (OC Normalized)** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 2.2 U | 0.81 | 1.8 |
| 1,2-Dichlorobenzene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 2.4 U | 2.3 | 2.3 |
| 1,4-Dichlorobenzene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 2.4 U | 3.1 | 9 |
| Hexachlorobenzene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 1 U | 0.38 | 2.3 |
| **Phthalates (Dry Weight)** | | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | µg/kg | -- | -- | -- | -- | **97** | **91** | 7 U | 1,300 | 1,900 |
| Butyl benzyl Phthalate | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 3.2 U | 63 | 900 |
| Dibutyl Phthalate | µg/kg | -- | -- | -- | -- | **9.2 J** | **16** | 7.9 U | 1,400 | 1,400 |
| Diethyl Phthalate | µg/kg | -- | -- | -- | -- | **1.9 J** | 9.1 U | 1.3 U | 200 | > 1,200 |
| Dimethyl Phthalate | µg/kg | -- | -- | -- | -- | **1 J** | 9.1 U | 1 U | 71 | 160 |
| Di-N-Octyl Phthalate | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 1.7 U | 6,200 | 6,200 |
| **Phthalates (OC Normalized)** | | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | -- | -- | -- | -- | **10.21** | **35** | 5.83 U | 47 | 78 |
| Butyl benzyl Phthalate | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 2.67 U | 5 | 64 |
| Dibutyl Phthalate | mg/kg OC | -- | -- | -- | -- | **0.97 J** | **6.15** | 6.58 U | 220 | 1,700 |
| Diethyl Phthalate | mg/kg OC | -- | -- | -- | -- | **0.2 J** | 3.50 | 1.08 U | 61 | 110 |
| Dimethyl Phthalate | mg/kg OC | -- | -- | -- | -- | **0.11 J** | 3.5 U | 0.83 U | 53 | 53 |
| Di-N-Octyl Phthalate | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 1.42 U | 58 | 4,500 |
| **Phenols (Dry Weight)** | | | | | | | | | | |
| 2,4-Dimethylphenol | µg/kg | -- | -- | -- | -- | -- | **46 R** | 5.5 U | 29 | 29 |
| 2-methylphenol (o-Cresol) | µg/kg | -- | -- | -- | -- | -- | 9.1 U | 1.5 U | 63 | 63 |
| 4-methylphenol (p-Cresol) | µg/kg | -- | -- | -- | -- | -- | 9.1 U | **3.4 J** | 670 | 670 |
| Pentachlorophenol | µg/kg | -- | -- | -- | -- | -- | 91 U | 20 U | 360 | 690 |
| Phenol | µg/kg | -- | -- | -- | -- | -- | 28 U | 2 U | 420 | 1,200 |
| **Miscellaneous Extractables (Dry Weight)** | | | | | | | | | | |
| Dibenzofuran | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.87 J** | 540 | 540 |
| Hexachlorobutadiene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.5 U | 11 | 120 |
| N-Nitrosodiphenylamine | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 1.6 U | 28 | 40 |
| Benzoic Acid | µg/kg | -- | -- | -- | -- | **200** | **190 R** | 96 U | 650 | 650 |
| Benzyl Alcohol | µg/kg | -- | -- | -- | -- | **6.2 J** | 19 U | 2.1 U | 57 | 73 |
| **Miscellaneous Extractables (OC Normalized)** | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | **0.73 J** | 15 | 58 |
| Hexachlorobutadiene | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 2.08 U | 3.9 | 6.2 |
| N-Nitrosodiphenylamine | mg/kg OC | -- | -- | -- | -- | 1.01 U | 3.5 U | 1.33 U | 11 | 11 |

| Sample Location ID[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level2 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A | DCI06-2-D | FB-A4-14 | FB-A4-15 | SMA 1-1 | | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | | |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| 4,4'-DDE | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| 4,4'-DDT | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| Total DDT (4,4 isomers) | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| Aldrin | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| Total Chlordane | µg/kg | -- | -- | -- | -- | 9.9 U | -- | -- | NE | NE |
| Dieldrin | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| Heptachlor | µg/kg | -- | -- | -- | -- | 0.99 U | -- | -- | NE | NE |
| **Polychlorinated Biphenyls (PCBs) (Dry Weight)** | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | mg/kg | -- | -- | -- | -- | 0.02 U | 0.013 U | 0.0013 U | 0.13 | 1 |
| **Polychlorinated Biphenyls (PCBs) (OC Normalized)** | | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | mg/kg OC | -- | -- | -- | -- | 2.11 U | 5 U | 1.08 U | 12 | 65 |

Notes:

[1] Sediment sample locations are shown on Figure 12.

[2] Proposed sediment cleanup levels for the protection of benthic organisms are referenced from Table 1.

[3] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[4] Total HPAH represents the sum of the detected concentrations of the following HPAH compounds: benz[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, dibenzo[a,h]anthracene, fluoranthene, indeno[1,2,3-c,d]pyrene, pyrene, and total benzofluoranthenes. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[5] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

SCO = Sediment Cleanup Objective

CSL = Cleanup Screening Level

LAET = Lowest Apparent Effects Threshold

2LAET = Second Lowest Apparent Effects Threshold

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

mg/kg = milligram per kilogram

mg/kg OC = milligram per kilogram normalized to organic carbon

µg/kg = microgram per kilogram

-- = not analyzed

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeters

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the SCO/LAET screening level.

Orange shading indicates exceedance of the CSL/2LAET screening level.

Grey text indicates that the reported value is not compared to the screening levels because the TOC concentration of the sample is outside the specified range for application of the screening level.

Blue shading indicates that the practical quantitation limit (PQL) is above screening level.

# Table 12

## Sediment Contaminant of Concern Chemical Analytical Data – Protection of Benthic Organisms

Dakota Creek Industries

Anacortes, Washington

| Sample Location ID[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | Proposed Sediment Screening Level[2] | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | | |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | | |
| **Conventionals** | | | | | | | | | |
| Total Organic Carbon (TOC) | % | 0.09 | 0.09 | 0.1 | 0.09 | 0.32 | 0.44 | NE | NE |
| Total Volatile Solids (TVS) | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Total Solids (TS) | % | 73.2 | 73.2 | 86.7 | 85.7 | 83.6 | 85 | NE | NE |
| Total Ammonia | mg-N/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| Total Sulfide | mg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| **Grain Size** | | | | | | | | | |
| Gravel *(>2,000 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| *µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Coarse Sand *(1,000 to 500 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Medium Sand *(500 to 250 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Fine Sand *(250 to 125 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Very Fine Sand *(125 to 62.5 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Coarse Silt *(62.5 to 31 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Medium Silt *(31 to 15.6 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Fine Silt *(15.6 to 7.8 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Very Fine Silt *(7.8 to 3.9 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Clay *(3.9 to <1 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| Total Fines *(<62.5 µm)* | % | -- | -- | -- | -- | -- | -- | NE | NE |
| **Metals** | | | | | | | | | |
| Arsenic | mg/kg | -- | -- | -- | -- | -- | -- | 57 | 73 |
| Cadmium | mg/kg | **0.091** | **0.078** | **0.077** | **0.071** | 0.3 U | 0.3 U | 5.1 | 6.7 |
| Chromium | mg/kg | **12.7** | **51.1** | **244** | **96.9** | **35.3** | **33.3** | 260 | 270 |
| Copper | mg/kg | **16.1** | **23.6** | **27.8** | **25.7** | **29.1** | **25.9** | 390 | 390 |
| Lead | mg/kg | **3.73** | **4.21** | **2.45** | **3** | 3 U | 2.9 U | 450 | 530 |
| Mercury | mg/kg | **0.0453** | **0.0221** | **0.032** | **0.036** | **0.041** | **0.036** | 0.41 | 0.59 |
| Silver | mg/kg | **0.05** | **0.07** | **0.07** | **0.06** | 0.8 U | **0.8** | 6.1 | 6.1 |
| Zinc | mg/kg | **25.4** | **42** | **43.7** | **44.2** | **53** | **41.7** | 410 | 960 |

| Sample Location ID[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | Proposed Sediment Screening Level[2] | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | | |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | | |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)** | | | | | | | | | |
| Sum of LPAHs[3] | µg/kg | **1.71** | **2.11** | **3.89** | **2.98** | **4.2** | **1.9** | 5,200 | 5,200 |
| 2-Methylnaphthalene | µg/kg | **6.8** | **0.61 J** | **0.5 J** | **0.42 J** | **0.79 J** | **0.53 J** | 670 | 670 |
| Acenaphthene | µg/kg | **6.8** | **0.78 J** | 0.23 U | 0.23 U | **5.1 J** | **0.91 J** | 500 | 500 |
| Acenaphthylene | µg/kg | **0.45 J** | **0.44 J** | 0.24 U | 0.24 U | **0.39 J** | 0.24 U | 1,300 | 1,300 |
| Anthracene | µg/kg | **8.3** | **2.5** | 0.47 U | 0.47 U | **2.8 J** | **0.82 J** | 960 | 960 |
| Fluorene | µg/kg | **8.6** | **1.3 J** | 0.5 U | 0.5 U | **4.5 J** | **1.2 J** | 540 | 540 |
| Naphthalene | µg/kg | **10** | **1.3 J** | **0.91 J** | **0.82 J** | **5 J** | **0.81 J** | 2,100 | 2,100 |
| Phenanthrene | µg/kg | **33** | **6.3** | **0.81 J** | **0.9 J** | **15 J** | **3.8** | 1,500 | 1,500 |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)** | | | | | | | | | |
| Sum of LPAHs[3] | mg/kg OC | **67.1 J** | **13.2 J** | **1.72 J** | **1.91 J** | **10.49 J** | **1.86 J** | 370 | 780 |
| 2-Methylnaphthalene | mg/kg OC | **7.6** | **0.68 J** | **0.5 J** | **0.47 J** | **0.25 J** | **0.12 J** | 38 | 64 |
| Acenaphthene | mg/kg OC | **7.6** | **0.87 J** | 0.23 U | 0.26 U | **1.59 J** | **0.21 J** | 16 | 57 |
| Acenaphthylene | mg/kg OC | **0.5 J** | **0.49 J** | 0.24 U | 0.27 U | **0.12 J** | 0.05 U | 66 | 66 |
| Anthracene | mg/kg OC | **9.2** | **2.8** | 0.47 U | 0.52 U | **0.88 J** | **0.19 J** | 220 | 1,200 |
| Fluorene | mg/kg OC | **9.6** | **1.4 J** | 0.5 U | 0.56 U | **1.41 J** | **0.27 J** | 23 | 79 |
| Naphthalene | mg/kg OC | **11** | **1.4 J** | **0.91 J** | **0.91 J** | **1.56 J** | **0.18 J** | 99 | 170 |
| Phenanthrene | mg/kg OC | **37** | **7** | **0.81 J** | **1 J** | **4.69 J** | **0.86 J** | 100 | 480 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)** | | | | | | | | | |
| Sum of HPAHs[4] | µg/kg | **114** | **40.98 J** | **1.82 J** | **1.26 J** | **58 J** | **16.97 J** | 12,000 | 17,000 |
| Benzo(a)anthracene | µg/kg | **15** | **5** | 0.48 U | 0.48 U | **3.2** | **0.98 J** | 1,300 | 1,600 |
| Benzo(a)pyrene | µg/kg | **13** | **5.3** | 0.14 U | 0.14 U | **2.9** | **0.61 J** | 1,600 | 1,600 |
| Total Benzofluoranthenes[5] | µg/kg | **20.6** | **9.1** | 0.25 U | 0.25 U | **6.7** | **1.72** | 3,200 | 3,600 |
| Benzo(g,h,i)perylene | µg/kg | **9.9** | **3.5** | 0.64 U | 0.64 U | **2.3** | 0.64 U | 670 | 720 |
| Chrysene | µg/kg | **16.0** | **7.1** | **0.47 J** | 0.25 U | **5.4** | **1.8** | 1,400 | 2,800 |
| Dibenzo(a,h)anthracene | µg/kg | **3.5** | **0.98 J** | 0.28 U | 0.28 U | **0.5 J** | 0.28 U | 230 | 230 |
| Fluoranthene | µg/kg | **36** | **10** | **0.63 J** | **0.61 J** | **14** | **4.4** | 1,700 | 2,500 |
| Indeno(1,2,3-c,d)pyrene | µg/kg | **8.9** | **4** | 0.16 U | 0.16 U | **2.3** | **0.54 J** | 600 | 690 |
| Pyrene | µg/kg | **40** | **11** | **0.72 J** | **0.65 J** | **14** | **3.7** | 2,600 | 3,300 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)** | | | | | | | | | |
| Sum of HPAHs[4] | mg/kg OC | **126.7** | **45.5 J** | **1.83 J** | **1.4 J** | **18.1 J** | **3.86 J** | 960 | 5,300 |
| Benzo(a)anthracene | mg/kg OC | **16.7** | **5.56** | 0.48 U | 0.53 U | **1.0** | **0.22 J** | 110 | 270 |
| Benzo(a)pyrene | mg/kg OC | **14.4** | **5.89** | 0.14 U | 0.16 U | **0.91** | **0.14 J** | 99 | 210 |
| Total Benzofluoranthenes[5] | mg/kg OC | **22.9** | **10.1** | 0.25 U | 0.28 U | **2.09** | **0.39** | 230 | 450 |
| Benzo(g,h,i)perylene | mg/kg OC | **11** | **3.89** | 0.64 U | 0.71 U | **0.72** | 0.15 U | 31 | 78 |
| Chrysene | mg/kg OC | **17.8** | **7.89** | **0.47 J** | 0.28 U | **1.69** | **0.41** | 110 | 460 |
| Dibenzo(a,h)anthracene | mg/kg OC | **3.89** | **1.09 J** | 0.28 U | 0.31 U | **0.16 J** | 0.06 U | 12 | 33 |
| Fluoranthene | mg/kg OC | **40** | **11.1** | **0.63 J** | **0.68 J** | **4.38** | **1.0** | 160 | 1,200 |
| Indeno(1,2,3-c,d)pyrene | mg/kg OC | **9.89** | **4.44** | 0.16 U | 0.18 U | **0.72** | **0.12 J** | 34 | 88 |
| Pyrene | mg/kg OC | **44.4** | **12.2** | **0.72 J** | **0.72 J** | **4.38** | **0.84** | 1,000 | 1,400 |

| Sample Location ID[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | Proposed Sediment Screening Level[2] | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | | |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | | |
| **Chlorinated Hydrocarbons (Dry Weight)** | | | | | | | | | |
| 1,2,4-Trichlorobenzene | µg/kg | 2.6 U | 2.6 U | 2.6 U | 2.6 U | 2.6 U | 2.6 U | 31 | 51 |
| 1,2-Dichlorobenzene | µg/kg | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 5.9 U | 35 | 50 |
| 1,4-Dichlorobenzene | µg/kg | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 110 | 110 |
| Hexachlorobenzene | µg/kg | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 22 | 70 |
| **Chlorinated Hydrocarbons (OC Normalized)** | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | 2.9 U | 2.9 U | 2.6 U | 2.9 U | 0.8 U | 0.6 U | 0.81 | 1.8 |
| 1,2-Dichlorobenzene | mg/kg OC | 3.2 U | 3.2 U | 2.9 U | 3.2 U | 0.9 U | 1.3 U | 2.3 | 2.3 |
| 1,4-Dichlorobenzene | mg/kg OC | 3.2 U | 3.2 U | 2.9 U | 3.2 U | 0.9 U | 0.7 U | 3.1 | 9 |
| Hexachlorobenzene | mg/kg OC | 1.3 U | 1.3 U | 1.2 U | 1.3 U | 0.4 U | 0.3 U | 0.38 | 2.3 |
| **Phthalates (Dry Weight)** | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | µg/kg | **9.4 J** | 7 U | 7 U | **18** | 7 U | 7 U | 1,300 | 1,900 |
| Butyl benzyl Phthalate | µg/kg | 3.2 U | 3.2 U | 3.2 U | 3.2 U | 3.2 U | 3.2 U | 63 | 900 |
| Dibutyl Phthalate | µg/kg | 7.9 U | 7.9 U | 7.9 U | 7.9 U | **8.4 J** | **8.9 J** | 1,400 | 1,400 |
| Diethyl Phthalate | µg/kg | 1.3 U | 1.3 U | 1.5 U | **1.4** | **1.4 J** | **1.4 J** | 200 | > 1,200 |
| Dimethyl Phthalate | µg/kg | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 71 | 160 |
| Di-N-Octyl Phthalate | µg/kg | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 6,200 | 6,200 |
| **Phthalates (OC Normalized)** | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | **10.4 J** | 7.78 U | 7 U | **20.00** | 2.19 U | 1.59 U | 47 | 78 |
| Butyl benzyl Phthalate | mg/kg OC | 3.56 U | 3.56 U | 3.2 U | 3.56 U | 1 U | 0.73 U | 5 | 64 |
| Dibutyl Phthalate | mg/kg OC | 8.78 U | 8.78 U | 7.9 U | 8.78 U | **2.63** | **2.02** | 220 | 1,700 |
| Diethyl Phthalate | mg/kg OC | 1.44 U | 1.44 U | 1.5 U | **1.56** | **0.44** | **0.32** | 61 | 110 |
| Dimethyl Phthalate | mg/kg OC | 1.11 U | 1.11 U | 1 U | 1.11 U | 0.31 U | 0.23 U | 53 | 53 |
| Di-N-Octyl Phthalate | mg/kg OC | 1.89 U | 1.89 U | 1.7 U | 1.89 U | 0.53 U | 0.39 U | 58 | 4,500 |
| **Phenols (Dry Weight)** | | | | | | | | | |
| 2,4-Dimethylphenol | µg/kg | 5.5 U | 5.5 U | 5.5 U | 5.5 U | 5.5 U | 5.5 U | 29 | 29 |
| 2-methylphenol (o-Cresol) | µg/kg | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 63 | 63 |
| 4-methylphenol (p-Cresol) | µg/kg | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 670 | 670 |
| Pentachlorophenol | µg/kg | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 360 | 690 |
| Phenol | µg/kg | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 420 | 1,200 |
| **Miscellaneous Extractables (Dry Weight)** | | | | | | | | | |
| Dibenzofuran | µg/kg | **6.3** | **0.85 J** | 0.59 U | 0.59 U | **2.8 J** | 1.2 U | 540 | 540 |
| Hexachlorobutadiene | µg/kg | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 11 | 120 |
| N-Nitrosodiphenylamine | µg/kg | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 28 | 40 |
| Benzoic Acid | µg/kg | 96 U | 96 U | 96 U | 96 U | 96 U | 96 U | 650 | 650 |
| Benzyl Alcohol | µg/kg | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 57 | 73 |
| **Miscellaneous Extractables (OC Normalized)** | | | | | | | | | |
| Dibenzofuran | mg/kg OC | **7.00** | **0.94 J** | 0.59 U | 0.66 U | **0.88 J** | 0.27 U | 15 | 58 |
| Hexachlorobutadiene | mg/kg OC | 2.78 U | 2.78 U | 2.5 U | 2.78 U | 0.78 U | 0.57 U | 3.9 | 6.2 |
| N-Nitrosodiphenylamine | mg/kg OC | 1.78 U | 1.78 U | 1.6 U | 1.78 U | 0.5 U | 0.36 U | 11 | 11 |

| Sample Location ID[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | Proposed Sediment Screening Level2 | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | | |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | SCO/ LAET | CSL/ 2LAET |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | | |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| 4,4'-DDE | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| 4,4'-DDT | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| Total DDT (4,4 isomers) | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| Aldrin | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| Total Chlordane | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| Dieldrin | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| Heptachlor | µg/kg | -- | -- | -- | -- | -- | -- | NE | NE |
| **Polychlorinated Biphenyls (PCBs) (Dry Weight)** | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | mg/kg | **0.0031** | 0.0013 U | 0.0013 U | 0.0013 U | 0.0013 U | 0.0013 U | 0.13 | 1 |
| **Polychlorinated Biphenyls (PCBs) (OC Normalized)** | | | | | | | | | |
| Total PCBs (Sum of Aroclors) | mg/kg OC | **3.44** | 1.44 U | 1.3 U | 1.44 U | 0.41 U | 0.3 U | 12 | 65 |

**Notes:**

[1] Sediment sample locations are shown on Figure 12.

[2] Proposed sediment cleanup levels for the protection of benthic organisms are referenced from Table 1.

[3] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[4] Total HPAH represents the sum of the detected concentrations of the following HPAH compounds: benz[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, dibenzo[a,h]anthracene, fluoranthene, indeno[1,2,3-c,d]pyrene, pyrene, and total benzofluoranthenes. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[5] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

SCO = Sediment Cleanup Objective

CSL = Cleanup Screening Level

LAET = Lowest Apparent Effects Threshold

2LAET = Second Lowest Apparent Effects Threshold

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

mg/kg = milligram per kilogram

mg/kg OC = milligram per kilogram normalized to organic carbon

µg/kg = microgram per kilogram

-- = not analyzed

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeters

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the SCO/LAET screening level.

Orange shading indicates exceedance of the CSL/2LAET screening level.

Grey text indicates that the reported value is not compared to the screening levels because the TOC concentration of the sample is outside the specified range for application of the screening level.

Blue shading indicates that the practical quantitation limit (PQL) is above screening level.

# Table 13

## Sediment Contaminant of Concern Chemical Analytical Data – Protection of Human Health and Higher Trophic Level Ecological Receptors

Dakota Creek Industries

Anacortes, Washington

| Sample Location[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level[2] |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A | DCI06-2-D | FB-A4-14 | FB-A4-15 | SMA 1-1 | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | |
| **Metals** | | | | | | | | | |
| Arsenic | mg/kg | **2.1 J** | -- | -- | -- | **2.37** | **2.1** | **4.40** | 11 |
| Cadmium | mg/kg | ND | -- | -- | -- | **0.09** | 0.08 U | **0.054** | 0.8 |
| Chromium | mg/kg | **13.4** | -- | -- | -- | **12.3** | **13.5** | **26.2** | 6,900,000 |
| Copper | mg/kg | **15.3** | -- | -- | -- | **10.4** | **9.49** | **27.4** | 180,000 |
| Lead | mg/kg | **6.23 J** | -- | -- | -- | **2.23 J** | **1.63** | **4.08** | 21 |
| Mercury | mg/kg | ND | -- | -- | -- | **0.01 J** | **0.01** | **0.033** | 0.2 |
| Silver | mg/kg | **0.0582** | -- | -- | -- | 0.02 U | **0.03** | **0.07** | 23,000 |
| Zinc | mg/kg | **21.3** | -- | -- | -- | **20.9** | **19.1** | **43.9** | 1,400,000 |
| **Organometallic Compounds** | | | | | | | | | |
| Tributyltin, bulk | µg/kg | -- | -- | -- | -- | -- | -- | **7.24 J** | 73 |
| Interstitial Tributyltin, porewater | µg/L | -- | -- | -- | -- | -- | -- | -- | 0.15 |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)** | | | | | | | | | |
| 2-Methylnaphthalene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.85 J** | 16,000,000 |
| Acenaphthene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.91 J** | 240,000,000 |
| Acenaphthylene | µg/kg | -- | -- | -- | -- | **1.4 J** | 9.1 U | 0.24 U | 240,000,000 |
| Anthracene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.5 J** | 1,200,000,000 |
| Fluorene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **1.1 J** | 160,000,000 |
| Naphthalene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **2.5** | 79,000,000 |
| Phenanthrene | µg/kg | -- | -- | -- | -- | **8.2 J** | 9.1 U | **2.9** | 1,200,000,000 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)** | | | | | | | | | |
| Benzo(a)anthracene | µg/kg | -- | -- | -- | -- | **4.1 J** | 9.1 U | **1.3 J** | NE |
| Benzo(a)pyrene | µg/kg | -- | -- | -- | -- | **2.6 J** | 9.1 U | **0.86 J** | cPAH TEQ |
| Total Benzofluoranthenes[3] | µg/kg | -- | -- | -- | -- | **9.9 J** | 9.1 U | **1.87 J** | NE |
| Benzo(g,h,i)perylene | µg/kg | -- | -- | -- | -- | **2 J** | 9.1 U | **0.94 J** | 120,000,000 |
| Chrysene | µg/kg | -- | -- | -- | -- | **18** | 9.1 U | **1.1 J** | NE |
| Dibenzo(a,h)anthracene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 0.28 U | NE |
| Fluoranthene | µg/kg | -- | -- | -- | -- | **50** | **2.2 J** | **3** | 160,000,000 |
| Indeno(1,2,3-c,d)pyrene | µg/kg | -- | -- | -- | -- | **1.8 J** | 9.1 U | **0.83 J** | NE |
| Pyrene | µg/kg | -- | -- | -- | -- | **33** | 9.1 U | **4.0** | 120,000,000 |
| **Carcinogenic PAHs (cPAHs)** | | | | | | | | | |
| Total cPAH TEQ[4] (ND=0.5 RL) | µg/kg | -- | -- | -- | -- | **4.85 J** | 6.42 U | **1.27 J** | 21 |

| Sample Location[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level[2] |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A[2] | DCI06-2-D[2] | FB-A4-14 | FB-A4-15 | SMA 1-1 | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | |
| **Chlorinated Hydrocarbons** | | | | | | | | | |
| 1,2,4-Trichlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.6 U | 140,000 |
| 1,2-Dichlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.9 U | 370,000,000 |
| 1,4-Dichlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.9 U | 780,000 |
| Hexachlorobenzene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 1.2 U | 2,500 |
| **Phthalates** | | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | µg/kg | -- | -- | -- | -- | **97** | **91** | 7 U | 290,000 |
| Butyl benzyl Phthalate | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 3.2 U | 2,100,000 |
| Dibutyl Phthalate | µg/kg | -- | -- | -- | -- | **9.2 J** | **16** | 7.9 U | 410,000,000 |
| Diethyl Phthalate | µg/kg | -- | -- | -- | -- | **1.9 J** | 9.1 U | 1.3 U | 3,100,000,000 |
| Dimethyl Phthalate | µg/kg | -- | -- | -- | -- | **1 J** | 9.1 U | 1 U | NE |
| Di-N-Octyl Phthalate | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 1.7 U | 41,000,000 |
| **Phenols** | | | | | | | | | |
| 2,4-Dimethylphenol | µg/kg | -- | -- | -- | -- | -- | **46 R** | 5.5 U | 82,000,000 |
| 2-methylphenol (o-Cresol) | µg/kg | -- | -- | -- | -- | -- | 9.1 U | 1.5 U | 200,000,000 |
| 4-methylphenol (p-Cresol) | µg/kg | -- | -- | -- | -- | -- | 9.1 U | **3.4 J** | 390,000,000 |
| Pentachlorophenol | µg/kg | -- | -- | -- | -- | -- | 91 U | 20 U | 10,000,000 |
| Phenol | µg/kg | -- | -- | -- | -- | -- | 28 U | 2 U | 1,200,000,000 |
| **Miscellaneous Extractables** | | | | | | | | | |
| Dibenzofuran | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | **0.87 J** | 4,100,000 |
| Hexachlorobutadiene | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 2.5 U | 52,000 |
| N-Nitrosodiphenylamine | µg/kg | -- | -- | -- | -- | 9.7 U | 9.1 U | 1.6 U | 830,000 |
| Benzoic Acid | µg/kg | -- | -- | -- | -- | **200** | **190 R** | 96 U | 16,000,000,000 |
| Benzyl Alcohol | µg/kg | -- | -- | -- | -- | **6.2 J** | 19 U | 2.1 U | 410,000,000 |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | |
| Total PCBs (Sum of Aroclors or Congeners) | mg/kg | -- | -- | -- | -- | 0.02 U | 0.013 U | 0.0013 U | 0.0035 |
| **Dioxins and Furans** | | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | -- | 1 U | 0.21 U | 0.18 U | -- | -- | -- | NE |
| 1,2,3,7,8-PeCDD | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,4,7,8-HxCDD | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,6,7,8-HxCDD | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,7,8,9-HxCDD | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | -- | 2.5 U | **2 J** | **5** | -- | -- | -- | NE |
| OCDD | ng/kg | -- | 5 U | **14** | **35** | -- | -- | -- | NE |
| 2,3,7,8-TCDF | ng/kg | -- | 1 U | 0.21 U | 0.18 U | -- | -- | -- | NE |
| 1,2,3,7,8-PeCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 2,3,4,7,8-PeCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,4,7,8-HxCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,6,7,8-HxCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 2,3,4,6,7,8-HxCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |

| Sample Location[1] | | DC-SED-09 | P1-2 | DC-106-2 | DC-106-2 | FB-A4-14 | FB-A4-15 | SMA-1 | Proposed Sediment Screening Level[2] |
|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | | DC-SED-09 | AN-P1-2 | DCI06-2A[2] | DCI06-2-D[2] | FB-A4-14 | FB-A4-15 | SMA 1-1 | |
| Sample Date | | 08/06/97 | 07/15/04 | N/A | N/A | 09/06/07 | 09/06/07 | 09/30/08 | |
| Sample Interval (dbm) | | 0-10 cm | 1-3 ft | 0-10 cm | 0-10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | |
| Sample Study | | 1997 Phase II ESA | 2004 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Sediment Study | 2007 Interim Action | |
| Sample Type | | Surface | Subsurface | Surface | Surface | Surface | Surface | Surface | |
| Sampled By | | Otten Engineering | Anchor Env. | Floyd\|Snider | Floyd\|Snider | Ecology | Ecology | GeoEngineers | |
| 1,2,3,7,8,9-HxCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | -- | 2.5 U | 1.1 U | 0.91 U | -- | -- | -- | NE |
| OCDF | ng/kg | -- | **9.1** | 2.1 U | **2.2 J** | -- | -- | -- | NE |
| Total Dioxin/Furan TEQ[5] (ND=0.5 RL) | ng/kg | -- | **3.13** | **1.32 J** | **1.09 J** | -- | -- | -- | 5 |

**Notes:**

[1] Sediment sample locations are shown on Figure 12.

[2] Proposed sediment cleanup levels for the protection of human health and higher trophic level ecological receptors are referenced from Table 2.

[3] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[4] Total cPAH Toxic Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) values referenced from MTCA Table 708.2 (WAC 173-340-900).

[5] Total dioxin and furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

µg/kg = microgram per kilogram

-- = not analyzed

NE = not established

ND = Not detected

RL = Reporting limit

ft = feet

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates that the identified concentration is greater than the sediment screening level for protection of human health (HH) and higher trophic level ecological receptors (HTLER).

Blue shading indicates that the practical quantitation limit (PQL) is above screening level.

# Table 13

## Sediment Contaminant of Concern Chemical Analytical Data – Protection of Human Health and Higher Trophic Level Ecological Receptors

Dakota Creek Industries
Anacortes, Washington

| Sample Location[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | |
|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | Proposed Sediment Screening Level[2] |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | |
| **Metals** | | | | | | | | |
| Arsenic | mg/kg | **1.71** | **2.11** | **3.89** | **2.98** | **4.2** | **1.9** | 11 |
| Cadmium | mg/kg | **0.091** | **0.078** | **0.077** | **0.071** | 0.3 U | 0.3 U | 0.8 |
| Chromium | mg/kg | **12.7** | **51.1** | **244** | **96.9** | **35.3** | **33.3** | 6,900,000 |
| Copper | mg/kg | **16.1** | **23.6** | **27.8** | **25.7** | **29.1** | **25.9** | 180,000 |
| Lead | mg/kg | **3.73** | **4.21** | **2.45** | **3** | 3 U | 2.9 U | 21 |
| Mercury | mg/kg | **0.0453** | **0.0221** | **0.032** | **0.036** | **0.041** | **0.036** | 0.2 |
| Silver | mg/kg | **0.05** | **0.07** | **0.07** | **0.06** | 0.8 U | **0.8** | 23,000 |
| Zinc | mg/kg | **25.4** | **42** | **43.7** | **44.2** | **53** | **41.7** | 1,400,000 |
| **Organometallic Compounds** | | | | | | | | |
| Tributyltin, bulk | µg/kg | **60.35 J** | **11.84 J** | **1.72 J** | **1.72 J** | **33.58 J** | **8.19 J** | 73 |
| Interstitial Tributyltin, porewater | µg/L | -- | -- | -- | -- | -- | -- | 0.15 |
| **Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)** | | | | | | | | |
| 2-Methylnaphthalene | µg/kg | **6.8** | **0.61 J** | **0.5 J** | **0.42 J** | **0.79 J** | **0.53 J** | 16,000,000 |
| Acenaphthene | µg/kg | **6.8** | **0.78 J** | 0.23 U | 0.23 U | **5.1 J** | **0.91 J** | 240,000,000 |
| Acenaphthylene | µg/kg | **0.45 J** | **0.44 J** | 0.24 U | 0.24 U | **0.39 J** | 0.24 U | 240,000,000 |
| Anthracene | µg/kg | **8.3** | **2.5** | 0.47 U | 0.47 U | **2.8 J** | **0.82 J** | 1,200,000,000 |
| Fluorene | µg/kg | **8.6** | **1.3 J** | 0.5 U | 0.5 U | **4.5 J** | **1.2 J** | 160,000,000 |
| Naphthalene | µg/kg | **10** | **1.3 J** | **0.91 J** | **0.82 J** | **5 J** | **0.81 J** | 79,000,000 |
| Phenanthrene | µg/kg | **33** | **6.3** | **0.81 J** | **0.9 J** | **15 J** | **3.8** | 1,200,000,000 |
| **High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)** | | | | | | | | |
| Benzo(a)anthracene | µg/kg | **15** | **5** | 0.48 U | 0.48 U | **3.2** | **0.98 J** | NE |
| Benzo(a)pyrene | µg/kg | **13** | **5.3** | 0.14 U | 0.14 U | **2.9** | **0.61 J** | cPAH TEQ |
| Total Benzofluoranthenes[3] | µg/kg | **20.6** | **9.1** | 0.25 U | 0.25 U | **6.7** | **1.72** | NE |
| Benzo(g,h,i)perylene | µg/kg | **9.9** | **3.5** | 0.64 U | 0.64 U | **2.3** | 0.64 U | 120,000,000 |
| Chrysene | µg/kg | **16.0** | **7.1** | **0.47 J** | 0.25 U | **5.4** | **1.8** | NE |
| Dibenzo(a,h)anthracene | µg/kg | **3.5** | **0.98 J** | 0.28 U | 0.28 U | **0.5 J** | 0.28 U | NE |
| Fluoranthene | µg/kg | **36** | **10** | **0.63 J** | **0.61 J** | **14** | **4.4** | 160,000,000 |
| Indeno(1,2,3-c,d)pyrene | µg/kg | **8.9** | **4** | 0.16 U | 0.16 U | **2.3** | **0.54 J** | NE |
| Pyrene | µg/kg | **40** | **11** | **0.72 J** | **0.65 J** | **14** | **3.7** | 120,000,000 |
| **Carcinogenic PAHs (cPAHs)** | | | | | | | | |
| Total cPAH TEQ[4] (ND=0.5 RL) | µg/kg | **17.96** | **7.28 J** | **0.005 J** | **0.003 J** | **4.22 J** | **0.95 J** | 21 |

| Sample Location[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | |
|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | Proposed Sediment Screening Level[2] |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | |
| **Chlorinated Hydrocarbons** | | | | | | | | |
| 1,2,4-Trichlorobenzene | µg/kg | 2.6 U | 2.6 U | 2.6 U | 2.6 U | 2.6 U | 2.6 U | 140,000 |
| 1,2-Dichlorobenzene | µg/kg | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 5.9 U | 370,000,000 |
| 1,4-Dichlorobenzene | µg/kg | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 780,000 |
| Hexachlorobenzene | µg/kg | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 2,500 |
| **Phthalates** | | | | | | | | |
| Bis(2-Ethylhexyl) Phthalate | µg/kg | **9.4 J** | 7 U | 7 U | **18** | 7 U | 7 U | 290,000 |
| Butyl benzyl Phthalate | µg/kg | 3.2 U | 3.2 U | 3.2 U | 3.2 U | 3.2 U | 3.2 U | 2,100,000 |
| Dibutyl Phthalate | µg/kg | 7.9 U | 7.9 U | 7.9 U | 7.9 U | **8.4 J** | **8.9 J** | 410,000,000 |
| Diethyl Phthalate | µg/kg | 1.3 U | 1.3 U | 1.5 U | **1.4** | **1.4 J** | **1.4 J** | 3,100,000,000 |
| Dimethyl Phthalate | µg/kg | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | NE |
| Di-N-Octyl Phthalate | µg/kg | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 1.7 U | 41,000,000 |
| **Phenols** | | | | | | | | |
| 2,4-Dimethylphenol | µg/kg | 5.5 U | 5.5 U | 5.5 U | 5.5 U | 5.5 U | 5.5 U | 82,000,000 |
| 2-methylphenol (o-Cresol) | µg/kg | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 200,000,000 |
| 4-methylphenol (p-Cresol) | µg/kg | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 390,000,000 |
| Pentachlorophenol | µg/kg | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 10,000,000 |
| Phenol | µg/kg | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 1,200,000,000 |
| **Miscellaneous Extractables** | | | | | | | | |
| Dibenzofuran | µg/kg | **6.3** | **0.85 J** | 0.59 U | 0.59 U | **2.8 J** | 1.2 U | 4,100,000 |
| Hexachlorobutadiene | µg/kg | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 52,000 |
| N-Nitrosodiphenylamine | µg/kg | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 830,000 |
| Benzoic Acid | µg/kg | 96 U | 96 U | 96 U | 96 U | 96 U | 96 U | 16,000,000,000 |
| Benzyl Alcohol | µg/kg | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 410,000,000 |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | |
| Total PCBs (Sum of Aroclors or Congeners) | mg/kg | **0.0031** | 0.0013 U | 0.0013 U | 0.0013 U | 0.0013 U | 0.0013 U | 0.0035 |
| **Dioxins and Furans** | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,7,8-PeCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,4,7,8-HxCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,6,7,8-HxCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,7,8,9-HxCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| OCDD | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 2,3,7,8-TCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,7,8-PeCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 2,3,4,7,8-PeCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,4,7,8-HxCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,6,7,8-HxCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 2,3,4,6,7,8-HxCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |

| Sample Location[1] | | SMA-2 | SMA-3 | SMA-4 | SMA-4 | SMA-5 | SMA-5 | |
|---|---|---|---|---|---|---|---|---|
| Sample Identification | | SMA 2-1 | SMA 3-2 | DCI 4-1 | DCI 4-1A | SMA 5-2 | SMA 5-3 | |
| Sample Date | | 09/30/08 | 08/28/08 | 10/10/08 | 10/10/08 | 08/26/08 | 08/26/08 | |
| Sample Interval (dbm) | | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | |
| Sample Study | | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | 2007 Interim Action | Proposed Sediment Screening Level[2] |
| Sample Type | | Surface | Surface | Surface | Surface | Surface | Surface | |
| Sampled By | | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | GeoEngineers | |
| 1,2,3,7,8,9-HxCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| OCDF | ng/kg | -- | -- | -- | -- | -- | -- | NE |
| Total Dioxin/Furan TEQ[5] (ND=0.5 RL) | ng/kg | -- | -- | -- | -- | -- | -- | 5 |

**Notes:**

[1] Sediment sample locations are shown on Figure 12.

[2] Proposed sediment cleanup levels for the protection of human health and higher trophic level ecological receptors are referenced from Table 2.

[3] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[4] Total cPAH Toxic Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) values referenced from MTCA Table 708.2 (WAC 173-340-900).

[5] Total dioxin and furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

µg/kg = microgram per kilogram

-- = not analyzed

NE = not established

ND = Not detected

RL = Reporting limit

ft = feet

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates that the identified concentration is greater than the sediment screening level for protection of human health (HH) and higher trophic level ecological receptors (HTLER).

Blue shading indicates that the practical quantitation limit (PQL) is above screening level.

# Table 14

## Groundwater Contaminant of Concern Chemical Analytical Data

Dakota Creek Industries

Anacortes, Washington

| Monitoring Well[1] | Sample Date | Units | Total Metals[2] | | Dissolved Metals[2] | | Total cPAH TEQ[3,4] |
|---|---|---|---|---|---|---|---|
| | | | Arsenic | Nickel | Arsenic | Nickel | |
| MW-1 (Upland Well) | 06/05/02 | µg/L | **5** | **3.8** | **4** | **2.2** | 1.41 U |
| | 08/19/02 | µg/L | **0.6** | **4.2** | -- | -- | 0.07 U |
| | 11/17/06 | µg/L | **3.3** | **2.1** | -- | -- | 0.07 U |
| | 06/17/08 | µg/L | **4.8** | **3.2** | -- | -- | 0.013 U |
| | 06/17/08[6] | µg/L | **4.9** | **3.3** | -- | -- | 0.013 U |
| | 05/23/12 | µg/L | 17 U | 8 U | 15 U | 8 U | 0.007 U |
| | 08/16/12 | µg/L | **15** | 8 U | **15** | 8 U | 0.007 U |
| | 11/13/12 | µg/L | 16 U | **5.4** | 16 U | 5 U | 0.007 U |
| | 02/13/13 | µg/L | **15** | 8 U | **14** | 8 U | 0.007 U |
| | 02/10/16 | µg/L | **1.3** | -- | **1.2 J** | -- | -- |
| | 08/18/16 | µg/L | **9.2** | -- | 7.8 U | -- | -- |
| | 02/15/17 | µg/L | **11** | -- | **5.6** | -- | -- |
| | 08/23/17 | µg/L | 5.6 U | -- | 5.6 U | -- | -- |
| MW-2 (Shoreline Well) | 06/05/02 | µg/L | **3** | **7.5** | **3** | **7.5** | 1.41 U |
| | 06/05/02[6] | µg/L | **3** | **7.5** | **3** | **7.5** | 1.41 U |
| | 08/19/02 | µg/L | **4** | **9.9** | -- | -- | 0.07 U |
| | 08/19/02[6] | µg/L | **2** | **8.2** | -- | -- | 0.07 U |
| | 11/17/06 | µg/L | **4** | **3.9** | -- | -- | **0.007** |
| | 11/17/06[6] | µg/L | **3.8** | **3.9** | -- | -- | 0.007 U |
| | 06/17/08 | µg/L | **3.4** | **2.4** | -- | -- | **0.015** |
| MW-2A (Shoreline Well) | 05/23/12 | µg/L | 12 U | 20 U | 11 U | 20 U | 0.007 U |
| | 08/16/12 | µg/L | 7.5 U | **17** | 7.5 U | **16** | 0.007 U |
| | 11/13/12 | µg/L | 10 U | **13** | 10 U | **13** | 0.007 U |
| | 02/13/13 | µg/L | 8 U | **7** | 8 U | 8 U | 0.007 U |
| | 02/10/16 | µg/L | --[6] | --[6] | --[6] | --[6] | -- |
| MW-2B (Shoreline Well) | 08/19/16 | µg/L | 7.8 U | 7.8 U | 7 U | 7 U | -- |
| | 02/15/17 | µg/L | 5.6 U | **8.2** | 5 U | **8.3** | -- |
| | 08/23/17 | µg/L | **6** | **6.9** | **6.5** | **6** | -- |
| MW-3 (Shoreline Well) | 06/05/02 | µg/L | 1 U | **3.4** | 0.1 U | **0.33** | 1.41 U |
| | 08/19/02 | µg/L | **1** | **3.7** | -- | -- | 0.07 U |
| | 11/17/06 | µg/L | **0.9** | **1.5** | -- | -- | **0.007 J** |
| | 06/17/08 | µg/L | **0.8** | **2.2** | -- | -- | 0.013 U |
| MW-3A (Shoreline Well) | 05/23/12 | µg/L | 4 U | 8 U | 4.5 U | 8 U | 0.007 U |
| | 08/16/12 | µg/L | 7.5 U | **19** | 7.5 U | **18** | 0.007 U |
| | 11/13/12 | µg/L | 8 U | **18** | 8 U | **17** | 0.007 U |
| | 02/13/13 | µg/L | 8 U | **16** | 8 U | **18** | 0.007 U |
| | 02/11/16 | µg/L | -- | **0.5 J** | -- | 0.5 U | -- |
| | 08/19/16 | µg/L | -- | 7.8 U | -- | 7 U | -- |
| | 02/16/17 | µg/L | -- | 5.6 U | -- | 5 U | -- |
| | 08/24/17 | µg/L | -- | 5.6 U | -- | 5 U | -- |
| Proposed Groundwater Cleanup Level[7] | | | 8 | 8.2 | 8 | 8.2 | 0.01 |

| Monitoring Well[1] | Sample Date | Units | Total Metals[2] | | Dissolved Metals[2] | | Total cPAH - TEQ[3,4] |
|---|---|---|---|---|---|---|---|
| | | | Arsenic | Nickel | Arsenic | Nickel | |
| MW-4 (Upland Well) | 06/05/02 | µg/L | **8** | **3.4** | **9** | **1.1** | – |
| | 08/19/02 | µg/L | **12** | **3.3** | – | – | 0.07 U |
| | 11/17/06 | µg/L | **11.6** | **2** | – | – | 0.007 U |
| | 06/17/08 | µg/L | **8.1** | **1.1** | – | – | 0.013 U |
| | 05/23/12 | µg/L | 9 U | 20 U | 9.5 U | 20 U | 0.007 U |
| | 08/16/12 | µg/L | **11** | 8 U | **10** | 8 U | 0.007 U |
| | 11/13/12 | µg/L | 10 U | 5 U | 10 U | 5 U | **0.031** |
| | 02/13/13 | µg/L | 8 U | 8 U | 8 U | 8 U | **0.015** |
| | 02/11/16 | µg/L | **3.5** | – | **3.5** | – | 0.008 |
| | 08/18/16 | µg/L | 7.8 U | – | 7.8 U | – | **0.008** |
| | 02/15/17 | µg/L | 5.6 U | – | 5 U | – | 0.007 U |
| | 08/24/17 | µg/L | 5.6 U | – | 5 U | – | 0.007 U |
| MW-5 (Upland Well) | 06/17/08 | µg/L | **10** | **5.2** | – | – | 0.013 U |
| MW-6 (Shoreline Well) | 05/23/12 | µg/L | 3.5 U | 20 U | 3 U | 20 U | **0.008** |
| | 08/16/12 | µg/L | 7.5 U | **18** | 7.5 U | **19** | 0.007 U |
| | 11/13/12 | µg/L | 8 U | **18** | 8 U | **18** | 0.007 U |
| | 02/13/13 | µg/L | 8 U | 8 U | 8 U | 8 U | 0.007 U |
| | 02/11/16 | µg/L | – | 0.4 U | – | 0.4 U | – |
| | 08/19/16 | µg/L | – | 7.8 U | – | 7 U | – |
| | 02/16/17 | µg/L | – | 5.6 U | – | 5 U | – |
| | 08/24/17 | µg/L | – | 5.6 U | – | 5 U | – |
| MW-7 (Upland Well) | 05/23/12 | µg/L | 11 U | 20 U | 9.8 U | 20 U | 0.007 U |
| | 08/16/12 | µg/L | **10** | **27** | 7.5 U | **27** | **0.0104** |
| | 11/13/12 | µg/L | 8 U | **18** | 8 U | **19** | **0.013** |
| | 02/13/13 | µg/L | **9** | **18** | 8 | **18** | 0.007 U |
| | 02/10/16 | µg/L | **12.9** | **9.9** | **13** | **5.2 J** | – |
| | 08/19/16 | µg/L | **12** | **11** | **11** | **10** | – |
| | 02/16/17 | µg/L | **9.2** | **6.7** | **7.1** | **6.6** | – |
| | 08/23/17 | µg/L | **14** | **8.8** | **12** | **9.3** | – |
| MW-8 (Shoreline Well) | 02/10/16 | µg/L | **16.6** | **9.1** | **16.1** | **7.4** | 0.008 U |
| | 02/10/16[6] | µg/L | **16.1** | **8.4** | **16.3** | **7.8** | 0.008 U |
| | 08/18/16 | µg/L | **16** | 7.8 U | **15** | 7.8 U | 0.008 U |
| | 08/18/16[6] | µg/L | **14** | 7.8 U | **14** | 7.8 U | 0.008 U |
| | 02/15/17 | µg/L | **12** | 5.6 U | **12** | 5 U | 0.007 U |
| | 02/15/17[6] | µg/L | 5.6 U | 5.6 U | 5 U | 5 U | 0.007 U |
| | 08/23/17 | µg/L | **17** | **6.7** | **17** | 5.6 U | **0.167** |
| | 08/23/17 | µg/L | **17** | **6** | **15** | 5.6 U | **0.040** |
| Proposed Groundwater Cleanup Level[7] | | | 8 | 8.2 | 8 | 8.2 | 0.01 |

**Notes:**

[1] Monitoring well locations are shown on Figure 13. Groundwater results are summarized on Figures 20 through 22.

[2] Metals analyzed using EPA Method 6010/6020.

[3] Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) analyzed by EPA method 8270D/SIM.

[4] Total cPAH Toxic Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) values referenced from MTCA Table 708.2 (WAC 173-340-900).

[5] Monitoring well not accessible at the time of sampling.

[6] Duplicate sample collected for laboratory analysis.

[7] Proposed groundwater cleanup level is referenced from Table 4.

J = Estimated value

T = qualifier indicating total concentration

U = qualifier indicating analyte not detected at level above listed practical quantitation limit

µg/L = microgram per liter

-- = not analyzed

Bold indicates analyte was detected.

Blue shading indicates that the reporting limit exceeds the proposed groundwater cleanup level.

Yellow shading indicates analyte was detected at a concentration above proposed groundwater cleanup level.

# Table 15

## Soil Contaminant of Concern Chemical Analytical Data

### Dakota Creek Industries

### Anacortes, Washington

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Gasoline-Range | Diesel-Range | Heavy Oil-Range | Vadose Zone | Saturated Zone |
| S-1 | DC-B-1 | 4.5 ft | 07/14/97 | mg/kg | **5.24** | **32.7** | -- | -- | -- | -- | -- |
| | DC-B-1B | 4.5 ft | 07/14/97 | mg/kg | **8.85** | **25.6** | -- | -- | -- | -- | -- |
| S-2 | DC-B-2 | 4.5 ft | 07/14/97 | mg/kg | **2.11** | **22.9** | -- | -- | -- | -- | -- |
| | DC-B-2A | 2.5 ft | 07/14/97 | mg/kg | **1.0** | **5.75** | -- | -- | -- | ND | -- |
| SS-1A/1B | DC-UPLD SS-1A | 0-1 ft | 07/03/97 | mg/kg | **32.1 J** | **20.9 J** | -- | -- | -- | -- | -- |
| | DC-UPLD SS-1B | 0-1 ft | 07/03/97 | mg/kg | **1.74 J** | **45.7 J** | -- | -- | -- | -- | -- |
| SS-2A/2B | DC-UPLD SS-2A | 0-1 ft | 07/30/97 | mg/kg | **15 J** | **27.9 J** | -- | -- | -- | -- | -- |
| | DC-UPLD SS-2B | 0-1 ft | 07/30/97 | mg/kg | **1.44 J** | **52.6 J** | -- | -- | -- | -- | -- |
| SS-3 | DC-UPLD SS-3 | 0-1 ft | 07/30/97 | mg/kg | **3** | **35.7 J** | ND | **10.9** | **63.9** | -- | -- |
| SS-4 | DC-UPLD SS-4 | 0-1 ft | 07/30/97 | mg/kg | **7.26** | **21.7 J** | ND | **203** | **2,220** | -- | -- |
| SS-6 | DC-UPLD SS-6 | 0-1 ft | 07/30/97 | mg/kg | -- | -- | ND | **492** | **2,100** | -- | -- |
| SS-9 | DC-UPLD SS-9 | 0-1 ft | 07/30/97 | mg/kg | -- | -- | **233** | **8,360** | **4,470** | ND | -- |
| SS-11 | DC-UPLD SS-11[2] | 0-1 ft | 07/30/97 | mg/kg | -- | -- | **126** | **16,300** | **1,980** | ND | -- |
| SS-13A | DC-UPLD SS-13A[2] | 0-1 ft | 07/30/97 | mg/kg | **22.6** | **15.1 J** | **26.7** | **421** | **843** | -- | -- |
| SS-14A | DC-UPLD SS-14A[2] | 0-1 ft | 07/30/97 | mg/kg | **27** | **16.5 J** | **22.9** | **1,590** | **18,500** | ND | -- |
| SS-14B | DC-UPLD SS-14B[2] | 0-1 ft | 07/30/97 | mg/kg | **1.97** | **23.3 J** | **23.1** | **2,900** | **2,820** | ND | -- |
| DCI-SB-UL01 | 0020-LAI | 2 ft | 07/17/01 | mg/kg | **5** | **46.7** | -- | -- | -- | **0.266 J** | -- |
| DCI-SB-UL01 | 0040-LAI | 4 ft | 07/17/01 | mg/kg | **6.5** | **35.4** | -- | -- | -- | **0.131 J** | -- |
| DCI-SB-UL01 | 0070-LAI | 7 ft | 07/17/01 | mg/kg | **5.3** | **42.9** | -- | -- | -- | 0.44 U | -- |
| DCI-SB-UL03 | 0020-LAI | 2 ft | 07/17/01 | mg/kg | **2.7** | **17.7** | -- | -- | -- | **0.285 J** | -- |
| DCI-SB-UL03 | 0060-LAI | 6 ft | 07/17/01 | mg/kg | **3.0** | **21.8** | -- | -- | -- | **0.315 J** | -- |
| S-1-WS | S-1-WS-0 | 0.5-1 ft | 08/22/01 | mg/kg | **3.4** | **58** | -- | -- | -- | -- | -- |
| | S-1-WS-1 | 1-4 ft | 08/22/01 | mg/kg | **3.8** | **52** | -- | -- | -- | -- | -- |
| | S-1-WS-2 | 4-7 ft | 08/22/01 | mg/kg | **3.1** | **59** | -- | -- | -- | -- | -- |
| | S-1-WS-3 | 7-10 ft | 08/22/01 | mg/kg | **2.2** | **16** | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| S-2-MS | S-2-MS-0 | 0.5-1 ft | 08/22/01 | mg/kg | **3.8** | **17** | 5.8 U | **8.1 J** | **18 J** | -- | -- |
| | S-2-MS-1 | 1-4 ft | 08/22/01 | mg/kg | **5.3** | **20** | 6 U | **5.9 J** | 10 U | -- | -- |
| | S-2-MS-2 | 4-7 ft | 08/22/01 | mg/kg | **1.5** | **12** | 7.3 U | **5.4 J** | 10 U | -- | -- |
| S-3-EFA | S-3-EFA-0 | 0-1 ft | 08/22/01 | mg/kg | **25** | **63** | **200** | **990** | **620** | **0.28** | -- |
| | S-3-EFA-1 | 1-4 ft | 08/22/01 | mg/kg | **4.3** | **32** | **250** | **370** | 50 U | 0.056 U | -- |
| | S-3-EFA-2 | 4-7 ft | 08/22/01 | mg/kg | **3.6** | **30** | 7.2 U | **19** | **22** | 0.06 U | -- |
| | S-3-EFA-3 | 10-13 ft | 08/22/01 | mg/kg | **6.5** | **38** | 17 U | **19 J** | **55 J** | -- | 0.08 U |
| S-4-EFA | S-4-EFA-0 | 0-1 ft | 08/22/01 | mg/kg | **13.6** | **52** | 5.5 U | **97** | **340** | **0.061** | -- |
| | S-4-EFA-1 | 1-4 ft | 08/22/01 | mg/kg | **5.4** | **42** | 6.4 U | **6.6 J** | **24 J** | 0.061 U | -- |
| | S-4-EFA-2 | 4-7 ft | 08/22/01 | mg/kg | **6.3** | **72** | 7.8 U | **130 J** | **220** | **1.38** | -- |
| S-5-EFA | S-5-EFA-0 | 0-1 ft | 08/22/01 | mg/kg | **21** | **63** | 6.3 U | **68** | **220** | **0.26** | -- |
| | S-5-EFA-1 | 1-4 ft | 08/22/01 | mg/kg | **6.1** | **39** | 6.7 U | **9** | **15** | 0.061 U | -- |
| | S-5-EFA-2 | 4-7 ft | 08/22/01 | mg/kg | **6.5** | **37** | 8.4 U | **10** | **23** | **0.12** | -- |
| | S-5-EFA-3 | 7-10 ft | 08/22/01 | mg/kg | **4.5** | **54** | 7.8 U | **8.2 J** | **35 J** | -- | 0.075 U |
| | S-5-EFA-4 | 10-13 ft | 08/22/01 | mg/kg | **3.1** | **43** | 6.8 U | 5 U | 10 U | -- | 0.05 U |
| S-6-UST | S-6-TPH-0 | 0-1 ft | 08/22/01 | mg/kg | **8.0** | **105** | 5.7 U | **46 J** | **230** | **0.2** | -- |
| | S-6-TPH-1 | 1-4 ft | 08/22/01 | mg/kg | **3.9** | **36** | 6.6 U | **65 J** | **42 J** | 0.05 U | -- |
| | Dup (S-6-TPH-1) | 1-4 ft | 08/22/01 | mg/kg | **3.8** | **41** | 7.1 U | **330 J** | **100 J** | **0.0069** | -- |
| | S-6-TPH-2 | 4-7 ft | 08/22/01 | mg/kg | **4.1** | **22** | 9.3 U | **68 J** | **91** | **0.79** | -- |
| S-7-UST | S-7-TPH-0[3] | 0-1 ft | 08/22/01 | mg/kg | **74** | **66** | 5.4 U | **48** | **76** | **0.16** | -- |
| | S-7-TPH-1[3] | 1-4 ft | 08/22/01 | mg/kg | **45** | **39** | **68** | **4,400** | 500 U | 0.17 U | -- |
| | S-7-TPH-2[3] | 4-7 ft | 08/22/01 | mg/kg | **6.2** | **28** | **560** | **7,600 J** | 500 U | **0.10** | -- |
| | S-7-TPH-3[3] | 7-10 ft | 08/22/01 | mg/kg | **1.8** | **12** | 7.8 U | **360 J** | 40 U | -- | 0.0061 U |
| S-8-UST | S-8-TPH-0[3] | 0-1 ft | 08/22/01 | mg/kg | -- | -- | **130** | **970 J** | **4,100** | -- | -- |
| | S-8-TPH-1[3] | 1-4 ft | 08/22/01 | mg/kg | -- | -- | **310** | **1,100 J** | **780** | -- | -- |
| | S-8-TPH-2[3] | 4-7 ft | 08/22/01 | mg/kg | -- | -- | **50** | **74 J** | **76** | -- | -- |
| | S-8-TPH-3[3] | 7-10 ft | 08/22/01 | mg/kg | -- | -- | **35** | **13 J** | **26** | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| S-9-CPH | S-9-CPH-0 | 0-1 ft | 08/22/01 | mg/kg | **5.3** | **59** | 5.6 U | **14 J** | **52 J** | -- | -- |
| | Dup (S-9-CPH-0) | 0-1 ft | 08/22/01 | mg/kg | **5.9** | **70** | 5.6 U | **18 J** | **60 J** | -- | -- |
| | S-9-CPH-1 | 1-4 ft | 08/22/01 | mg/kg | **2.3** | **28** | 6 U | **5.5 J** | 10 U | -- | -- |
| | S-9-CPH-2 | 4-7 ft | 08/22/01 | mg/kg | **2.6** | **31** | 6.5 U | **25 J** | **23 J** | -- | -- |
| | S-9-CPH-3 | 7-9 ft | 08/22/01 | mg/kg | **7.2** | **24** | **47** | **420 J** | **330 J** | -- | -- |
| | S-9-CPH-3A | 9-10 ft | 08/22/01 | mg/kg | **4.7** | **24** | 9 U | **94 J** | **82 J** | -- | -- |
| S-10-MR | S-10-MR-0 | 0-1 ft | 08/22/01 | mg/kg | **10.5** | **173** | 5.6 U | **35 J** | **200 J** | -- | -- |
| | S-10-MR-1 | 1-4 ft | 08/22/01 | mg/kg | **5.1** | **26** | 6.1 U | **22 J** | **70 J** | -- | -- |
| | S-10-MR-2 | 4-7 ft | 08/22/01 | mg/kg | **4.5** | **42** | 6.7 U | **8.3 J** | **25 J** | -- | -- |
| | S-10-MR-3 | 7-10 ft | 08/22/01 | mg/kg | **4.2** | **28** | **8** | **8.0 J** | **29 J** | -- | -- |
| S-11-MR | S-11-MR[3] | 0-1 ft | 08/22/01 | mg/kg | **39** | **67 J** | **470** | **2,600** | **1,300** | -- | -- |
| S-12-MR | S-12-MR-0[3] | 0-1 ft | 08/22/01 | mg/kg | **124 J** | **56 J** | 5.9 U | **1,900** | **790** | -- | -- |
| | Dup (S-12-MR-0)[3] | 0.7 ft | 08/22/01 | mg/kg | **240 J** | **65 J** | 6 U | **1,900** | **720** | -- | -- |
| S-13-MR | S-13-MR[3] | 0-0.5 ft | 08/22/01 | mg/kg | **270** | **22 J** | **7** | **120** | **340** | -- | -- |
| S-14-TPH | S-14-TPH-1 | 1-3.1 ft | 10/24/01 | mg/kg | -- | -- | 5.8 U | **72** | **100** | -- | -- |
| | S-14-TPH-4 | 4-6.4 ft | 10/24/01 | mg/kg | -- | -- | 6.4 U | 5 U | 10 U | -- | -- |
| | S-14-TPH-7 | 7-10 ft | 10/24/01 | mg/kg | -- | -- | 7.9 U | 5 U | 10 U | -- | -- |
| S-15-TPH | S-15-TPH-1 | 1-3.8 ft | 10/24/01 | mg/kg | -- | -- | 5.5 U | **15** | **32** | -- | -- |
| | S-15-TPH-4 | 4-6.1 ft | 10/24/01 | mg/kg | -- | -- | 6.8 U | **7** | 10 U | -- | -- |
| | S-15-TPH-7 | 7-9.9 ft | 10/24/01 | mg/kg | -- | -- | 7.6 U | 5 U | 10 U | -- | -- |
| S-16-TPH | S-16-TPH-1[3] | 1-3.7 ft | 10/24/01 | mg/kg | -- | -- | **120** | **730** | **730** | -- | -- |
| | S-16-TPH-4[3] | 4-6.3 ft | 10/24/01 | mg/kg | -- | -- | **2,000** | **40,000** | **1,300** | -- | -- |
| | S-16-TPH-7[3] | 7-10 ft | 10/24/01 | mg/kg | -- | -- | 7.2 U | **21** | 10 U | -- | -- |
| S-17-TPH | S-17-TPH-1 | 1-3.7 ft | 10/24/01 | mg/kg | -- | -- | 6.6 U | **51** | **130** | -- | -- |
| | S-17-TPH-4A | 4-4.4 ft | 10/24/01 | mg/kg | -- | -- | 9.3 U | **500** | 100 U | -- | -- |
| | S-17-TPH-4B | 4.4-6.3 ft | 10/24/01 | mg/kg | -- | -- | 7.3 U | **6** | 10 U | -- | -- |
| | S-17-TPH-7 | 7-9.8 ft | 10/24/01 | mg/kg | -- | -- | 7.6 U | 5 U | 10 U | -- | -- |
| S-18-TPH | S-18-TPH-1 | 1-3.4 ft | 10/24/01 | mg/kg | -- | -- | 5.9 UJ | **48 J** | **150** | -- | -- |
| | S-18-TPH-4 | 4-6.7 ft | 10/24/01 | mg/kg | -- | -- | 6.2 U | **9** | 10 U | -- | -- |
| | S-18-TPH-7 | 7-9.9 ft | 10/24/01 | mg/kg | -- | -- | 6.8 U | 5 U | 10 U | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| S-19-TPH | S-19-TPH-1 | 1-3.6 ft | 10/24/01 | mg/kg | -- | -- | 6.1 U | **350** | 100 U | -- | -- |
| | S-19-TPH-4 | 4-6.4 ft | 10/24/01 | mg/kg | -- | -- | **69** | **1700 J** | **36 J** | -- | -- |
| | S-19-TPH-7 | 7-9.9 ft | 10/24/01 | mg/kg | -- | -- | 7.5 U | **190** | 10 U | -- | -- |
| S-20-TPH | S-20-TPH-1[3] | 1-3.9 ft | 10/24/01 | mg/kg | -- | -- | 5.8 U | **9** | **15** | -- | -- |
| | S-20-TPH-4[3] | 4-6.5 ft | 10/24/01 | mg/kg | -- | -- | **210** | **2,600** | **140 J** | -- | -- |
| | S-20-TPH-7[3] | 7-10 ft | 10/24/01 | mg/kg | -- | -- | 9 U | **12** | **18** | -- | -- |
| S-21-TPH | S-21-TPH-1[3] | 1-2.2 ft | 10/24/01 | mg/kg | -- | -- | 5.5 U | **12** | 10 U | -- | -- |
| | S-21-TPH-4[3] | 4-4.1 ft | 10/24/01 | mg/kg | -- | -- | 5.7 U | **140** | **35** | -- | -- |
| | S-21-TPH-7[3] | 7-9.4 ft | 10/24/01 | mg/kg | -- | -- | 8 U | **8** | 10U | -- | -- |
| S-22-TPH | S-22-TPH-1A[3] | 1-2.5 ft | 10/24/01 | mg/kg | -- | -- | 6.9 U | **1,600** | **960** | -- | -- |
| | S-22-TPH-1B[3] | 2.5-4 ft | 10/24/01 | mg/kg | -- | -- | **700** | **6,700** | **110 J** | -- | -- |
| | S-22-TPH-4[3] | 4-5 ft | 10/24/01 | mg/kg | -- | -- | **360** | **380** | **39** | -- | -- |
| | S-22-TPH-7[3] | 7-9.5 ft | 10/24/01 | mg/kg | -- | -- | **34** | **10** | **11** | -- | -- |
| S-23-TPH | S-23-TPH-1[3] | 1-3.4 ft | 10/24/01 | mg/kg | -- | -- | 5.9 U | 5 U | 10 U | -- | -- |
| | S-23-TPH-4[3] | 4-6.7 ft | 10/24/01 | mg/kg | -- | -- | 6.9 U | **3,800** | **210 J** | -- | -- |
| | S-23-TPH-7[3] | 7-9.6 ft | 10/24/01 | mg/kg | -- | -- | 8.9 U | **9** | 10 U | -- | -- |
| SS-1 | SS-1-1 | 1-1.5 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SS-2 | SS-2-1 | 1-1.5 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SS-3 | SS-3-1 | 1-1.5 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SS-4 | SS-4-0.5 | 0.5 -1 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| MW-5 | MW-5-5.0 | 5-6.5 ft | 05/27/08 | mg/kg | -- | -- | 3 U | -- | -- | **0.19** | -- |
| | MW-5-10.0 | 10-11.5 ft | 05/27/08 | mg/kg | -- | -- | 3 U | -- | -- | -- | **0.18** |
| SB-1 | SB-1-2.0 | 2-3 ft | 06/16/08 | mg/kg | **8.7** | -- | -- | -- | -- | -- | -- |
| | SB-1-4.0 | 4-5 ft | 06/16/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| SB-2 | SB-2-2.0 | 2-3 ft | 06/16/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| | SB-2-4.0 | 4-5 ft | 06/16/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| SB-4 | SB-4-3.0 | 3-4 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | 0.02 U | -- |
| | SB-4-9.0 | 9-10 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SB-5 | SB-5-3.0 | 3-4 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | **0.07** | -- |
| | SB-5-9.0 | 9-10 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| SB-7 | SB-7-3.0 | 3-4 ft | 06/16/08 | mg/kg | -- | -- | | | | **0.038** | -- |
| | SB-7-9.0 | 9-10 ft | 06/16/08 | mg/kg | -- | -- | | | | -- | -- |
| SB-8 | SB-8-0.5 | 0.5-1.5 ft | 06/17/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| | SB-8-4.0 | 4-5 ft | 06/17/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SB-9 | SB-9-0.5 | 0.5-1.5 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| | SB-9-4.0 | 4-5 ft | 06/16/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SB-10 | SB-10-0.5 | 0.5-1.5 ft | 06/17/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| | SB-10-4.0 | 4-5 ft | 06/17/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SB-11 | SB-11-0.5 | 0.5-1.5 ft | 06/17/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| | SB-11-4.0 | 4-5 ft | 06/17/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| SB-12 | SB-12-0.5 | 0.5-1.5 ft | 06/16/08 | mg/kg | **910** | -- | -- | -- | -- | -- | -- |
| | SB-12-4.0 | 4-5 ft | 06/16/08 | mg/kg | **48** | -- | -- | -- | -- | -- | -- |
| SB-13 | SB-13-0.5 | 0.5-1.5 ft | 06/16/08 | mg/kg | **5.2** | -- | -- | -- | -- | -- | -- |
| | SB-13-4.0 | 4-5 ft | 06/16/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| SB-14 | SB-14-0.5 | 0.5-1.5 ft | 06/16/08 | mg/kg | **73** | -- | -- | -- | -- | -- | -- |
| | SB-14-4.0 | 4-5 ft | 06/16/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| SB-15 | SB-15-0.5 | 0.5-1.5 ft | 06/16/08 | mg/kg | **180** | -- | -- | -- | -- | -- | -- |
| | SB-15-4.0 | 4-5 ft | 06/16/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| TP-3 | TP-3-6 | 6-6.5 ft | 09/05/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| TP-4 | TP-4-6 | 6-6.5 ft | 09/08/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| TP-5 | TP-5-2 | 2-2.5 ft | 09/08/08 | mg/kg | **15** | -- | -- | -- | -- | -- | -- |
| | TP-5-4 | 4-4.5 ft | 09/08/08 | mg/kg | **9.6** | -- | -- | -- | -- | -- | -- |
| TP-10 | TP-10-4 | 4-4.5 ft | 09/08/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| | TP-10-6 | 6-6.5 ft | 09/08/08 | mg/kg | -- | -- | -- | -- | -- | -- | -- |
| TP-11 | TP-11-6 | 6-6.5 ft | 09/08/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| TP-12 | TP-12-3 | 3-3.5 ft | 09/08/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| TP-13 | TP-13-2 | 2-2.5 ft | 09/08/08 | mg/kg | **24** | -- | -- | -- | -- | -- | -- |
| | TP-13-4 | 4-4.5 ft | 09/08/08 | mg/kg | **34** | -- | -- | -- | -- | -- | -- |
| TP-14 | TP-14-0-2 | 0-2 ft | 09/18/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| TP-15 | TP-15-2-4 | 2-4 ft | 09/18/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| TP-16 | TP-16-0-2 | 0-2 ft | 09/18/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| | TP-16-4-6 | 4-6 ft | 09/18/08 | mg/kg | 5 U | -- | -- | -- | -- | -- | -- |
| GEI-01 | GEI-01_3-4 | 3-4 ft | 09/29/14 | mg/kg | 6 U | -- | -- | -- | -- | -- | -- |
| GEI-02 | GEI-02_1-2 | 1-2 ft | 09/29/14 | mg/kg | 5.2 U | **34** | -- | -- | -- | -- | -- |
| | GEI-02_4-5 | 4-5 ft | 09/29/14 | mg/kg | 5.8 U | -- | -- | -- | -- | -- | -- |
| | GEI-02_7-8 | 7-8 ft | 09/29/14 | mg/kg | 5.3 U | **8** | -- | -- | -- | -- | -- |
| GEI-03 | GEI-03_2.5-3.5 | 2.5-3.5 ft | 09/29/14 | mg/kg | **7.8** | **25** | -- | -- | -- | -- | -- |
| | GEI-03_7-8 | 7-8 ft | 09/29/14 | mg/kg | 5.7 U | **21 J** | -- | -- | -- | -- | -- |
| GEI-04 | GEI-04_1-2 | 1-2 ft | 09/29/14 | mg/kg | 5.2 U | **31** | -- | -- | -- | -- | -- |
| | GEI-04_3-4 | 3-4 ft | 09/29/14 | mg/kg | **13** | -- | -- | -- | -- | -- | -- |
| | GEI-04_6-7 | 6-7 ft | 09/29/14 | mg/kg | **33** | 43 | -- | -- | -- | -- | -- |
| GEI-05 | GEI-05_7-8 | 7-8 ft | 09/29/14 | mg/kg | 6.0 U | **88** | -- | -- | -- | -- | -- |
| GEI-06 | GEI-06_1.5-2.5 | 1.5-2.5 ft | 09/29/14 | mg/kg | **23** | **58** | -- | -- | -- | -- | -- |
| | GEI-06_4-5 | 4-5 ft | 09/29/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-06_7-8 | 7-8 ft | 09/29/14 | mg/kg | 5.6 U | **29** | -- | -- | -- | -- | -- |
| GEI-07 | GEI-07_1.5-2.5 | 1.5-2.5 ft | 09/29/14 | mg/kg | **27** | **52** | -- | -- | -- | -- | -- |
| | GEI-07_7-8 | 7-8 ft | 09/29/14 | mg/kg | **4.4** | **38** | -- | -- | -- | -- | -- |
| GEI-08 | GEI-08_1.5-2.5 | 1.5-2.5 ft | 09/29/14 | mg/kg | 5.2 U | **50** | -- | -- | -- | -- | -- |
| | GEI-08_4-5 | 4-5 ft | 09/29/14 | mg/kg | 5.3 U | -- | -- | -- | -- | -- | -- |
| | GEI-08_7-8 | 7-8 ft | 09/29/14 | mg/kg | 6.3 U | **27** | -- | -- | -- | -- | -- |
| GEI-09 | GEI-09_0.5-1.5 | 0.5-1.5 ft | 09/29/14 | mg/kg | **62** | **57** | -- | -- | -- | -- | -- |
| | GEI-09_3-4 | 3-4 ft | 09/29/14 | mg/kg | 5.4 U | -- | -- | -- | -- | -- | -- |
| | GEI-09_6-7 | 6-7 ft | 09/29/14 | mg/kg | **4.6** | **40** | -- | -- | -- | -- | -- |
| GEI-10 | GEI-10_2-3 | 2-3 ft | 09/29/14 | mg/kg | **33** | **150** | -- | -- | -- | -- | -- |
| | GEI-10_7-8 | 7-8 ft | 09/29/14 | mg/kg | 6.1 U | **8.3** | -- | -- | -- | -- | -- |
| GEI-11 | GEI-11_2-3 | 2-3 ft | 09/29/14 | mg/kg | **5.9** | **26** | -- | -- | -- | -- | -- |
| | GEI-11_7-8 | 7-8 ft | 09/29/14 | mg/kg | 5.5 U | **38** | -- | -- | -- | -- | -- |
| | GEI-11_9-10 | 9-10 ft | 09/29/14 | mg/kg | 5.6 U | **34** | -- | -- | -- | -- | -- |
| GEI-12 | GEI-12_2-3 | 2-3 ft | 09/29/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-12_4-5 | 4-5 ft | 09/29/14 | mg/kg | **19** | -- | -- | -- | -- | -- | -- |
| | GEI-12_7-8 | 7-8 ft | 09/29/14 | mg/kg | 5.8 U | -- | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| GEI-13 | GEI-13_2-3 | 2-3 ft | 09/30/14 | mg/kg | **85** | **110** | -- | -- | -- | -- | -- |
| | GEI-13_5-6 | 5-6 ft | 09/30/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-13_7-8 | 7-8 ft | 09/30/14 | mg/kg | 5.3 U | **12** | -- | -- | -- | -- | -- |
| GEI-14 | GEI-14_2-3 | 2-3 ft | 09/30/14 | mg/kg | **91** | **43** | -- | -- | -- | -- | -- |
| | GEI-14_3.5-4.5 | 3.5-4.5 ft | 09/30/14 | mg/kg | **6.5** | -- | -- | -- | -- | -- | -- |
| | GEI-14_7-8 | 7-8 ft | 09/30/14 | mg/kg | **7.4** | **13** | -- | -- | -- | -- | -- |
| | GEI-14_9-10 | 9-10 ft | 09/30/14 | mg/kg | 6.4 U | -- | -- | -- | -- | -- | -- |
| GEI-15 | GEI-15_2-3 | 2-3 ft | 09/30/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-15_5.5-6.5 | 5.5-6.5 ft | 09/30/14 | mg/kg | 6.0 U | **41** | -- | -- | -- | 0.0061 U | -- |
| | GEI-15_10-11 | 10-11 ft | 09/30/14 | mg/kg | -- | **39** | -- | -- | -- | -- | -- |
| GEI-16 | GEI-16_2-3 | 2-3 ft | 09/30/14 | mg/kg | **6.6** | **36** | -- | -- | -- | -- | -- |
| | GEI-16_6-7 | 6-7 ft | 09/30/14 | mg/kg | 6.6 U | **6.2** | -- | -- | -- | -- | -- |
| | GEI-16_8-9 | 8-9 ft | 09/30/14 | mg/kg | 5.8 U | **15** | -- | -- | -- | -- | -- |
| GEI-17 | GEI-17_1-2 | 1-2 ft | 09/30/14 | mg/kg | -- | **41** | -- | -- | -- | -- | -- |
| | GEI-17_4-5 | 4-5 ft | 09/30/14 | mg/kg | **8** | -- | -- | -- | -- | -- | -- |
| | GEI-17_7-8 | 7-8 ft | 09/30/14 | mg/kg | **31** | **39** | -- | -- | -- | -- | -- |
| | GEI-17_9-10 | 9-10 ft | 09/30/14 | mg/kg | **8.1** | **58** | -- | -- | -- | -- | -- |
| GEI-18 | GEI-18_1-2 | 1-2 ft | 09/30/14 | mg/kg | **5.2** | **36** | -- | -- | -- | -- | -- |
| | GEI-18_4-5 | 4-5 ft | 09/30/14 | mg/kg | **18** | **37** | -- | -- | -- | -- | -- |
| | GEI-18_8-9 | 8-9 ft | 09/30/14 | mg/kg | **11** | **200** | -- | -- | -- | -- | -- |
| | GEI-18_9-10 | 9-10 ft | 09/30/14 | mg/kg | **6.9** | **49** | -- | -- | -- | -- | -- |
| GEI-19 | GEI-19_2-3 | 2-3 ft | 09/30/14 | mg/kg | -- | **43** | -- | -- | -- | -- | -- |
| | GEI-19_4-5 | 4-5 ft | 09/30/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-19_7-8 | 7-8 ft | 09/30/14 | mg/kg | **2.6** | -- | -- | -- | -- | -- | -- |
| | GEI-19_9-10 | 9-10 ft | 09/30/14 | mg/kg | -- | **29** | -- | -- | -- | -- | -- |
| GEI-20 | GEI-20_2-3 | 2-3 ft | 09/30/14 | mg/kg | -- | **37** | -- | -- | -- | -- | -- |
| | GEI-20_4-5 | 4-5 ft | 09/30/14 | mg/kg | **6.5** | -- | -- | -- | -- | -- | -- |
| | GEI-20_6-7 | 6-7 ft | 09/30/14 | mg/kg | -- | -- | -- | -- | -- | **0.06** | -- |
| | GEI-20_8-9 | 8-9 ft | 09/30/14 | mg/kg | **5.7** | -- | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| GEI-21 | GEI-21_1-2 | 1-2 ft | 09/30/14 | mg/kg | -- | **33** | -- | -- | -- | -- | -- |
| | GEI-21_5-6 | 5-6 ft | 09/30/14 | mg/kg | 5.9 U | **28** | -- | -- | -- | **0.015** | -- |
| | GEI-21_7.5-8.5 | 7.5-8.5 ft | 09/30/14 | mg/kg | **3.1** | -- | -- | -- | -- | -- | **0.024** |
| GEI-22 | GEI-22_2-3 | 2-3 ft | 10/01/14 | mg/kg | 5.3 U | **35** | -- | -- | -- | -- | -- |
| | GEI-22_5-6 | 5-6 ft | 10/01/14 | mg/kg | 5.4 U | **30** | -- | -- | -- | **0.022** | -- |
| | GEI-22_7.5-8.5 | 7.5-8.5 ft | 10/01/14 | mg/kg | **92** | -- | -- | -- | -- | -- | -- |
| GEI-23 | GEI-23_1-2 | 1-2 ft | 09/30/14 | mg/kg | 5.2 U | **27** | -- | -- | -- | -- | -- |
| | GEI-23_5-6 | 5-6 ft | 09/30/14 | mg/kg | **12** | -- | -- | -- | -- | -- | -- |
| | GEI-23_7.5-8.5 | 7.5-8.5 ft | 09/30/14 | mg/kg | 6.1 U | -- | -- | -- | -- | -- | 0.0061 U |
| GEI-24 | GEI-24_2-3 | 2-3 ft | 09/30/14 | mg/kg | 5.2 U | **40** | -- | -- | -- | -- | -- |
| | GEI-24_4-5 | 4-5 ft | 09/30/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-24_6-7 | 6-7 ft | 09/30/14 | mg/kg | **13** | -- | -- | -- | -- | -- | -- |
| | GEI-24_9-10 | 9-10 ft | 09/30/14 | mg/kg | 6.3 U | -- | -- | -- | -- | -- | -- |
| GEI-25 | GEI-25_1-2 | 1-2 ft | 09/30/14 | mg/kg | **7.5** | **36** | -- | -- | -- | -- | -- |
| | GEI-25_4-5 | 4-5 ft | 09/30/14 | mg/kg | 6.0 U | **80** | -- | -- | -- | -- | -- |
| | GEI-25_7-8 | 7-8 ft | 09/30/14 | mg/kg | 6.1 U | **130** | -- | -- | -- | -- | -- |
| | GEI-25_9-10 | 9-10 ft | 09/30/14 | mg/kg | -- | **130** | -- | -- | -- | -- | -- |
| GEI-26 | GEI-26_2 -3 | 2-3 ft | 09/30/14 | mg/kg | **5.4** | **40** | -- | -- | -- | -- | -- |
| | GEI-26_6-7 | 6-7 ft | 09/30/14 | mg/kg | 5.8 U | **33** | -- | -- | -- | -- | -- |
| GEI-27 | GEI-27_1-2 | 1-2 ft | 10/01/14 | mg/kg | -- | **28** | -- | -- | -- | -- | -- |
| | GEI-27_5-6 | 5-6 ft | 10/01/14 | mg/kg | **22** | **20** | -- | -- | -- | -- | -- |
| | GEI-27_9-10 | 9-10 ft | 10/01/14 | mg/kg | 6.6 U | -- | -- | -- | -- | -- | -- |
| GEI-28 | GEI-28_2-3 | 2-3 ft | 10/01/14 | mg/kg | 5.9 U | **34** | -- | -- | -- | -- | -- |
| | GEI-28_5-6 | 5-6 ft | 10/01/14 | mg/kg | 5.8 U | **50** | -- | -- | -- | 0.0058 U | -- |
| | GEI-28_10-11 | 10-11 ft | 10/01/14 | mg/kg | **6.7** | **37** | -- | -- | -- | -- | -- |
| GEI-29 | GEI-29_2-3 | 2-3 ft | 09/30/14 | mg/kg | 5.5 U | **42** | -- | -- | -- | -- | -- |
| | GEI-29_5-6 | 5-6 ft | 09/30/14 | mg/kg | **6.4** | -- | -- | -- | -- | -- | -- |
| | GEI-29_8-9 | 8-9 ft | 09/30/14 | mg/kg | 3.6 U | -- | -- | -- | -- | -- | -- |
| | GEI-29_9-10 | 9-10 ft | 09/30/14 | mg/kg | 6.0 U | -- | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| GEI-30 | GEI-30_3-4 | 3-4 ft | 09/30/14 | mg/kg | 5.4 U | **7.3** | -- | -- | -- | -- | -- |
| | GEI-30_7-8 | 7-8 ft | 09/30/14 | mg/kg | 5.7 U | **8.9** | -- | -- | -- | -- | -- |
| | GEI-30_9-10 | 9-10 ft | 09/30/14 | mg/kg | 6.0 U | **11** | -- | -- | -- | -- | -- |
| GEI-31 | GEI-31_1-2 | 1-2 ft | 10/01/14 | mg/kg | **7.6** | **110** | -- | -- | -- | -- | -- |
| | GEI-31_4-5 | 4-5 ft | 10/01/14 | mg/kg | -- | **40** | -- | -- | -- | -- | -- |
| | GEI-31_6-7 | 6-7 ft | 10/01/14 | mg/kg | -- | **86** | -- | -- | -- | -- | -- |
| | GEI-31_9-10 | 9-10 ft | 10/01/14 | mg/kg | -- | **48** | -- | -- | -- | -- | -- |
| GEI-32 | GEI-32_1-2 | 1-2 ft | 10/01/14 | mg/kg | 5.3 U | **64** | -- | -- | -- | -- | -- |
| | GEI-32_6-7 | 6-7 ft | 10/01/14 | mg/kg | -- | **14** | -- | -- | -- | -- | -- |
| GEI-33 | GEI-33_1-2 | 1-2 ft | 10/01/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| GEI-34 | GEI-34_2.5-3.5 | 2.5-3.5 ft | 10/01/14 | mg/kg | 5.3 U | -- | -- | -- | -- | -- | -- |
| | GEI-34_6-7 | 6-7 ft | 10/01/14 | mg/kg | -- | **38** | -- | -- | -- | -- | -- |
| | GEI-34_9-10 | 9-10 ft | 10/01/14 | mg/kg | -- | **38** | -- | -- | -- | -- | -- |
| GEI-35 | GEI-35_3-4 | 3-4 ft | 10/01/14 | mg/kg | 6.2 U | **35** | -- | -- | -- | -- | -- |
| | GEI-35_4-5 | 4-5 ft | 10/01/14 | mg/kg | -- | **22** | -- | -- | -- | -- | -- |
| | GEI-35_8-9 | 8-9 ft | 10/01/14 | mg/kg | -- | **40** | -- | -- | -- | -- | -- |
| | GEI-35_9-10 | 9-10 ft | 10/01/14 | mg/kg | -- | **28** | -- | -- | -- | -- | -- |
| GEI-36 | GEI-36_1-2 | 1-2 ft | 10/01/14 | mg/kg | **5.7** | -- | -- | -- | -- | -- | -- |
| | GEI-36_5-6 | 5-6 ft | 10/01/14 | mg/kg | **6.9** | **50** | -- | -- | -- | -- | -- |
| GEI-37 | GEI-37_1-2 | 1-2 ft | 10/01/14 | mg/kg | 5.2 U | -- | -- | -- | -- | -- | -- |
| | GEI-37_6-7 | 6-7 ft | 10/01/14 | mg/kg | 5.7 U | **8.1** | -- | -- | -- | -- | -- |
| GEI-38 | GEI-38_1-2 | 1-2 ft | 10/01/14 | mg/kg | 5.6 U | -- | -- | -- | -- | -- | -- |
| | GEI-38_6-7 | 6-7 ft | 10/01/14 | mg/kg | 5.8 U | -- | -- | -- | -- | -- | -- |
| GEI-39 | GEI-39_1.5-2.5 | 1.5-2.5 ft | 10/01/14 | mg/kg | 6.0 U | **38** | -- | -- | -- | -- | -- |
| | GEI-39_4-5 | 4-5 ft | 10/01/14 | mg/kg | -- | **45** | -- | -- | -- | -- | -- |
| | GEI-39_6-7 | 6-7 ft | 10/01/14 | mg/kg | 6.5 U | **40** | -- | -- | -- | -- | -- |
| GEI-40 | GEI-40_2-3 | 2-3 ft | 10/01/14 | mg/kg | **6.2** | -- | -- | -- | -- | -- | -- |
| GEI-41 | GEI-41_1-2 | 1-2 ft | 10/01/14 | mg/kg | 6.2 U | **46** | -- | -- | -- | -- | -- |
| | GEI-41_4-5 | 4-5 ft | 10/01/14 | mg/kg | 5.8 U | -- | -- | -- | -- | -- | -- |
| | GEI-41_6-7 | 6-7 ft | 10/01/14 | mg/kg | -- | **43** | -- | -- | -- | -- | -- |
| | GEI-41_8-9 | 8-9 ft | 10/01/14 | mg/kg | -- | **30** | -- | -- | -- | -- | -- |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

| Sample Location[1] | Sample Identification | Sample Depth (bgs) | Sample Date | Units | Total Metals[2] | | Petroleum Hydrocarbons | | | Total cPAH TEQ[3,4] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Arsenic | Nickel | Range | Range | Range | Zone | Zone |
| GEI-42 | GEI-42_1-2 | 1-2 ft | 10/01/14 | mg/kg | **5.5** | **34** | -- | -- | -- | -- | -- |
| | GEI-42_4-5 | 4-5 ft | 10/01/14 | mg/kg | -- | **24** | -- | -- | -- | -- | -- |
| | GEI-42_6-7 | 6-7 ft | 10/01/14 | mg/kg | 6.0 U | **31** | -- | -- | -- | -- | -- |
| GEI-43 | GEI-43_1-2 | 1-2 ft | 10/01/14 | mg/kg | **6.6** | **52** | -- | -- | -- | -- | -- |
| | GEI-43_6-7 | 6-7 ft | 10/01/14 | mg/kg | -- | **37** | -- | -- | -- | -- | -- |
| GEI-44 | GEI-44_1.5-2 | 1.5-2 ft | 07/23/18 | mg/kg | **9.5** | -- | -- | -- | -- | **0.049** | -- |
| | GEI-44_7.5-10 | 7.5-10 ft | 07/23/18 | mg/kg | 5.6 U | -- | -- | -- | -- | -- | 0.006 U |
| | GEI-44_16-17.5 | 16-17.5 ft | 07/23/18 | mg/kg | 5.4 U | -- | -- | -- | -- | -- | 0.006 U |
| GEI-45 | GEI-45_1-3 | 1-3 ft | 07/23/18 | mg/kg | 5.3 U | -- | -- | -- | -- | 0.005 U | -- |
| | GEI-45_9-10 | 9-10 ft | 07/23/18 | mg/kg | 5.5 U | -- | -- | -- | -- | -- | 0.006 U |
| | GEI-45_17-20 | 17-20 ft | 07/23/18 | mg/kg | 5.6 U | -- | -- | -- | -- | -- | 0.006 U |
| GEI-46 | GEI-46_7-8.5 | 7-8.5 ft | 07/23/18 | mg/kg | 5.7 U | -- | -- | -- | -- | 0.006 U | -- |
| | GEI-46_13.5-15 | 13.5-15 ft | 07/23/18 | mg/kg | 6.0 U | -- | -- | -- | -- | -- | 0.006 U |
| Proposed Soil Cleanup Level[5] | | | | | 20 | 48 | 100 | 2,000 | 2,000 | 0.31 | 0.016 |

**Notes:**

[1] Soil sample locations are shown on Figure 14. Soil sample results are summarized on Figures s 23 through 26.

[2] Metals analyzed using United States Environmental Protection Agency (EPA) Method 6010/6020.

[3] Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) analyzed by EPA method 8270D/SIM.

[4] Total cPAHs calculated using toxic equivalent (TEQ) methodology relative to benzo(a)pyrene. Non-detect compounds were assigned a value of one half the reporting limit for the calculation.

[5] Proposed soil cleanup level is referenced from the Remedial Investigation/Feasibility Study Work Plan (GeoEngineers 2008).

bgs = below the ground surface

mg/kg = milligram per kilogram

J = Estimated value

U = qualifier indicating analyte not detected at level above listed practical quantitation limit

-- = not analyzed

**Bold** indicates analyte was detected.

Blue shading indicates that the reporting limit exceeds the proposed groundwater cleanup level.

Yellow shading indicates analyte was detected at a concentration above proposed groundwater cleanup level.

# Table 16

## Applicable or Relevant and Appropriate Requirements

### Dakota Creek Industries

### Anacortes, Washington

| Authorizing Statute and Implementing Regulation | Citation | Procedural/Substantive Requirements | Description and Applicability |
|---|---|---|---|
| **Federal ARARs** | | | |
| Archaeological Resources Protection Act | 16 USC § 470aa et seq.<br>43 CFR Part 7 | Prohibits the unauthorized disturbance of archaeological resources on public or Indian lands. Archaeological resources are "any material remains of past human life and activities which are of archaeological interest," including pottery, baskets, tools, and human skeletal remains. The unauthorized removal of archaeological resources from public or Indian lands is prohibited without a permit, and any archaeological investigations at a site must be conducted by a professional archeologist. | Potentially applicable to a site where response actions involve disturbance/ alteration of the ground and/or site terrain. Appropriate measures will be taken to evaluate the presence of cultural resources. If a potential for an existence of cultural resources exists then appropriate measures will be taken during excavation activities and appropriate tribal members will be contacted in the event that an artifact is encountered. |
| American Indian Religious Freedom Act | 42 USC § 1996 et seq | The American Indian Religious Freedom Act and implementing regulations are intended to protect Native American religious, ceremonial, and burial sites, and the free practice of religions by Native American groups. The requirements of this Act must be followed if sacred sites graves are discovered in the course of ground-disturbing activities. | |
| Native American Graves Protection and Repatriation Act | 25 USC § 3001 et seq<br>43 CFR Part 10<br>25 USC 3001 et seq.<br>43 CFR 10 | Intended to protect Native American graves from desecration through the removal and trafficking of human remains and "cultural items" including funerary and sacred objects. The requirements of this Act must be followed when graves are discovered or ground-disturbing activities encounter Native American burial sites. | |
| Clean Air Act (CAA), National Ambient Air Quality Standards | 42 USC 7401 et seq.<br>40 CFR 50 | Provides air quality standards for six criteria pollutants, including particulate matter, to protect public health and welfare. | Applicable. |
| Endangered Species Act (ESA) | 16 U.S.C. § 1531 – 1544<br>50 CFR Parts 17, 402 | Provides for the protection of species of fish, wildlife, and plants that are listed as threatened or endangered with extinction. It also protects designated critical habitat for listed species. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, including consultation with resource agencies. | Potentially applicable to the site for listed and proposed to be listed threatened or endangered species and their habitat areas which will, or could, be impacted by cleanup action. |
| Federal Coastal Zone Management Act (CZMA) | 16 USC 1451-1464<br>15 CFR 923-930 | The CZMA requires that federal agency action that is reasonably likely to affect use of shorelines be consistent with the approved coastal zone management plan to the maximum extent practicable, subject to limitations set forth in the CZMA and requires that construction activities near the shoreline must be consistent with the State's Coastal Zone Management Program. | Applicable if construction is completed within 200 feet of the shoreline. The requirements will be met by preparing a CMZA form for Washington State Department of Ecology's review. Ecology reviews the proposed project for consistency with state environmental requirements, including shoreline permitting requirements. |
| Fish and Wildlife Conservation Act (FWCA) | 16 U.S.C. § 661 et seq<br>50 CFA 83 | Requires that adequate provision must be made for the conservation, maintenance, and management of wildlife resources and habitat and requires consultation with the U.S. Fish and Wildlife service and appropriate state agencies. | Applicable to the site if listed threatened or endangered species habitat areas will, or could, be impacted by cleanup action. |

| Authorizing Statute and Implementing Regulation | Citation | Procedural/Substantive Requirements | Description and Applicability |
|---|---|---|---|
| Hazardous Materials Transportation Act | 49 USC 1801-1813<br>49 CFR 107, 171-177 | Regulates the transportation of hazardous waste. | Applicable to the site if offsite disposal is included in cleanup action. |
| Migratory Bird Treaty Act (MBTA) | 16 USC § 703 et seq | Makes it unlawful to "hunt, take, capture, kill" or take various other actions adversely affecting a broad range of migratory birds, including tundra swans, hawks, falcons, songbirds, without prior approval by the U.S. Fish and Wildlife Service. | Applicable for protecting migratory bird species if identified. The selected response action must be carried out in a manner that avoids the taking of protected migratory bird species, including individual birds or their nests or eggs. |
| Occupational Safety and Health Act (OSHA) | 29 CFR 1904<br>29 CFR 1910<br>29 CFR 1926 | Specifies minimum requirements to maintain worker health and safety during hazardous waste operations, including training and construction safety requirements. | Applicable to construction phases of a cleanup. Construction activities will be conducted in accordance with the requirements of OSHA. |
| Resource Conservation and Recovery Act (RCRA), Identification and Management of Hazardous Wastes | 40 CFR 261 et seq. | Specifies how to determine whether a solid waste is considered hazardous (whether listed or based on characteristic) and how to manage hazardous wastes. | Relevant and appropriate to the site. Washington State is authorized for RCRA. |
| **State ARARs** | | | |
| Model Toxics Control Act (MTCA) Cleanup Regulation | RCW 70.105D<br>Chapter 173-340 WAC | MTCA is the primary regulation governing cleanup actions. | Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits. |
| State Environmental Policy Act (SEPA) | Chapter 43.21C RCW<br>Chapter 173-802 WAC<br>Chapter 197-11 WAC | Prior to taking any action on a proposal, agencies must follow specific procedures to ensure that appropriate consideration has been given to the environment. The severity of potential environmental impacts associated with a project determines whether an Environmental Impact Statement is required. | Applicable. A SEPA checklist is required prior remedial construction activities. |
| Shoreline Management Act | Chapter 90.58 RCW<br>Chapter 173-27-060 WAC | The Shoreline Management Act and its implementing regulations establish requirements for substantial developments occurring within waters of the state or within 200 feet of the shoreline. Local shoreline management programs are adopted under state regulations, creating an enforceable state law. | Applicable to upland cleanup action alternatives that include activities within 200 feet of the shoreline. Cleanup actions under MTCA are exempt from shoreline management act permitting; however, will need to meet substantive requirements. |
| MTCA, Site Cleanup and Monitoring | WAC 173-340-400 through 173-340-440 | Provides requirements for implementation of the cleanup action, compliance monitoring, periodic review, interim action and institutional controls. | Applicable. |
| Washington Clean Air Act | Chapter 70.94 RCW<br>Chapter 43.21A RCW<br>Chapter 173-400 WAC | Requires all sources of air contaminants to meet emission standards for visible, particulate, fugitive, odors, and hazardous air emissions. Requires use of reasonably available control technology. | Substantive requirements are applicable for any response actions in the project area that may create fugitive dust or other regulated air emissions. |
| Puget Sound Clean Air Agency (PSCAA) | Regulation 1, Section 9.15. | Provides regulation for the visible emissions of fugitive dust and reasonable precautions that should be employed to minimize these emissions. | Substantive requirements are applicable for any response actions in the project area that may create fugitive dust or other regulated air emissions. |

| Authorizing Statute and Implementing Regulation | Citation | Procedural/Substantive Requirements | Description and Applicability |
|---|---|---|---|
| Hazardous Waste Management Act, Dangerous Waste Regulations | Chapter 70.105 RCW<br>Chapter 173-303 WAC | Governs handling and disposition of dangerous waste, including identification, accumulation, storage, transport, treatment, and disposal. | Substantive requirements are applicable handling, storage, and disposal of hazardous material. These requirements will apply if dangerous wastes are generated during the cleanup action. |
| Solid Waste Handling Standards | Chapter 70.95 RCW<br>Chapter 173-350 WAC. | The solid waste requirements are applicable to remedial alternatives that consist of off-site disposal of solid non-hazardous wastes and contaminated media. | For off site disposal activities, waste materials will be sent to facilities licensed and permitted to accept the specific waste material and documentation will be obtained of such disposition. |
| Washington Industrial Safety and Health Act (WISHA) | Chapter 49.17 RCW<br>Chapter 296-62 WAC<br>Chapter 296-843 WAC | Specifies minimum requirements to maintain worker health and safety during hazardous waste operations, including training and construction safety requirements. | Applicable to construction phases of a cleanup. Construction activities will be conducted in accordance with the requirements of WISHA. |
| **City ARARs** | | | |
| City of Anacortes Noise Ordinance | Chapter 17.54.010<br>Ordinance 2316 (part), 1994 | Establishes noise levels and standards. | Applicable. |
| City of Anacortes Publicly Owned Treatment Water (POTW) Discharge Authorization | Chapter 13.40.060 | Establishes the requirements and limitations for discharges to the POTW. | Potentially applicable if collected water from construction activities will be treated and permitted for disposal under a discharge authorization by the City. |
| City of Anacortes Stormwater Management Program | Chapter 13.36<br>Chapter 17.54.050 | Provides the necessary measures to control the quantity and quality of stormwater produced by new development and redevelopment such that they comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters. | Potentially applicable if dredged material is processed upland of the Site prior to permitted landfill disposal. |

**Notes:**

ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
RCW = Revised Code of Washington
WAC = Washington Administrative Code
USC = United States Code

# Table 17

## Soil Remedial Technologies Screening

**Dakota Creek Industries**

**Anacortes, Washington**

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| No Action | No Action | None | No institutional controls or treatment. | Not effective for protecting human health and environment. | Implementable but not acceptable to the general public or government agencies. | None | None | Used as a baseline for comparison. | No |
| Institutional Controls (ICs) | Governmental/ Property Controls | Environmental Covenant | Legal restrictions associated with future land use and activities (e.g., development, construction, etc.); may also be used to specify long-term maintenance requirements of remediation systems. | Technically implementable. Specific legal requirements and authority would need to be met. | Not effective for remediating contaminants. Can be effective at reducing risks and maintaining integrity of a remedy. | Low | Low | Applicable and/or required in combination with other technologies. | Yes |
| | | Land Use Restrictions, Soil Management Plans/ Requirements | Restrictions on activities such as excavation to prevent physical damage to in situ remedies (e.g., caps) and/or exposure to hazardous substances that remain in-place. Implement soil management plans/requirements so that contaminated soils are managed properly in an event that it is necessary to disturb/excavate (e.g., utility work, etc.). | Technically implementable but administratively more difficult. Requires an implementing agency. | Not effective for remediating contaminants. Enforcement would be required for restrictions to be effective. | Low | Low | Applicable and/or required in combination with other technologies. | Yes |
| | Access Restrictions and Information Devices | Fencing and Warning Signage | Placement of fencing and warning signs to prevent access and inform the public regarding health risks. Fencing currently exists at the Site to restrict public access. Signage would be used to inform site workers of potential health risks. | Technically implementable. Implementability and applicability depends on current and future site uses. | Not effective for remediating contaminants. Effective in minimizing human exposure to contaminated media by preventing access. | Low | Low | Applicable and/or required in combination with other technologies. | Yes |
| Containment/ Capping | Low-Permeability Cap with Drainage Controls | Asphalt and/or Concrete Cap | Maintain existing asphalt or concrete cap over contaminated soil as well as existing stormwater collection and treatment system. Installation of additional asphalt and/or concrete cap in unpaved areas of the Site. Primary function of the cap is to prevent/minimize stormwater infiltration, contaminant migration and exposure to hazardous substances that remain in-place. | Technically implementable. A majority of the Site is currently paved and stormwater collection systems are in place to manage and treat water prior to discharge. | Effective for preventing exposure to hazardous substances that remain in-place, erosion of source material, and reducing stormwater infiltration and contaminant migration. | Low to Moderate | Low | Applicable and/or required in combination with other technologies. | Yes |
| | | A minimum of 1-Foot of Soil Cover with Underlying Low-Permeability Barrier | Install soil cover (a minimum of 1-foot thick) with underlying barrier (plastic or similar) over contaminated soil in unpaved areas. Surface/storm water collection and discharge would be designed to reduce infiltration of stormwater at the site. Primary function of the cover is to prevent/minimize contaminant migration and exposure to hazardous substances that remain in-place. | Technically implementable. Implementability and applicability depends on current and future site uses. Additional considerations for stormwater collection, treatment, and discharge will be needed. May require off-site disposal of material removed to facilitate cap placement. | Effective for preventing exposure to hazardous substances that remain in-place, and reducing stormwater infiltration and contaminant migration. However, the use of heavy equipment on site may compromise the integrity of underlying barrier causing this technology to be less effective. | Low to Moderate | Low | May not be effective due to current site use. | No |

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| Containment/ Capping | Permeable Cap | Permeable Soil Cover | Install and/or maintain existing 6-feet thick (conditional point of compliance) soil cover over contaminated soil. Can be vegetated at the surface based on current/future site use. Primary function of the cover is to prevent/minimize exposure to hazardous substances that remain in-place. Not effective at reducing stormwater infiltration. | Technically implementable. Implementability and applicability depends on current and future site uses. Requires disposal of material removed to facilitate placement of cover. | Effective for preventing exposure to hazardous substances that remain in-place and erosion of source material. Not effective at reducing stormwater infiltration and contaminant migration. | Moderate to High | Low | Ineffective at reducing stormwater infiltration/ contaminant migration and high cost relative to other remedial technologies. | No |
| In Situ Treatment | Monitored Natural Attenuation (MNA) | Natural Attenuation | Natural biotransformation processes such as volatilization, biodegradation, adsorption, and chemical reactions with soil materials are used to reduce contaminant concentrations. | Technically implementable. Monitoring may be required to ensure adequate reduction rate. Require institutional controls during treatment period. | Generally not effective for reducing risk to human health and ongoing threats to groundwater in a reasonable time frame. Effectiveness is highest in combination with other technologies as a final step to achieve cleanup levels when risks to human health and the environment are low. | Low | Moderate | Remediation time frame would not be reasonable. | No |
| | Physical Treatment | Soil Flushing | The extraction of contaminants from soil with aqueous solution accomplished by passing fluid through in-place soils using an injection or infiltration process. Extraction fluids must be recovered from underlying groundwater. | Technically implementable, but would require significant safety components to prevent exacerbating groundwater contamination. Regulatory concerns over potential to wash contaminants beyond fluid capture zones and introduction of surfactants in to the subsurface would make permitting difficult. | Effective for more soluble chemicals. Presence of fine-grained soils and debris limits effectiveness. | High | Moderate | High cost and uncertainty relative to other remedial technologies. | No |
| | Chemical Treatment | In Situ Stabilization (ISS) | ISS is accomplished by injecting solutions of chemical reagents with contaminated media. The reagents reduce the mobility/leachability of contaminants and stabilizes it. | Technically implementable. Buried debris or subsurface obstruction such as foundation/utilities may interfere and would require prior removal. Solidification and stabilization processes can result in an increase in volume. Treatability testing is required. | Effective for reducing mobility of metals. Most common in situ source control technology for metals used at CERCLA sites. | Moderate to High | Low | Applicable for site conditions and contaminants (metals) but requires treatability testing. | Yes |
| | | In Situ Chemical Oxidation (ISCO) | ISCO is accomplished by injecting solutions of chemical oxidation reagents with contaminated media. The reagents chemically oxidizes and destroys contaminants. | Technically implementable. Buried debris or subsurface obstruction such as foundation/utilities may interfere and would require prior removal. Treatability testing is required. | Effective for treating PAHs and other organics. Implemented widely on CERCLA sites. | Moderate to High | Low | Applicable for site conditions and contaminants (PAHs) but requires treatability testing. | Yes |
| | Biological Treatment | Phytoextraction/ Phytodegradation | Plants, called "Hyperaccumulators" (e.g. Chinese brake fern) have the capacity to extract and store large amounts of contaminants (metals, hydrocarbons etc.) from soil and use them as nutrients during metabolism. Phytoremediation typically involves interaction of plant roots and microorganisms associated with them to remediate soil. | Technically implementable. However, industrial site use would limit implementation. Disposal of accumulated waste materials or plant materials may be necessary. Pilot testing that would be required will significantly delay implementation of full-scale remediation. | Use for Chinese brake fern for remediating soil contaminated with metals were evaluated as part of Tacoma Smelter Plume and the study concluded that phytoremediation is not a good cleanup option due to following reasons: Phytoremediating plants (Chinese brake fern) did not grow well in climatic conditions of Puget Sound, arsenic level in the fronds pose a health risk, fronds hyperaccumulated arsenic and became dangerous waste and fern did not take up other metals. | Moderate | Moderate | Not applicable to all contaminants on site, industrial site use would limit implementation, and climatic conditions limit effectiveness. | No |

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| Removal | Soil Excavation and Off-Site Disposal | Excavation and Landfill | Removal of impacted soil using common excavation techniques. Disposal of impacted soil at an off-site, permitted landfill. May include treatment of contaminated soil by off-site landfill prior to disposal. | Technically implementable where accessibility allows for excavation. | Effective for all site soil contaminants. | High | Low | Commonly used established technology effective for all site soil contaminants. | Yes |
| | Soil Excavation, Ex Situ Treatment and Off-Site Disposal/On Site Reuse | Solidification/ Stabilization (S/S) | Removal of impacted soil using common excavation techniques. Contaminants are physically bound or enclosed within a stabilized mass using cementitious reagents (cement, lime, etc.) or surface adsorption/chemical reagents. | Requires sufficient space on site to set up temporary treatment plant and treat/process excavated material prior to disposal. S/S processes may result in an increase in the overall volume of material for off-site disposal/on-site reuse. Additionally S/S processes increases density which increases disposal costs. | Stabilization is a common and effective technology for reducing the leachability of metals in soil. | High | Low | Requires sufficient space on site to set up ex-situ treatment. High capital cost and does not provide specific advantage over in situ S/S. | No |
| | | Soil Washing | Removal of impacted soil using common excavation techniques. Wash soil with water-based surfactants, detergents, acids, etc., to remove chemicals from soil particles. Treat or dispose of high chemical concentration residuals fluids. | Technically implementable. Require sufficient space on site to set up temporary treatment plant and treat/process excavated material prior to disposal/reuse. Require treatment of residual fluids. | Effective for more soluble chemicals. Presence of fine-grained soils and debris limits effectiveness. | High | Moderate | High cost and uncertainty relative to other remedial technologies. | No |
| | Soil Excavation, Ex Situ Treatment and Off-Site Disposal/On Site Reuse | Incineration | Removed soil is heated above approximately 1,600 degrees Fahrenheit to volatilize and combust organic contaminants. Incinerator off-gas is treated in an air pollution control system. | Potentially difficult to implement. Limited space for on-site treatment system and staging. Specific feed size and material handling requirements may impact implement ability. Suitable off-site facility not currently identified. | Proven effective treatment for organics, however, ineffective for inorganic hazardous substances. | High | High | High cost and uncertainty relative to other remedial technologies. Not applicable to all contaminants on site. | No |
| | | Bioremediation | Biodegradation of contaminants in removed soil is enhanced through modification of the material for microbial growth. Treatment is conducted in landfarm arrangement, aboveground reactor, or in treatment cells (biopiles). | Difficult to implement. Landfarming option may require use of a large amount of space, depending on quantity of excavated material. Slurry and biopile treatment require reactor or treatment cell construction. Leachate and off-gas require collection and treatment. Addition of additives may increase total bulk volume of treated material. | While bioremediation cannot degrade inorganic contaminants, bioremediation can be used to change the valence state of inorganics and cause adsorption, immobilization onto soil particulates, precipitation, uptake, accumulation, and concentration of inorganics in micro or macroorganisms. | Moderate to High | Moderate to High | Likely not effective and difficult to implement. | No |

**Notes:**

O&M = Operations and Maintenance

MNR = Monitored Natural Recovery

ISS = In Situ Stabilization

ISCO = In Situ Chemical Oxidation

S/S = Solidification and Stabilization

Shading indicates remedial technology retained for cleanup action evaluation.

# Table 18

## Groundwater Remedial Technologies Screening

**Dakota Creek Industries**

**Anacortes, Washington**

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| No Action | No Action | None | No institutional controls or treatment. | Not effective for protecting human health and environment. | Implementable but not acceptable to the general public or government agencies. | None | None | Used as a baseline for comparison. | No |
| Institutional Controls (ICs) | Governmental/ Property Controls | Environmental Covenant | Legal restrictions associated with future land use and activities (e.g., development, construction, etc.); may also be used to specify long-term maintenance requirements of remediation systems. | Technically implementable. Specific legal requirements and authority would need to be met. | Not effective for remediating contaminants. Can be effective at reducing risks and maintaining integrity of a remedy. | Low | Low | Applicable and/or required in combination with other technologies. | Yes |
| | | Groundwater Use Restrictions, Groundwater Management Plans/ Requirements | Restrictions on groundwater extraction and use and/or exposure of humans and environment to hazardous substances present in groundwater. Implement groundwater management plans/requirements so that contaminated groundwater is managed properly in an event that it is necessary to remove groundwater (e.g., utility work, etc.). | Technically implementable but administratively more difficult. Requires an implementing agency. | Not effective for remediating contaminants. Enforcement would be required for restrictions to be effective. | Low | Low | Applicable and/or required in combination with other technologies. | Yes |
| Containment | Physical Groundwater Barrier | Low-Permeability Vertical Barrier | Construction of a low-permeability vertical barrier such as driven steel sheet piles, soil-bentonite or cement-bentonite wall to restrict groundwater flow and contaminant migration in the downgradient direction. Barrier can be installed down to the nearest aquitard to provide full containment, or installed at a partial depth to direct groundwater deeper. Groundwater extraction may be required to achieve containment under some scenarios. Long-term monitoring of containment structure required. | Technically implementable. A sheet pile wall is currently present which separates a majority of the Marine Area from the Upland Area. | Established technology effective for reducing mobility of contaminants. Effective for containing impacted groundwater or directing groundwater away from a source. However, does not provide treatment of contaminants. Effectiveness likely to increase if implemented to encapsulate the entire source area such that upgradient groundwater flows around the source area thereby minimizing contaminant mobility. | Low | Low | Applicable and/or required in combination with other technologies. A sheet pile wall barrier already exists at Site which separates a majority of the Marine and Upland Areas. | Yes |
| | Hydraulic Groundwater Barrier | Groundwater Pumping | Groundwater pumping to establish a hydraulic capture zone and restrict groundwater flow and contaminant migration in the downgradient direction. May be used in conjunction with a physical barrier to achieve full containment. | Technically implementable using standard groundwater extraction methods. The need to treat extracted groundwater to acceptable levels to allow discharge will reduce the implementability. | Potentially effective for hydraulic control of impacted groundwater. May be implemented to increase effectiveness of physical barrier technologies. Requires continuous long-term operation to achieve effective containment and maintenance of treatment components to prevent discharge of contaminated groundwater. | Moderate | High | Potentially applicable in combination with other technologies, but at high cost. Not expected to be cost effective if applied as sole containment method. | No |

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| In Situ Treatment | Monitored Natural Attenuation (MNA) | Natural Attenuation | Monitoring of naturally occurring physical, chemical and biological processes that reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. Involves monitoring over time to confirm that natural processes are occurring to reduce risk associated with contaminant concentrations. A contingency plan is needed if the expected processes do not occur. | Technically implementable but requires long-term monitoring. Cleanup time frame may be longer than other remedial technologies. Source to groundwater generally requires treatment such as removal, containment or stabilization. | Effectiveness is dependent on site conditions and time frame for implementation. Not effective in preventing contaminant migration and/or exposure. | Low | Low | Applicable in combination with other technologies. | Yes |
| | Chemical Treatment | Chemical Oxidation | ENA is the use of low-energy, long-acting (sustainable) technologies to augment the natural attenuation processes. Oxygen releasing material (additive) is injected into ground to oxidize metals to a higher valence state which are more stable and less mobile in groundwater. Enhanced attenuation is based on a mass balance between contaminant loading into the system and the attenuation capacity of the system that will result in contaminants meeting the cleanup action objectives. | Technically implementable but requires long-term monitoring. Cleanup time frame longer than other remedial technologies but shorter compared to MNA. Source to groundwater generally requires treatment such as removal, containment or stabilization. | Not anticipated to be effective long term because additive injected into ground to alter geochemical parameters of groundwater can be consumed resulting in the release contaminants that were previously stabilized. | Low to Moderate | Low to Moderate | Not a permanent solution. Pre-treatment groundwater geochemical parameters may return after the additives are consumed resulting in the release contaminants. COCs in groundwater are below screening levels except for cPAHs at MW-8 which there is no identified source. Therefore the likelihood of implementing/maintaining remedy is uncertain/indefinite. | No |
| | | Permeable Reactive Barrier (PRB) | PRBs are walls containing reactive media that are installed across the path of contaminated groundwater flow to intercept and treat contaminated groundwater. The barrier allows water to pass through while the media remove the contaminants by precipitation, degradation, adsorption, or ion exchange. PRB wall can be installed by excavating a trench (continuous or funnel/gate) or by injection method. | Technically implementable where accessibility allows for placement of reactive barrier. | Effective treatment configuration under proper hydrogeologic conditions that direct Site groundwater through PRB. Effectiveness relies on selecting an effective reactive treatment component. Reactive media used are chemical reagent such as zero valent iron (ZVI) or combination of ZVI, iron sulfide, iron oxide and/or calcium carbonate (pH adjusting agent). | Moderate | Moderate | PRB is most effective when combined with other technologies to reduce source area (i.e., removal or treatment). COCs in groundwater are below screening levels except for cPAHs at MW-8 which there is no identified source. Therefore the likelihood of implementing/maintaining PRB is uncertain/indefinite. | No |

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| In Situ Treatment | Physical Treatment | Electrokinetics Remediation (ER) | ER includes passing a low density current between electrodes to mobilize contaminants through soil and water in form of charged species. Positively-charged metal or metalloid cations migrate to the negatively-charged electrode (cathode), while metal or metalloid anions migrate to the positively charged electrode (anode). Contaminants arriving at the electrodes can be removed by means of electroplating/ electrodeposition, precipitation/ coprecipitation, adsorption, complexing with ion exchange resins, or by pumping of water (or other fluid) near the electrode. | Difficult implementability. ER is an emerging technology with relatively few applications for arsenic treatment. | Effectiveness may be limited by a variety of contaminants and soil and water characteristics. Treatment depth is limited by the depth to which the electrodes can be placed. ER is most applicable to saturated soil and soil with small particle sizes, such as clay. | High | High | Emerging technologies with limited case studies. Difficult Implementability. High capital and O&M cost. | No |
| Ex-Situ Treatment | Pump and Treat | Precipitation/ Coprecipitation | Extracted groundwater is treated by either mixing treatment chemicals into groundwater or by passing extracted groundwater through a fixed bed of media (e.g. ferric salts, alum) to form solid matrix through precipitation/coprecipitation. Usually involves pretreatment of pH adjustment and addition of chemical oxidant to create oxidizing environment to increase effectiveness. The precipitated/coprecipitated solid is then removed from the liquid phase by clarification or filtration. | Technically implementable. Long treatment time frame. Permitting may be required for discharge of treated water. May need to be combined with pre- and post-treatment steps. Treatment byproducts (e.g., settled solids) require management. Systems using this technology generally require skilled operators. | The effectiveness of this technology is less likely to be reduced by characteristics and contaminants other than arsenic, compared to other pump and treat water treatment technologies. It is also capable of treating heavy metals. | High | High | Potential physical constraints in relation to current/future site use. The nature of the groundwater contamination source at the site makes actively pumping and treating groundwater expensive and timeframe for running an active system uncertain if source to groundwater contamination is left in-place. | No |
| | Pump and Treat | Adsorption | Extracted groundwater is treated by passing extracted groundwater through a fixed bed of adsorption media (e.g. activated alumina, activated carbon). As contaminated water is passed through the adsorption media, contaminants are adsorbed. When adsorption sites become filled, the column must be regenerated or disposed of and replaced with new media. Like precipitation/coprecipitation, this technology requires pretreatment of pH adjustment and addition of chemical oxidant to create oxidizing environment to increase effectiveness. | Technically implementable. Long treatment time frame. Permitting may be required for discharge of treated water. May need to be combined with pre- and post-treatment steps. Treatment byproducts (e.g., spent carbon) require management. Systems using this technology generally require skilled operators. | Effectiveness of adsorption treatment process is sensitive to a variety of untreated water contaminants and characteristics. Competition for adsorption sites could reduce the effectiveness of adsorption because other constituents may be preferentially adsorbed, resulting in a need for more frequent bed regeneration or replacement. It is used less frequently than precipitation/coprecipitation, and is most commonly used as a polishing step for other water treatment processes. | High | High | Less effective in treating contaminants as compared to pump and treat with precipitation/coprecipitation. | No |

| Remedial Technology Identification | | | Description of Remedial Technology | Implementability of Remedial Technology | Effectiveness of Remedial Technology | Relative Cost of Remedial Technology | | Summary of Screening | Technology Retained (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|
| General Response Action | Type of Remedial Technology | Process Option | | | | Capital | O&M | | |
| Ex-Situ Treatment | Pump and Treat | Ion Exchange: Xanthate Treatment | Ion exchange removes ions from the aqueous phase by the exchange of cations or anions between the contaminants and the exchange medium. Ion exchange materials may consist of resins made from synthetic organic materials that contain ionic functional groups to which exchangeable ions are attached. They also may be inorganic and natural polymeric materials. After the resin capacity has been exhausted, resins can be regenerated for re-use. | Technically implementable. Long treatment time frame. Permitting may be required for discharge of treated water. May need to be combined with pre- and post-treatment steps. Treatment byproducts (e.g., treatment chemicals) require management. Systems using this technology generally require skilled operators. | Effectiveness of Ion Exchange treatment process is sensitive to a variety of untreated water contaminants and characteristics. | High | High | Less effective in treating contaminants as compared to pump and treat with precipitation/coprecipitation. | No |

**Notes:**

O&M = Operations and Maintenance
IC = Institutional Controls
MNR = Monitored Natural Recovery
ENA = Enhanced Natural Attenuation
ZVI = Zero Valent Iron
PRB = Permeable Reactive Barrier
ER = Electrokinetics Remediation
cm = centimeters

# Table 19

## Cleanup Action Alternative Descriptions

### Dakota Creek Industries

### Anacortes, Washington

| Matrix | Contaminants of Concern (COCs) | Cleanup Action Objectives (CAOs) | Cleanup Action Alternative Components | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Alternative 1 - Containment and Compliance Monitoring** | **Alternative 2 - Partial Source Area Removal** | **Alternative 3 - Source Area In Situ Treatment** | **Alternative 4 - Source Area Removal** | **Alternative 5 - Site-Wide In Situ Treatment** | **Alternative 6 - Site-Wide Removal** |
| Soil and Groundwater | ■ Arsenic<br>■ Nickel<br>■ Total cPAH TEQ | ■ Prevent contact (dermal or incidental ingestion) by workers, visitors and other Site users with hazardous substances in soil and groundwater.<br>■ Prevent leaching of hazardous substances through the soil column to groundwater.<br>■ Prevent contact (dermal or incidental ingestion) by aquatic receptors to impacted groundwater that may discharge to the Marine Area resulting in acute or chronic effects.<br>■ Prevent the ingestion of aquatic organisms affected by the discharge of impacted groundwater to the Marine Area by higher trophic level ecological receptors. | ■ Maintenance of existing physical containment barriers including surface pavement and sheet pile bulkhead to prevent stormwater infiltration and contaminant leaching/ migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ Installation of new physical containment barrier (i.e., asphalt/concrete pavement) to further prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ Compliance Groundwater Monitoring<br>■ Institutional Controls<br>■ Annual Cap Inspection | ■ Asphalt demolition, soil removal and offsite disposal of COCs in the southwest Source Area generally centered around location SB-12.<br>■ Verification Soil Sampling<br>■ Site Restoration<br>■ Maintenance of existing physical containment barriers including surface pavement and sheet pile bulkhead to prevent stormwater infiltration and contaminant leaching/ migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ Compliance Groundwater Monitoring<br>■ Institutional Controls<br>■ Annual Cap Inspection | ■ Installation of new physical containment barrier (i.e., asphalt/concrete pavement) to further prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ Maintenance of existing physical containment barriers including surface pavement and sheet pile bulkhead to prevent stormwater infiltration and contaminant leaching/ migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ In situ soil treatment through injection of chemical reagents to immobilize/treat COCs in Source Areas generally centered around locations SB-12, GEI-17 and GEI-22.<br>■ Institutional Controls<br>■ Performance/Compliance Groundwater Monitoring<br>■ Institutional Controls<br>■ Annual Cap Inspection | ■ Asphalt demolition, soil removal and offsite disposal of COCs in Source Areas generally centered around SB-12, GEI-17 and GEI-22.<br>■ Verification Soil Sampling<br>■ Site Restoration<br>■ Maintenance of existing physical containment barriers including surface pavement and sheet pile bulkhead to prevent stormwater infiltration and contaminant leaching/ migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ Compliance Groundwater Monitoring<br>■ Institutional Controls<br>■ Annual Cap Inspection | ■ Installation of new physical containment barrier (i.e., asphalt/concrete pavement) to further prevent stormwater infiltration and contaminant leaching/migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ Maintenance of existing physical containment barriers including surface pavement and sheet pile bulkhead to prevent stormwater infiltration and contaminant leaching/ migration through the soil column as well as to provide a physical barrier to prevent direct contact to Site COCs.<br>■ In situ soil treatment through injection of chemical reagents to immobilize/treat COCs throughout the Site.<br>■ Performance/Compliance Groundwater Monitoring<br>■ Institutional Controls<br>■ Annual Cap Inspection | ■ Asphalt demolition, soil removal and offsite disposal of COCs throughout the Site.<br>■ Verification Soil Sampling<br>■ Site Restoration<br>■ Compliance Groundwater Monitoring |
| Estimated Alternative Cost (+50%/-30%)[1] | | | $1,180,000 | $2,120,000 | $2,610,000 | $4,390,000 | $7,030,000 | $15,060,000 |
| Estimated Volume of Contaminated Soil Removed/Treated | | | N/A | 3,600 bcy | 9,000 bcy | 9,000 bcy | 46,500 bcy | 46,500 bcy |
| Estimated Restoration Time frame | | | 1-2 Years[2] | 1-2 Years[2] | 2-3 Years[2] | 2-3 Years[2] | 3-4 Years[2] | 3-4 Years[2] |

**Notes:**

[1] Alternative cost estimates are presented in Appendix A.

[2] Compliance groundwater monitoring is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards.

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbons

TEQ = Toxicity Equivalence

COC = Contaminant of Concern

bcy = bulk (in-place) cubic yards

% = percent

N/A = Not Applicable

# Table 20

## Evaluation of Cleanup Action Alternatives

### Dakota Creek Industries Feasibility Report

### Anacortes, Washington

| Evaluation Criteria | Alternative 1 - Containment and Compliance Monitoring | Alternative 2 - Partial Source Area Removal | Alternative 3 - Source Area In Situ Treatment |
|---|---|---|---|
| **Compliance with MTCA Threshold Criteria** | | | |
| Protection of Human Health and the Environment | **Yes** - Alternative would protect human health and the environment through a combination of containment technologies and institutional controls. | **Yes** - Alternative would protect human health and the environment through a combination of source area removal, containment technologies, and institutional controls. | **Yes** - Alternative would protect human health and the environment through a combination of source area in situ treatment, containment technologies, and institutional controls. |
| Compliance With Cleanup Standards | **Yes** - Alternative is expected to comply with cleanup standards. This alternative utilizes containment technologies and institutional controls to prevent exposure to contaminants in the subsurface. Compliance would rely on long-term monitoring and maintenance of institutional controls. Future development of property could potentially require additional environmental cleanup or special provisions. | **Yes** - Alternative is expected to comply with cleanup standards. This alternative utilizes partial source area removal, containment technologies, and institutional controls to prevent exposure to contaminants in the subsurface. Compliance would rely on long-term monitoring and maintenance of institutional controls. Future development of property could potentially require additional environmental cleanup or special provisions. | **Yes** - Alternative is expected to comply with cleanup standards. This alternative utilizes in situ treatment and containment technologies, and institutional controls to prevent exposure to contaminants in the subsurface. Compliance would rely on long-term monitoring and maintenance of institutional controls. Future development of property could potentially require additional environmental cleanup or special provisions. |
| Compliance With Applicable State and Federal Regulations | **Yes** - Alternative complies with applicable state and federal regulations. | **Yes** - Alternative complies with applicable state and federal regulations. | **Yes** - Alternative complies with applicable state and federal regulations. |
| Provision for Compliance Monitoring | **Yes** - Alternative includes provisions for compliance monitoring. | **Yes** - Alternative includes provisions for compliance monitoring. | **Yes** - Alternative includes provisions for compliance monitoring. |
| **Restoration Time Frame** | | | |
| Restoration Time Frame | A significant portion of the containment barriers are currently in place. Additional containment in the form of asphalt paving of existing gravel surfaces is expected to occur over a 1-2 year period. Monitoring of containment elements (i.e., asphalt/concrete pavement and sheet pile wall) and groundwater conditions to document compliance with cleanup objectives. Compliance groundwater monitoring is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards. | A significant portion of the containment barriers are currently in place. The removal of COCs in southeast source area followed by restoration is expected to occur over a 1-2 year period. Monitoring of containment elements (i.e., existing asphalt/concrete pavement and sheet pile wall) and groundwater conditions Site to document compliance with cleanup objectives. Compliance groundwater monitoring in portions of the Site containing residual contamination is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards. | A significant portion of the containment barriers are currently in place. Additional containment in the form of asphalt paving of existing gravel surfaces and the injection of chemical reagents to treat source areas COCs are expected to occur over a 2-3 year period. More than one injection event may be necessary. Monitoring of containment elements (i.e., asphalt/concrete pavement and sheet pile wall) and groundwater conditions to document compliance with cleanup objectives. Compliance groundwater monitoring is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards. |
| **Relative Benefits Ranking (Scored from 1-lowest to 10-highest)** | | | |
| | **Score = 2** | **Score = 6** | **Score = 5** |
| Protectiveness | Achieves a moderate-low level of protectiveness as all portions of the Site containing COCs receive a protective containment barriers under this alternative to prevent potential human exposure and/or stormwater infiltration. However, contamination will be left onsite throughout the uplands in a heavy industrial and active site. | Achieves a moderate-high level of protectiveness s this alternative improves overall environmental quality onsite by removing the source area with elevated contaminant levels in soil and groundwater greater than the PCULs in the eastern portion of the Site. The remaining residual contamination will utilize existing asphalt and sheetpile wall barriers to prevent worker exposure under this alternative. Short-term on-site and off-site risk of exposure are slightly increased due to removal action and off-site disposal of contaminated soil over | Achieves a moderate level of protectiveness as all portions of the Site containing COCs receive a protective containment barrier under this alternative. Achieves a higher score then Alternative 1 since this alternative improves overall environmental quality through in situ treatment of COCs in identified Source Areas. However, there is no contaminant mass removal under this alternative, therefore receives a slightly lower score than Alternative 2. |

| Evaluation Criteria | Alternative 1 - Containment and Compliance Monitoring | Alternative 2 - Partial Source Area Removal | Alternative 3 - Source Area In Situ Treatment |
|---|---|---|---|
| Permanence | **Score = 2** | **Score = 6** | **Score = 5** |
| | Achieves a low level of permanence since COCs remain in-place and/or untreated. Alternative 1 relies on the installation of additional pavement combined with other technologies to reduce the mobility of COCs. | Achieves a moderate level of permanence. The alternative receives a higher score as compared to Alternative 1 and 3 due to the removal and off-site disposal of COCs which provides a relatively higher level reduction in the toxicity, mobility or volume of COCs. | Achieves a moderate level of permanence since under this alternative due to the treatment/stabilization of COCs in Source Areas through in situ technologies combined with other technologies to reduce the toxicity, mobility or volume of COCs. However the site is located along the shoreline of a marine system and it is relying on effective monitoring of the cap to remain in place and undamaged in a heavy industrial site. Therefore receives a lower score than Alternative 2. |
| Long-Term Effectiveness | **Score = 2** | **Score = 6** | **Score = 6** |
| | Provides a level of certainty in long-term effectiveness as all areas containing COCs receive a protective impermeable cap, which reduces exposure risk and contaminant leaching from vadose to saturated zone. However, relies on diligence of entity where history of leadership changes, frequent leasee modifications, and heavy industrial activity damage has been shown to alter priorities and increase risk of exposure. This puts a heavy and unidentified cost on PLP related to approval under the EC, reporting and repair costs along with potential contaminant release while exposed. | Provides a higher level of certainty in long-term effectiveness over Alternative 1 due to the permanent removal of COCs in the southeastern Source Area. However, it requires the central and western portions of the upland to remain under institutional controls which needs to be monitored in a heavy industrial and active site. | Provides a moderate level of certainty in long-term effectiveness. Slightly higher score than Alternative 2 is achieved due to in situ treatment of COCs within each of the Source Areas. However, it received a lower score than Alternative 4 as decreasing metals mobility through in situ reduction can be reversed under certain conditions. |
| Management of Short-Term Risks | **Score = 8** | **Score = 7** | **Score = 8** |
| | Achieves a high level of confidence in managing short-term risk to human health and environment since this alternative involves construction of pavement. Exposure risk to Site COCs during pavement construction is low to negligible. | Achieves a moderate level of confidence in managing short-term risk due to degree of health and safety risks associated with heavy earthwork construction, and potential for exposure to COCs during removal, on-site management, transport and disposal of contaminated material. Receives a slightly higher score than Alternative 4 due to the lesser degree of soil disturbance. | Achieves a moderate-high level of confidence in managing short-term risk as there is some potential for exposure to contamination during in-situ injection of reagents as well as other construction related risks. Since in situ treatment is limited to the Source Areas, the short-term risk are limited. |
| Technical and Administrative Implementability | **Score = 7** | **Score = 6** | **Score = 6** |
| | Achieves a high level of implementability since this alternative involves construction of an asphalt cap, which is a proven remedial technology. | Achieves a moderate level of implementability due to the design and coordination associated with implementation of soil removal. Implementation will be challenging since it will likely impact current site use at the property. | Achieves a moderate level of implementability due to the design and coordination associated with implementation of in situ treatment technologies. Implementation will be challenging since it may impact current site use at the Property. |
| Consideration of Public Concerns | **Score = 3** | **Score = 7** | **Score = 6** |
| | Residual contamination remaining in place below containment features could result in concerns by the public and nearby property owners and potentially affect the future development and Site use. However, the further addition of asphalt pavement to reduce the potential for contaminant migration and exposure would slightly reduce public concerns. | Residual contamination remaining in place below containment features could result in concerns by the public and nearby property owners and potentially affect the future development and Site use. However, the removal of source material to reduce the potential for contaminant migration and exposure would reduce public concerns. | Residual contamination remaining in place below containment features could result in concerns by the public and nearby property owners and potentially affect the future development and Site use. However, the further addition of asphalt pavement and in situ treatment of source areas to reduce the potential for contaminant migration and exposure would reduce public concerns. |

**Notes:**

COC = Contaminant of Concern

# Table 20

## Evaluation of Cleanup Action Alternatives

### Dakota Creek Industries Feasibility Report

### Anacortes, Washington

| Evaluation Criteria | Alternative 4 - Source Area Removal | Alternative 5 - Site-Wide In Situ Treatment | Alternative 6 - Site-Wide Removal |
|---|---|---|---|
| **Compliance with MTCA Threshold Criteria** | | | |
| Protection of Human Health and the Environment | **Yes** - Alternative would protect human health and the environment through a combination of source area removal, containment technologies, and institutional controls. | **Yes** - Alternative would protect human health and the environment through a combination of site-wide in situ treatment, containment technologies, and institutional controls. | **Yes** - Alternative would protect human health and the environment through complete source removal. |
| Compliance With Cleanup Standards | **Yes** - Alternative is expected to comply with cleanup standards. This alternative utilizes source area removal, containment technologies, and institutional controls to prevent exposure to contaminants in the subsurface. Compliance would rely on long-term monitoring and maintenance of institutional controls. Future development of property could potentially require additional environmental cleanup or special provisions. | **Yes** - Alternative is expected to comply with cleanup standards. This alternative utilizes site-wide in situ treatment, containment technologies, and institutional controls to prevent exposure to contaminants in the subsurface. Compliance would rely on long-term monitoring and maintenance of institutional controls. Future development of property could potentially require additional environmental cleanup or special provisions. | **Yes** - Alternative is expected to comply with cleanup standards to the greatest extent practicable. All contaminant exceedance will be removed for offsite disposal. |
| Compliance With Applicable State and Federal Regulations | **Yes** - Alternative complies with applicable state and federal regulations. | **Yes** - Alternative complies with applicable state and federal regulations. | **Yes** - Alternative complies with applicable state and federal regulations. |
| Provision for Compliance Monitoring | **Yes** - Alternative includes provisions for compliance monitoring. | **Yes** - Alternative includes provisions for compliance monitoring. | **Yes** - Alternative includes provisions for compliance monitoring. |
| **Restoration Time Frame** | | | |
| Restoration Time Frame | A significant portion of the containment barriers are currently in place. Additional containment in the form of asphalt paving of existing gravel surfaces and the removal of COCs in identified source areas followed by restoration are expected to occur over a 2-3 year period. Monitoring of containment elements (i.e., asphalt/concrete pavement and sheet pile wall) and groundwater conditions to document compliance with cleanup objectives. Compliance groundwater monitoring to evaluate residual contamination in other portions of the Site is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards. | A significant portion of the containment barriers are currently in place. The injection of chemical reagents to treat COCs Site-wide are expected to occur over a 3-4 year period. In situ treatment activities may require phasing during implementation to reduce disturbances to the DCI operations as well as more than one injection event if necessary. Monitoring of containment elements (i.e., asphalt/ concrete pavement and sheet pile wall) and groundwater conditions to document compliance with cleanup objectives. Compliance groundwater monitoring is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards. | Complete removal of COCs Site-wide followed by restoration are expected to occur over a 3-4 year period. Removal activities may require phasing during implementation to reduce disturbances to the DCI operations. Compliance groundwater monitoring to verify the effectiveness of the cleanup action is expected to occur over a 1-2 year period following removal. |
| **Relative Benefits Ranking (Scored from 1-lowest to 10-highest)** | | | |
| | **Score = 7** | **Score = 8** | **Score = 9** |
| Protectiveness | Achieves a moderate-high level of protectiveness as all portion of the Site containing COCs receive a protective containment barrier under this alternative. Therefore, this alternative receives a slightly higher score than Alternative 2. This alternative improves overall environmental quality onsite by removing COCs in Source Areas through removal. Similar to Alternative 2, short-term on-site and off-site risk of exposure are increased due to removal action and off-site disposal. | Achieves a high level of protectiveness as all COCs are treated/stabilized through in-situ treatment. Overall environmental quality on Site is increased as well as exposure risk to contamination are reduced to high degree under this alternative. No risk of exposure off-site as contamination is not removed. | Achieves a high level of protectiveness as all COCs are removed from the site thereby increasing the overall environmental quality on site to the highest degree. However, short-term on-site and off-site risk of exposure are increased due to removal action and off-site disposal. Therefore gets a slightly higher score than Alternative 5. |

| Evaluation Criteria | Alternative 4 - Source Area Removal | Alternative 5 - Site-Wide In Situ Treatment | Alternative 6 - Site-Wide Removal |
|---|---|---|---|
| Permanence | **Score = 7**<br>Achieves a moderate-high level of permanence. The alternative receives a higher score due to the removal and off-site disposal of Source Area COCs which provides a relatively higher level reduction in the toxicity, mobility or volume of COCs than Alternative 3. | **Score = 8**<br>Achieves a high level of permanence by reducing toxicity, mobility and volume of COCs through Site-wide in-situ treatment of all COCs. | **Score = 10**<br>Achieves highest level of permanent reduction of mass, toxicity, and mobility of hazardous substances throughout the Site through removal and off-site permitted disposal. This alternative would eliminate/minimize to the need to perform additional cleanup actions. |
| Long-Term Effectiveness | **Score = 7**<br>Provides a high level of certainty in long-term effectiveness due to the permanent removal of COCs in the Source Areas in addition to other technologies implemented similar to Alternative 2. However, it requires the entire upland to remain under institutional controls which needs to be monitored in a heavy industrial and active site. | **Score = 8**<br>Provides a high level of certainty in long-term effectiveness due to the site-wide treatment/stabilization of COCs. However, it requires the entire upland to remain under institutional controls which needs to be monitored in a heavy industrial and active site. | **Score = 10**<br>Achieves highest level of long-term effectiveness through removal of hazardous substances from the Site to the greatest degree feasible and utilizes approved off-site disposal facilities for final disposition |
| Management of Short-Term Risks | **Score = 5**<br>Achieves a moderate level of confidence in managing short-term risk due to degree of health and safety risks associated with heavy earthwork construction, and potential for exposure to COCs during removal, on-site management, transport and disposal of contaminated material. | **Score = 4**<br>Achieves a moderate-high level of confidence in managing short-term risk as there is some potential for exposure to contamination during in-situ injection of reagents as well as other construction related risks. Since in situ treatment is to be performed site-wide under this alternative, the short-term risk are higher than the risk associated with in situ treatment of Source Areas under Alternative 3. Therefore is scored slightly lower than Alternative 3. | **Score = 3**<br>Achieves a low level of confidence in managing short-term risk due to degree of health and safety risks associated with heavy earthwork construction, and potential for exposure to COCs during removal, on-site management, transport and disposal of contaminated material. Achieves a lower score than Alternative 4 due to higher volume of contaminated material that will be removed under this alternative. |
| Technical and Administrative Implementability | **Score = 6**<br>Achieves a moderate level of implementability due to the design and coordination associated with implementation of soil removal. Implementation will be challenging since it will likely impact current site use at the property. | **Score = 5**<br>Achieves a low-moderate level of implementability due to the design and coordination associated with implementation of in situ treatment technologies. Receives a lower score than Alternative 3 since the extent of in situ treatment is larger making implementation more challenging. | **Score = 4**<br>Achieves a low-moderate level of implementability due to the design and coordination associated with implementation of soil removal. Receives a lower score than Alternative 4 since the extent of soil removal is larger making implementation more challenging. |
| Consideration of Public Concerns | **Score = 7**<br>Residual contamination remaining in place below containment features could result in concerns by the public and nearby property owners and potentially affect the future development and Site use. However, the further addition of asphalt pavement and removal of source areas to reduce the potential for contaminant migration and exposure would reduce public concerns. | **Score = 9**<br>Site-wide in situ treatment to reduce the potential for contaminant migration and exposure would produce minimum public concerns. However, there may be public concern for the temporary disruptions to Site operations and increased traffic resulting from construction activities. However, long-term public concerns are expected to be low. | **Score = 8**<br>Soil contamination would be removed to the extent practical under this alterative. However, there may be public concern for the temporary disruptions to Site operations, increased traffic resulting from construction activities and potential spills during transport of contaminated soil to the landfill. However, long-term public concerns are expected to be low. |

**Notes:**

COC = Contaminant of Concern

# Table 21

## Cleanup Action Alternative Evaluation Summary and Ranking

**Dakota Creek Industries**

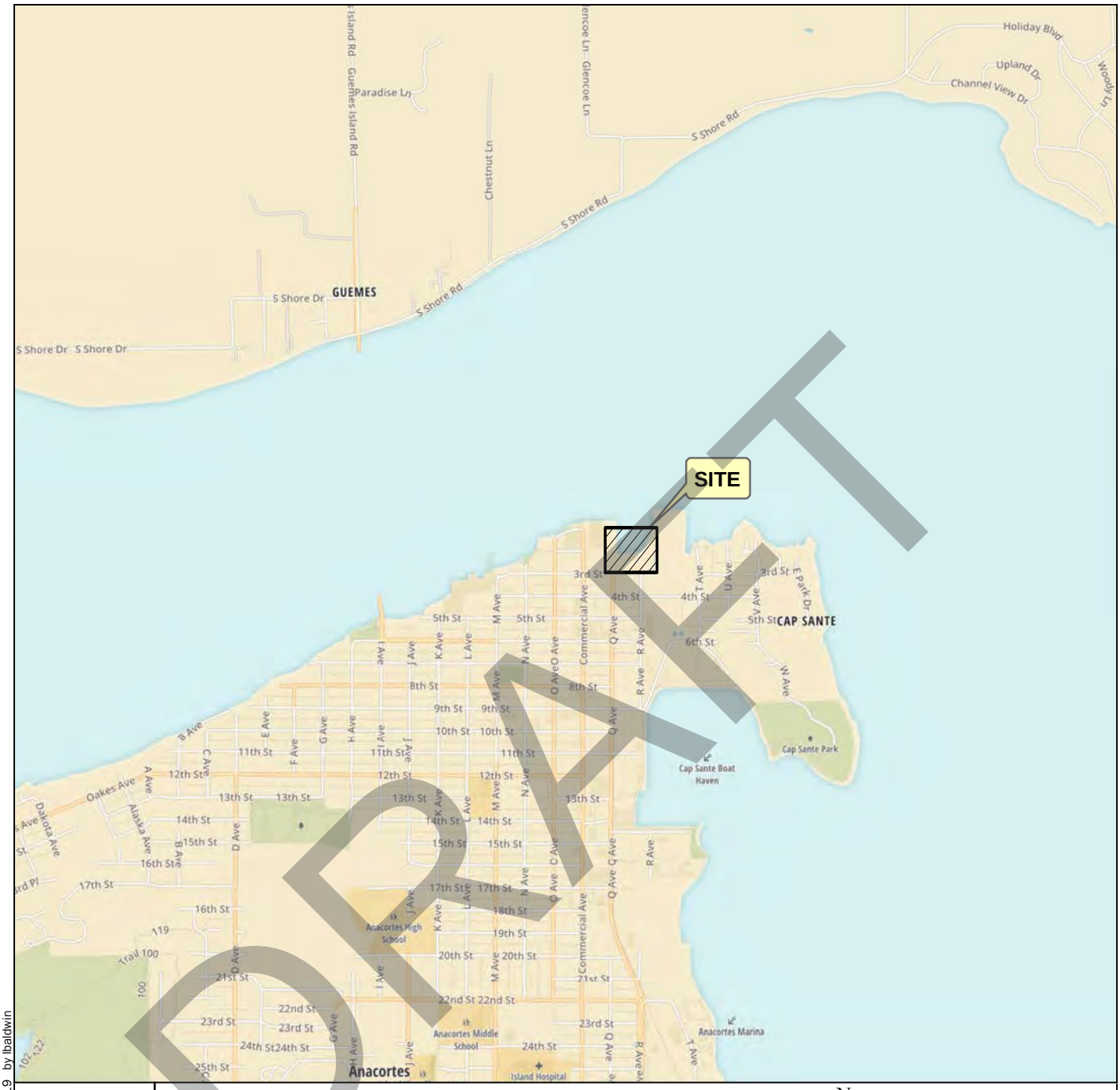
**Anacortes, Washington**

| Remedial Alternative | Alternative 1 - Containment and Compliance Monitoring | Alternative 2 - Partial Source Area Removal | Alternative 3 - Source Area In Situ Treatment | Alternative 4 - Source Area Removal | Alternative 5 - Site-Wide In Situ Treatment | Alternative 6 - Site-Wide Removal |
|---|---|---|---|---|---|---|
| **Evaluation** | | | | | | |
| Compliance with MTCA Threshold Criteria | Yes | Yes | Yes | Yes | Yes | Yes |
| Restoration Time Frame | 1-2 Years[1] | 1-2 Years[1] | 2-3 Years[1] | 2-3 Years[1] | 3-4 Years[1] | 3-4 Years |
| Estimated Volume of Contaminated Soil Removed/Treated | N/A | 3,600 bcy | 9,000 bcy | 9,000 bcy | 46,500 bcy | 46,500 bcy |
| **Relative Benefits Ranking[2]** | | | | | | |
| Protectiveness (weighted as 30%) | 0.6 | 1.8 | 1.5 | 2.1 | 2.4 | 2.7 |
| Permanence (weighted as 20%) | 0.4 | 1.2 | 1 | 1.4 | 1.6 | 2 |
| Long-Term Effectiveness (weighted as 20%) | 0.4 | 1.2 | 1.2 | 1.4 | 1.6 | 2 |
| Management of Short-Term Risks (weighted as 10%) | 0.8 | 0.7 | 0.8 | 0.5 | 0.4 | 0.3 |
| Technical and Administrative Implementability (weighted as 10%) | 0.7 | 0.6 | 0.6 | 0.6 | 0.5 | 0.4 |
| Consideration of Public Concerns (weighted as 10%) | 0.3 | 0.7 | 0.6 | 0.7 | 0.9 | 0.8 |
| **Overall Weighted Benefit Score** | **3.20** | **6.20** | **5.70** | **6.70** | **7.40** | **8.20** |
| **Disproportionate Cost Analysis** | | | | | | |
| Probable Remedy Cost (+50%/-30%, rounded) | $1,180,000 | $2,120,000 | $2,610,000 | $4,390,000 | $7,030,000 | $15,060,000 |
| Practicability of Remedy | Practicable | Practicable | Practicable | Practicable | Practicable | Practicable |
| Remedy Permanent to Maximum Extent Practicable | Yes | Yes | Yes | Yes | Yes | Yes |
| Relative Benefit Ranking to Remedial Cost (Benefit/$1M) | 2.71 | 2.92 | 2.18 | 1.53 | 1.05 | 0.54 |
| Costs Disproportionate to Incremental Benefits | No | No | Yes | Yes | Yes | Yes |
| **Overall Alternative Ranking** | **2nd** | **1st** | **3rd** | **4th** | **5th** | **6th** |

**Note:**

[1] Compliance groundwater monitoring is expected to occur over a 5 year time frame (minimum). Additional long-term monitoring may be required to verify compliance with cleanup standards.

[2] Weightings were established by Ecology as referenced in their Opinion Letter dated December 28, 2009.







N
W E
S

2,000 0 2,000
Feet

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

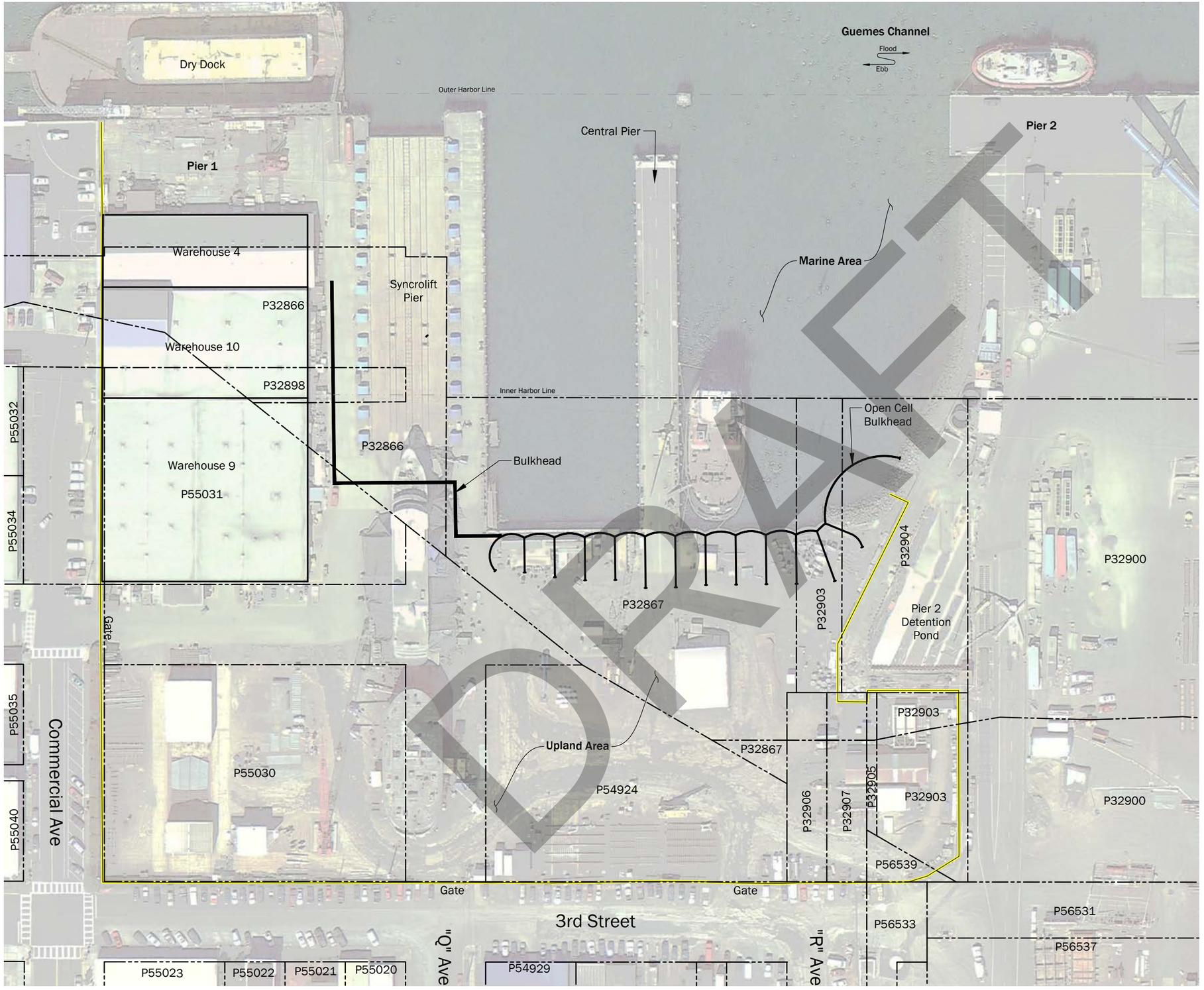
**Vicinity Map**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 1**

C:\Users\lbaldwin\Desktop\Templates\VicinityMap.mxd Date Exported: 02/27/19 by lbaldwin






## Legend

- Dakota Creek Industries (DCI) Property Boundary
- P32904 Skagit County Parcel Boundary and Number

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

N
W E
S

100 0 100
Feet

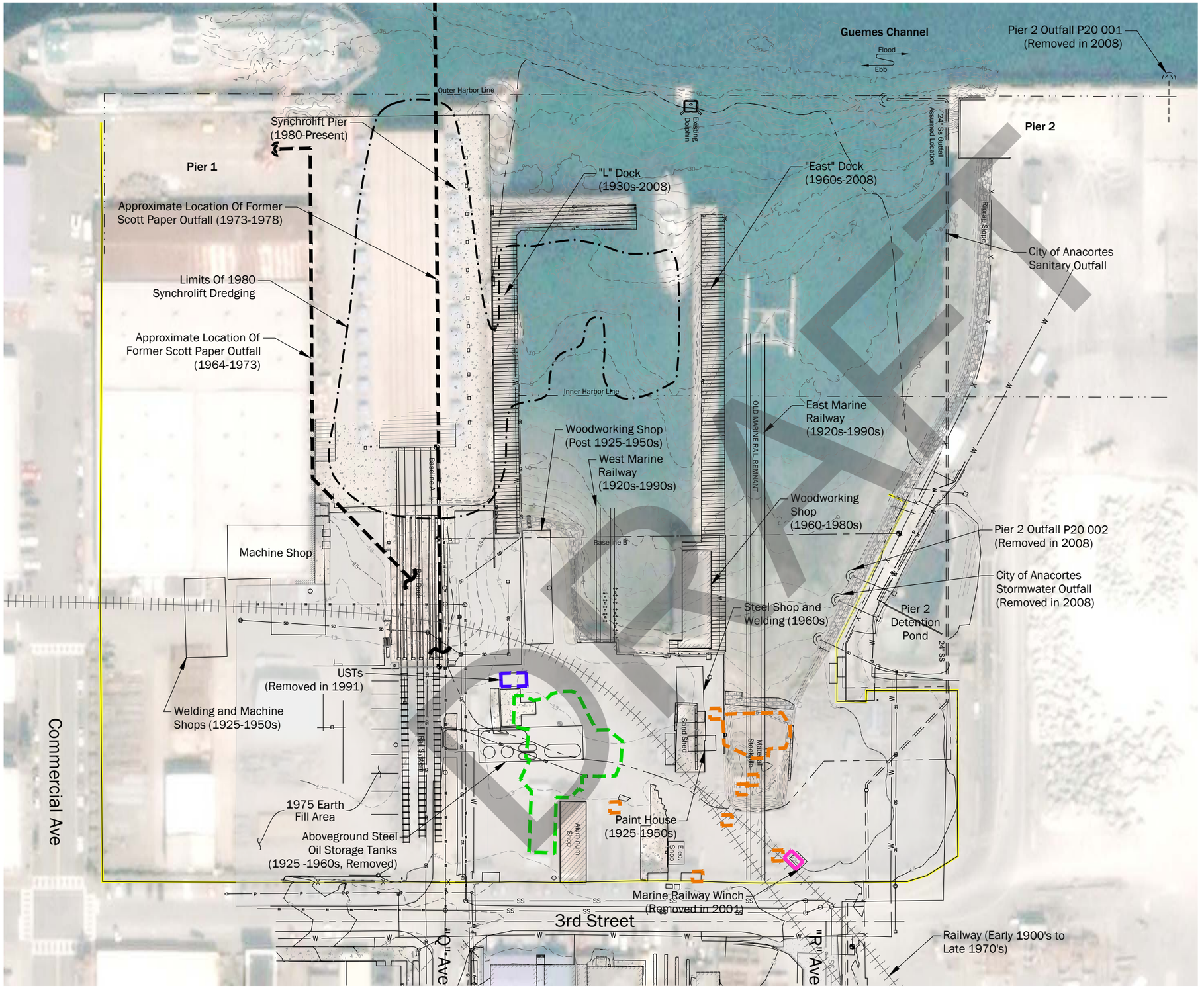
**Site Plan**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 2**

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F02_Site Plan.dwg TAB:F02 Date Exported: 08/21/19 - 22:03 by hmara




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Existing Fence
- Catch Basin
- Sewer Manhole
- Storm Manhole
- Gravel
- Concrete
- Rip Rap
- Approximate Synchrolift Dredge Limits
- Elevation Contour
- Approximate Footprint of Historical Structures - Labels Indicate Function and Time Period in Existence.
- Sanitary Sewer
- UST Removal Enclosure Area (A-1 1991)
- Marine Railway Winch Removal Area (Landau 2001)
- Petroleum Cleanup Action Area (Landau 2002)
- Marine Railway Cleanup Action Area (Landau 2002)

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection:
Horizontal Datum: WA State Plane, North Zone, NAD83, US Foot
Vertical Datum: Mean Low Low Water (MLLW)

N
W E
S

100 0 100
Feet

# Historical Property Layout and Features

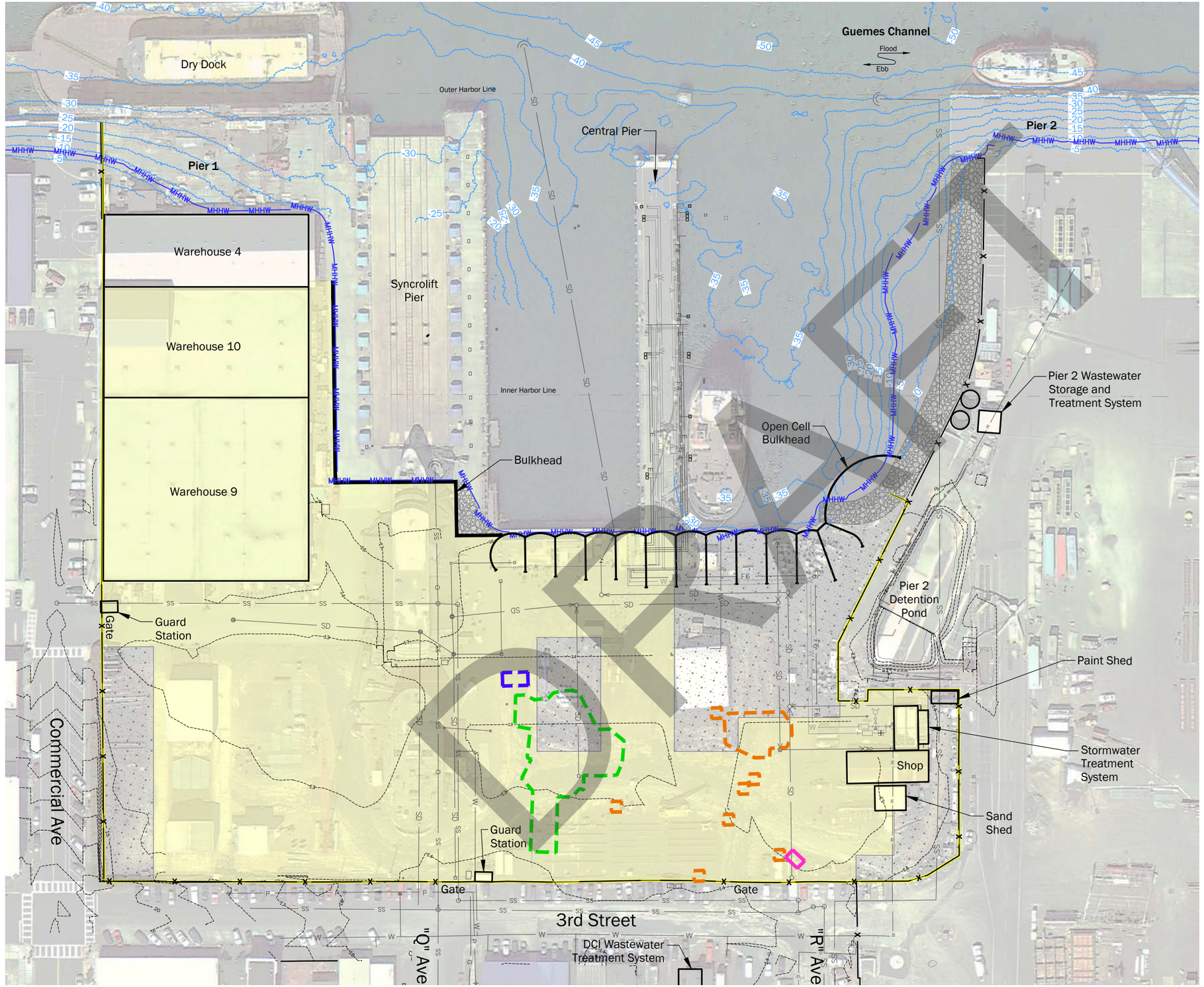
Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 3



P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F03_Historical Property Layout.dwg TAB:F03 Date Exported: 08/21/19 - 22:33 by hmara




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Existing Fence
- Compressed Air
- Comm Line
- Electrical
- Fireline 4
- Fireline 6
- Sanitary Sewer
- Stormwater Drain
- Water
- Cold Water
- Power
- Catch Basin
- Manhole
- Outfall
- Gravel
- Concrete/Asphalt Pavement or Asphalt for Building
- Rip Rap
- Topographic Contour
- Bathymetric Contour
- Mean Higher High Water (MHHW)
- UST Removal Enclosure Area (A-1 1991)
- Marine Railway Winch Removal Area (Landau 2001)
- Petroleum Cleanup Action Area (Landau 2002)
- Marine Railway Cleanup Action Area (Landau 2002)

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.
Projection:
Horizontal Datum: WA State Plane, North Zone, NAD83, US Foot
Vertical Datum: Mean Low Low Water (MLLW)

N W E S

100 0 100
Feet

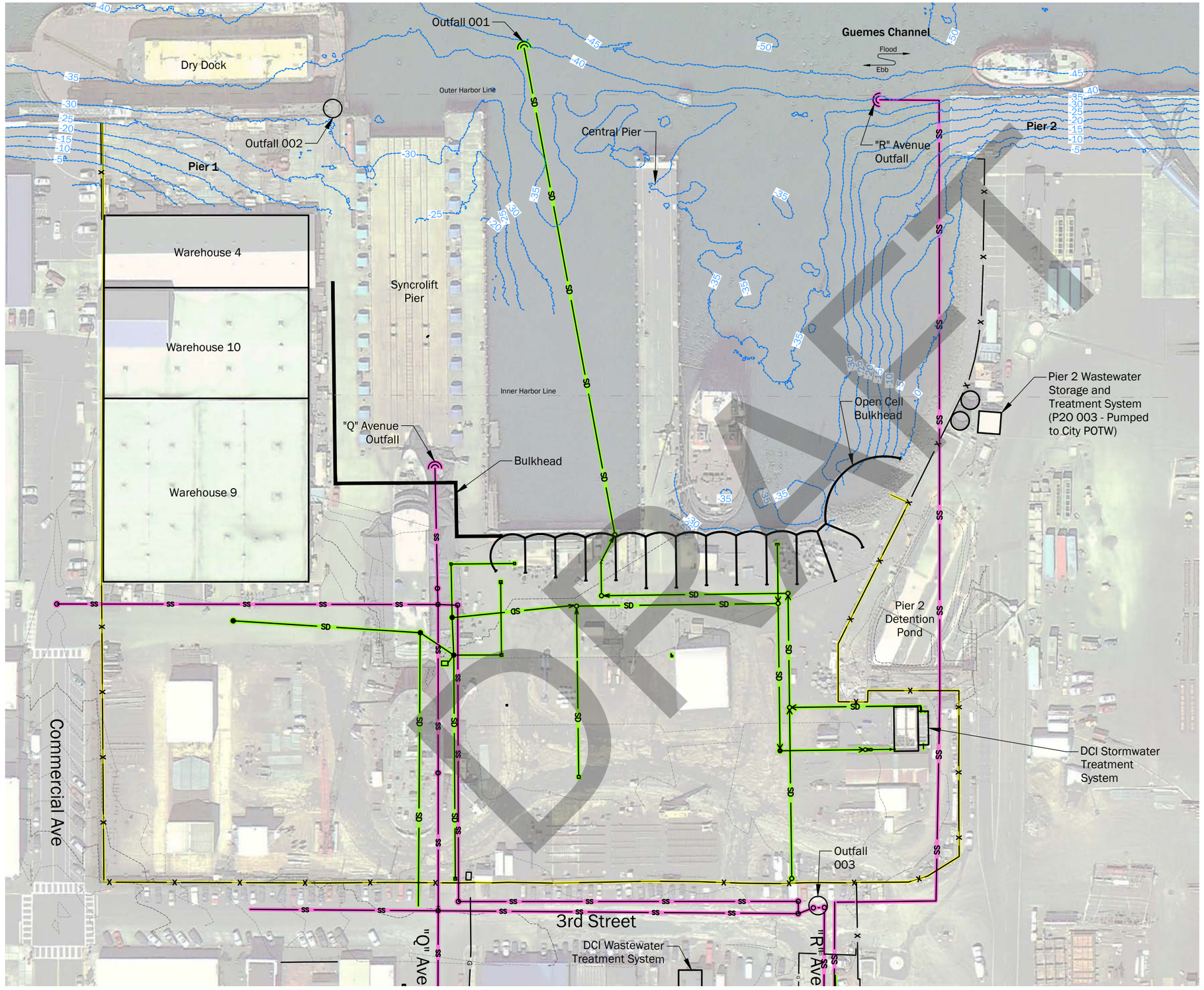
**Current Property Layout and Features**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 4**

P:\5\5147006\CAD\13\Draft Final R1\5147006613_F04_Current Property Layout.dwg TAB:F04 Date Exported: 08/21/19 - 22:33 by hmara




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- City of Anacortes Sanitary Sewer Line and Flow Direction
- DCI Stormwater Line and Flow Direction
- Catch Basin
- Manhole
- Outfall

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

N W E S

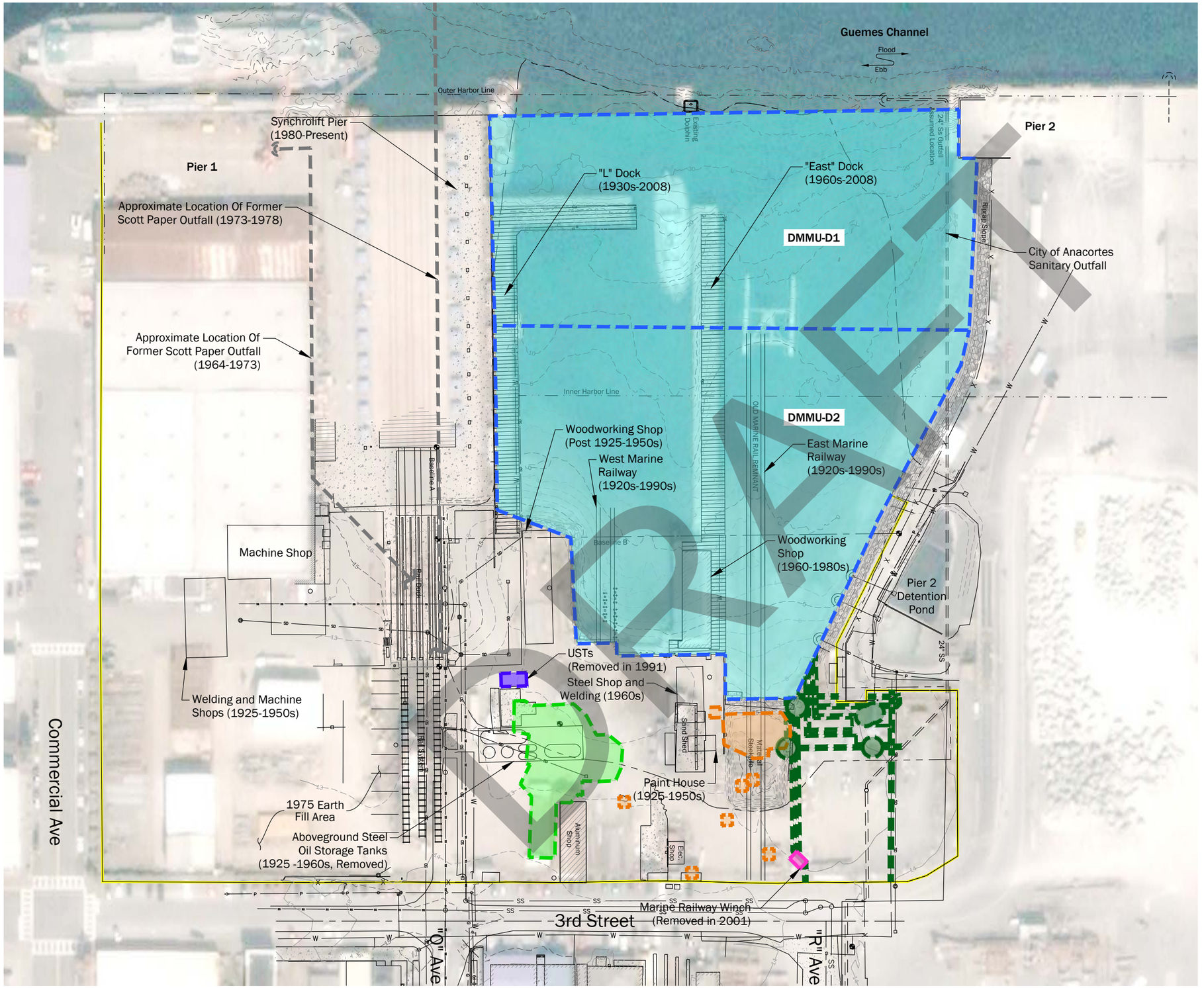
100 0 100
Feet

**Stormwater and Combined Sewer Outfalls**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 5**




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- UST Removal Enclosure Area (A-1 1991)
- Marine Railway Winch Removal Area (Landau 2001)
- Petroleum Cleanup Action Area (Landau 2002)
- Marine Railway Cleanup Action Area (Landau 2002)
- Marine Area Dredge and Interim Action (GeoEngineers 2008)
- Upland Area Interim Action (GeoEngineers 2008)

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot

N
W E
S

100 0 100
Feet

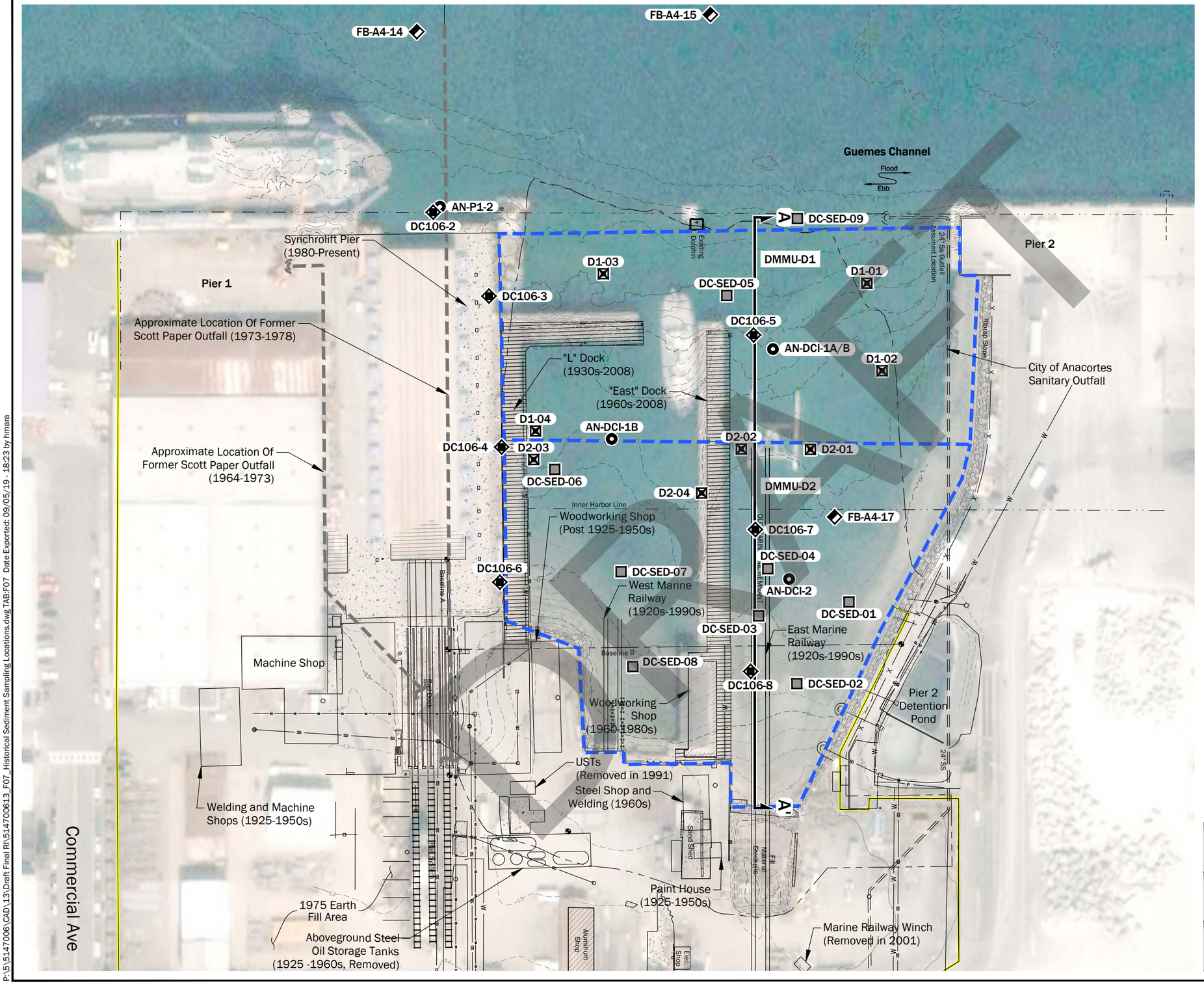
**Independent Cleanup Action Areas and Marine Area Dredging**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 6**

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F06_Historical Cleanup Action Areas.dwg TAB:F06 Date Exported: 09/05/19 - 18:21 by hmara




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Marine Area Dredge and Interim Action (GeoEngineers 2008)

Historical Sediment Sample Location and Type

- Phase 2 Environmental Assessment (Otten Engineering 1997)
- Dredged Material Characterization (Hart Crowser 2000)
- Supplemental Dredged Material Characterization (Anchor 2004)
- DCI Basin Surface Sediment Dioxin Study (Floyd|Snider 2007)
- Fidalgo Bay Sediment Study (SAIC 2008)
- A — A' Cross Section A-A' (See Figure 15)

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot

N W E S

100 0 100
Feet

**Historical Sediment Sampling Locations**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 7**

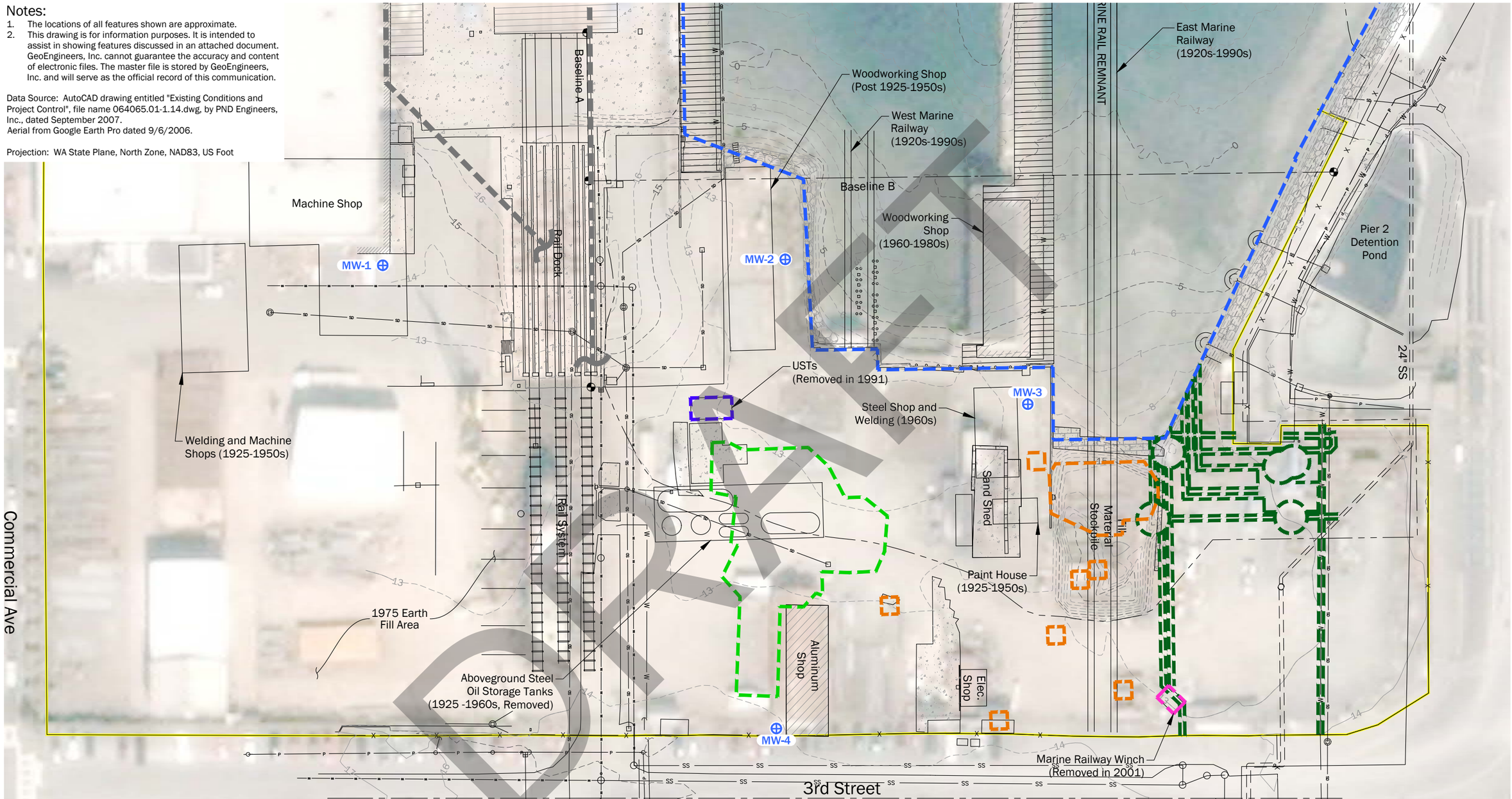
P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F07_Historical Sediment Sampling Locations.dwg TAB:F07 Date Exported: 09/05/19 - 18:23 by hmara

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot




**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- UST Removal Enclosure Area (A-1 1991)
- Marine Railway Winch Removal Area (Landau 2001)
- Petroleum Cleanup Action Area (Landau 2002)
- Marine Railway Cleanup Action Area (Landau 2002)
- Marine Area Dredge and Interim Action (GeoEngineers 2008)
- Upland Area Interim Action (GeoEngineers 2008)

Historical Groundwater Sample Location and Type

- ⊕ Monitoring Well (Landau 2002)

N W E S

60 0 60
Feet

# Historical Groundwater Sampling Locations

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 8



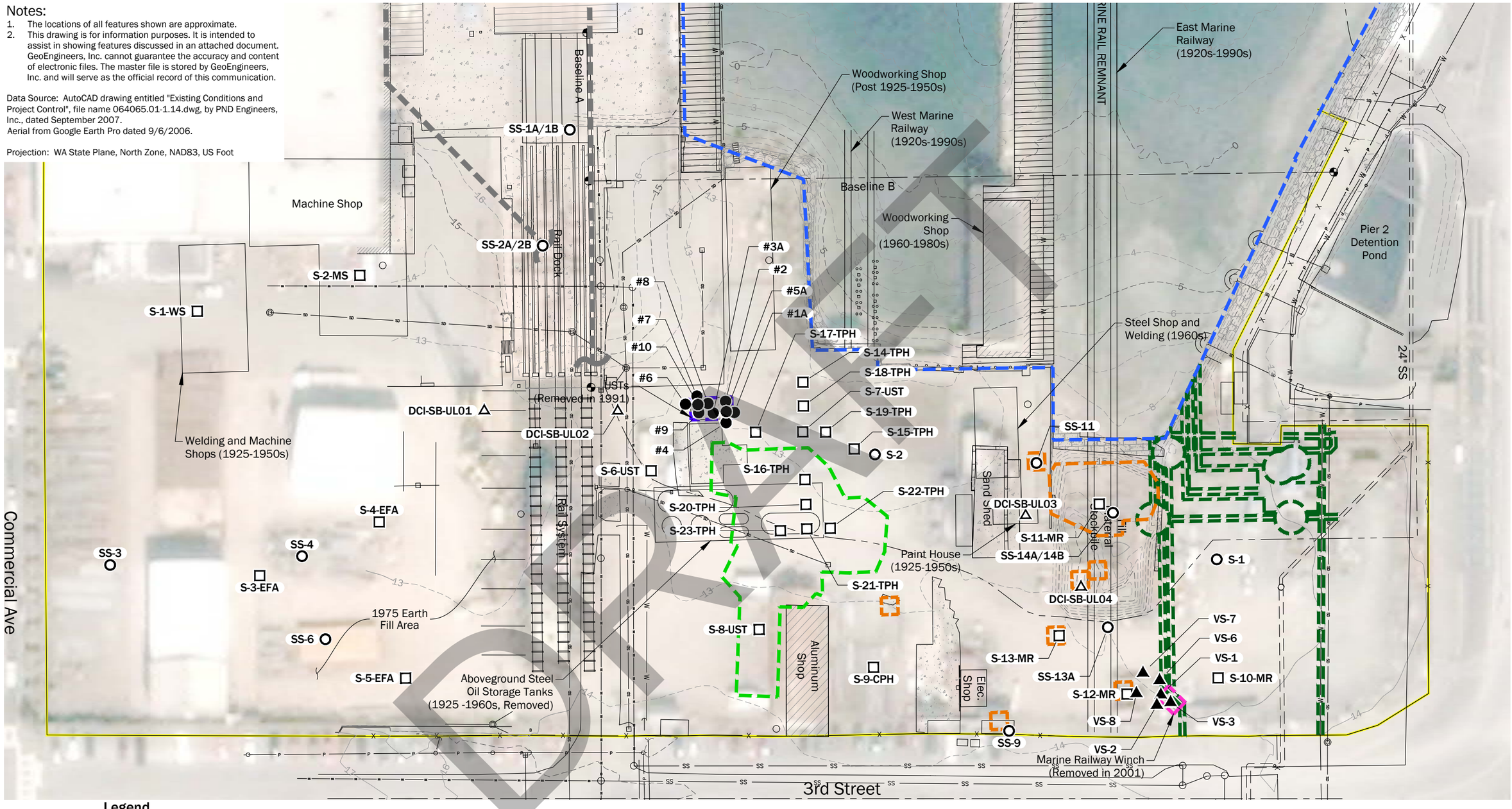
P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F08_Historical GW Sampling Locations.dwg TABF08 Date Exported: 09/05/19 - 18:24 by hmara

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot




DRAFT

### Legend

- Dakota Creek Industries (DCI) Property Boundary
- UST Removal Enclosure Area (A-1 1991)
- Marine Railway Winch Removal Area (Landau 2001)
- Petroleum Cleanup Action Area (Landau 2002) See Figure 11 for Confirmation Soil Sample Locations
- Marine Railway Cleanup Action Area (Landau 2002) See Figure 12 for Confirmation Soil Sample Locations
- Marine Area Dredge and Interim Action (GeoEngineers 2008)
- Upland Area Interim Action (GeoEngineers 2008)

Historical Soil Sample Location and Type

- UST Removal and Closure (A-1 1991)
- Phase 2 Environmental Site Assessment (Otten 1997)
- EPA Site Inspection (Landau 2001)
- Marine Railway Hydraulic Winch Soil Excavation (Landau 2001)
- Remedial Investigation Study (Landau 2002b)

N W E S

60 0 60
Feet

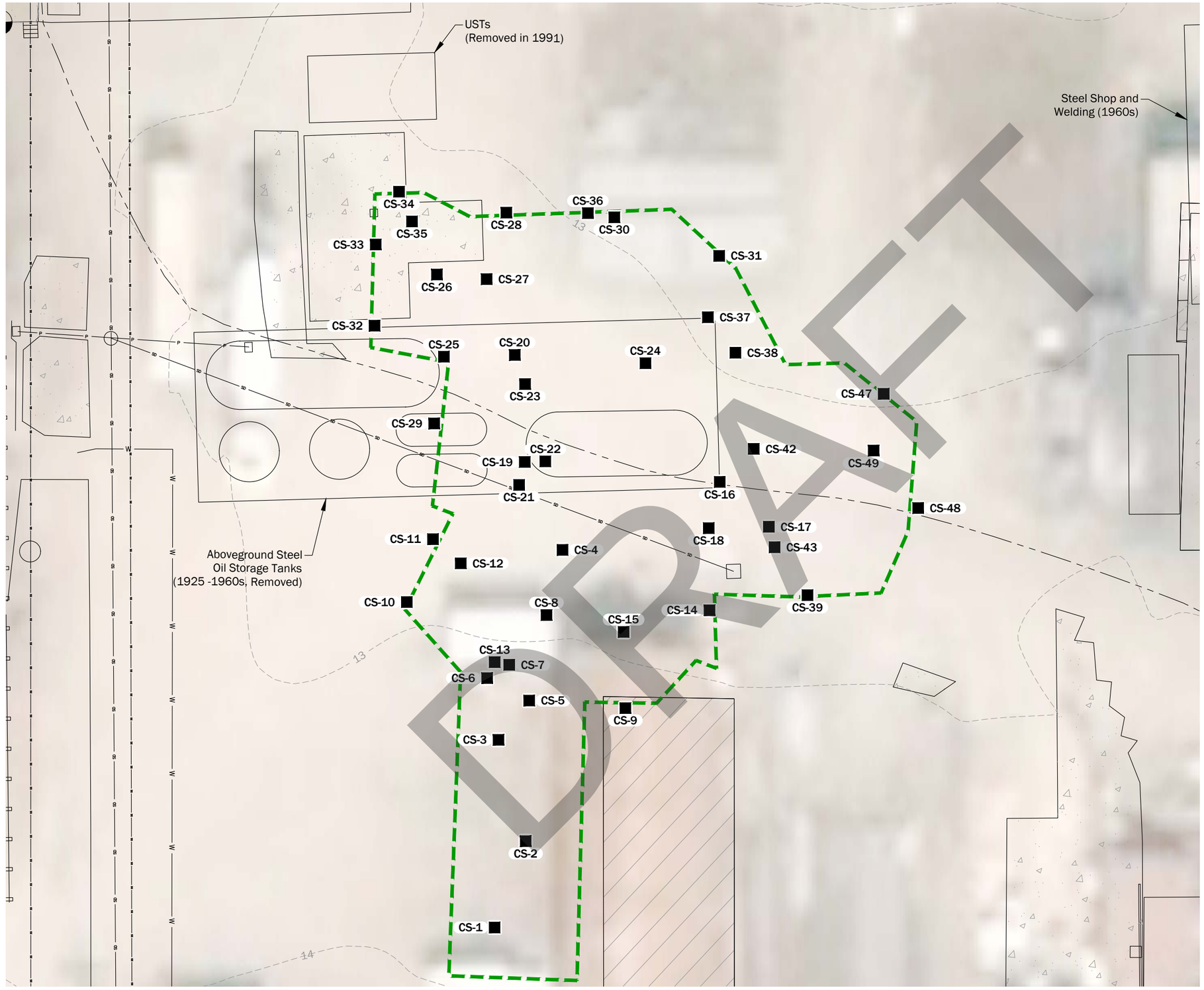
**Historical Soil Sampling Locations**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 9**

P:\5\5147006\CAD\13\Draft Final RI\5147006l3_F09_Historical Soil Sampling Overview.dwg TAB:F09 Date Exported: 09/05/19 - 18:28 by hmara




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Petroleum Cleanup Action Area (Landau 2002)
- Independent Cleanup Action Confirmation Sampling Location
- Independent Cleanup Action (Landau 2002c)

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot

N
W E
S

20 0 20
Feet

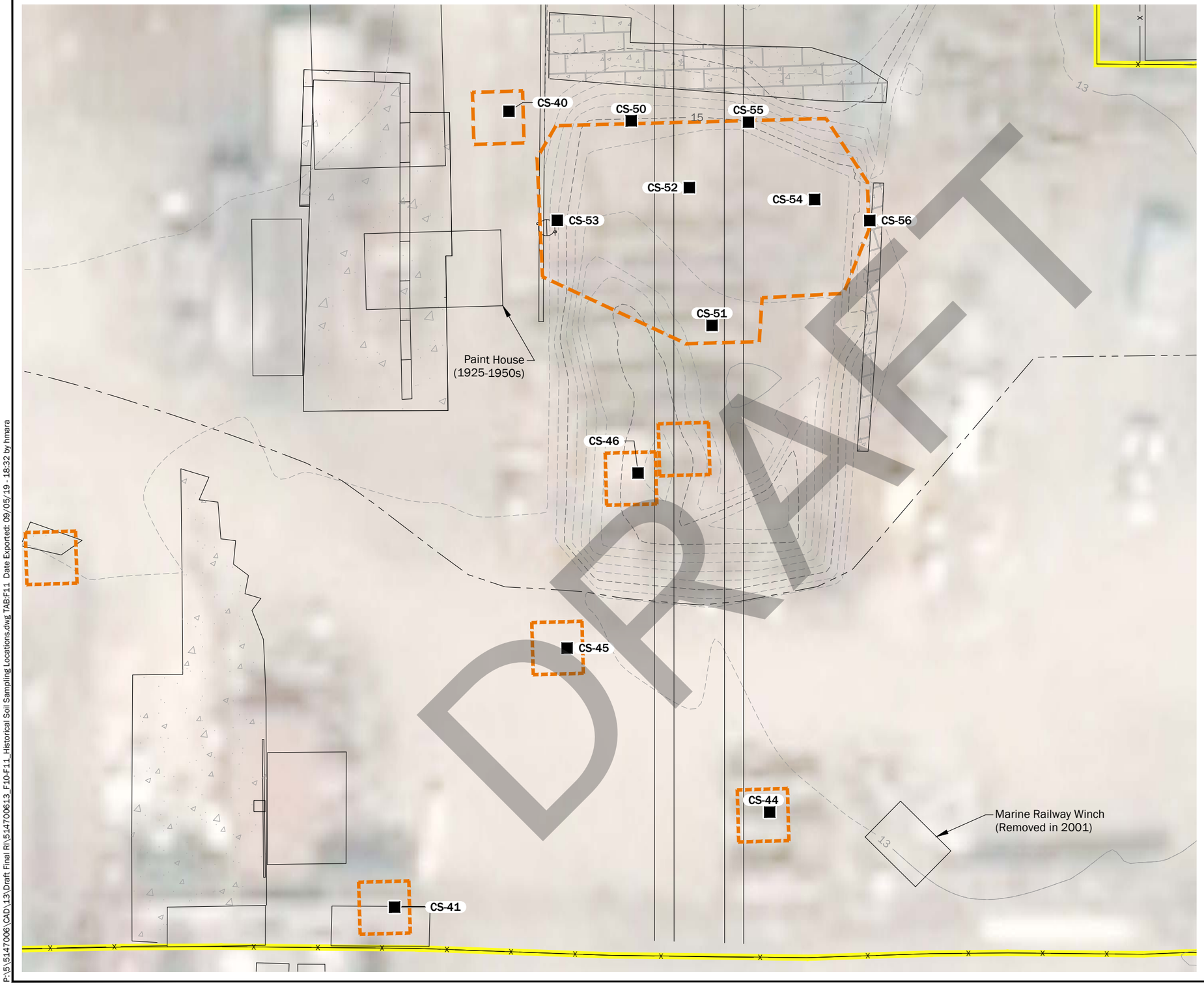
**Petroleum Cleanup Action Area and Confirmation Sampling Locations**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 10**

P:\5\5147006\CAD\13\Draft Final RI\5147006l3_F10-F11_Historical Soil Sampling Locations.dwg TAB:F10 Date Exported: 09/05/19 - 18:32 by hmara






## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Marine Railway Cleanup Action Area (Landau 2002)
- Independent Cleanup Action Confirmation Sampling Locations
- Independent Cleanup Action (Landau 2002c)

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot

N W E S

20 0 20
Feet

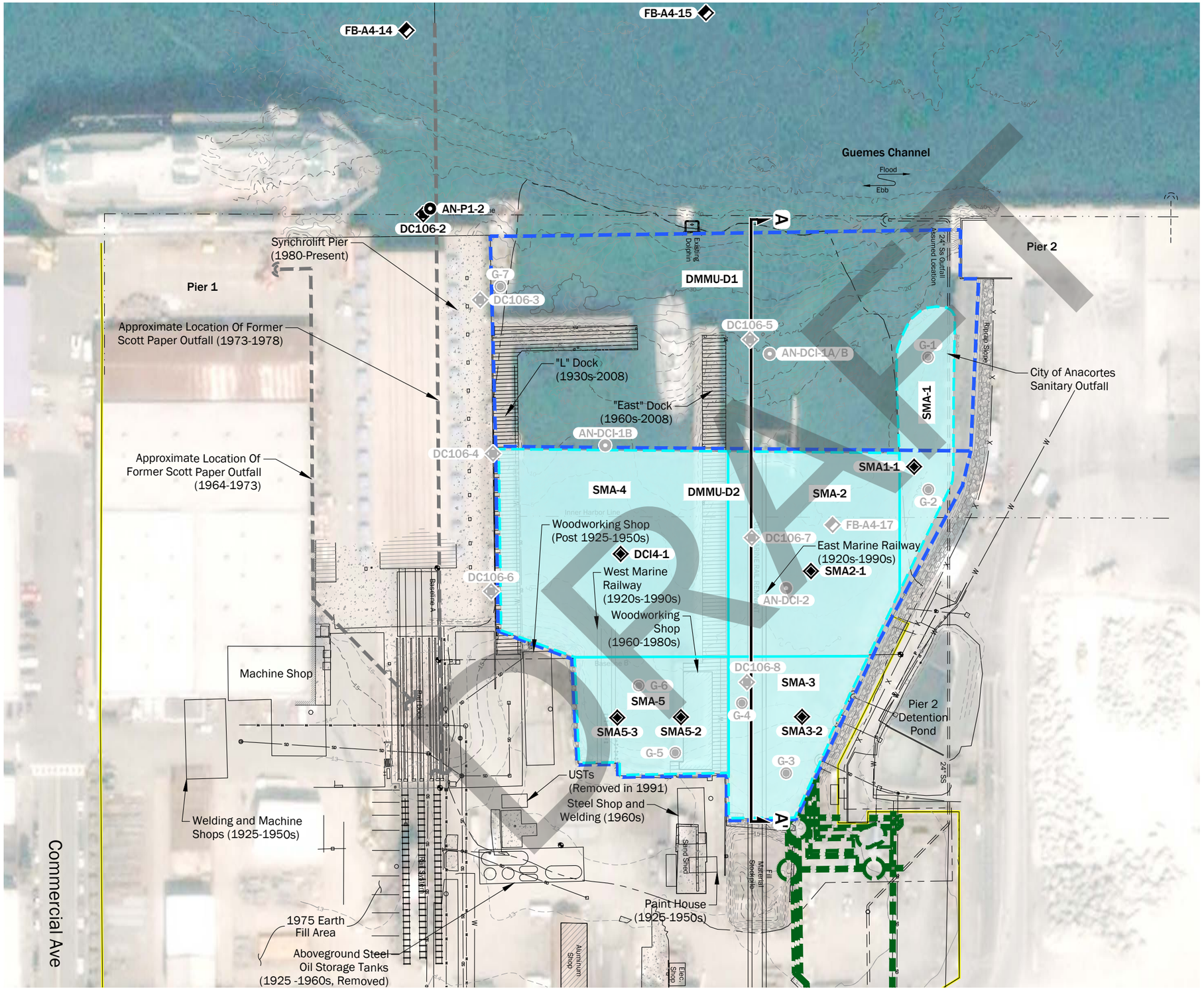
**Marine Railway Cleanup Action Area and Confirmation Sampling Locations**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 11**

P:\S\5147006\CAD\13\Draft Final RI\5147006I3_F10-F11_Historical Soil Sampling Locations.dwg TAB:F11 Date Exported: 09/05/19 - 18:32 by hmara




## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Marine Area Interim Action (GeoEngineers 2008)
- Sediment Deposits with PCUL Exceedances Removed for Upland Landfill Disposal During Marine Area Dredging
- Upland Area Interim Action - Fill Soil with PCUL Exceedances Removed for Upland Landfill Disposal During Utility Installation

Sample Location Representing Pre-Dredge Sediment Conditions

- Supplemental Dredged Material Characterization (Anchor 2004)
- DCI Basin Surface Sediment Dioxin Study (Floyd|Snider 2007)
- Fidalgo Bay Sediment Study (SAIC 2008)
- Sediment Remedial Investigation (GeoEngineers 2008)

Sample Location Representing Post-Dredge Sediment Conditions

- Fidalgo Bay Sediment Study (SAIC 2008)
- Interim Action (GeoEngineers 2008)
- A A' Cross Section A-A' (See Figure 16)

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.
Aerial from Google Earth Pro dated 9/6/2006.

Projection: WA State Plane, North Zone, NAD83, US Foot

N W E S

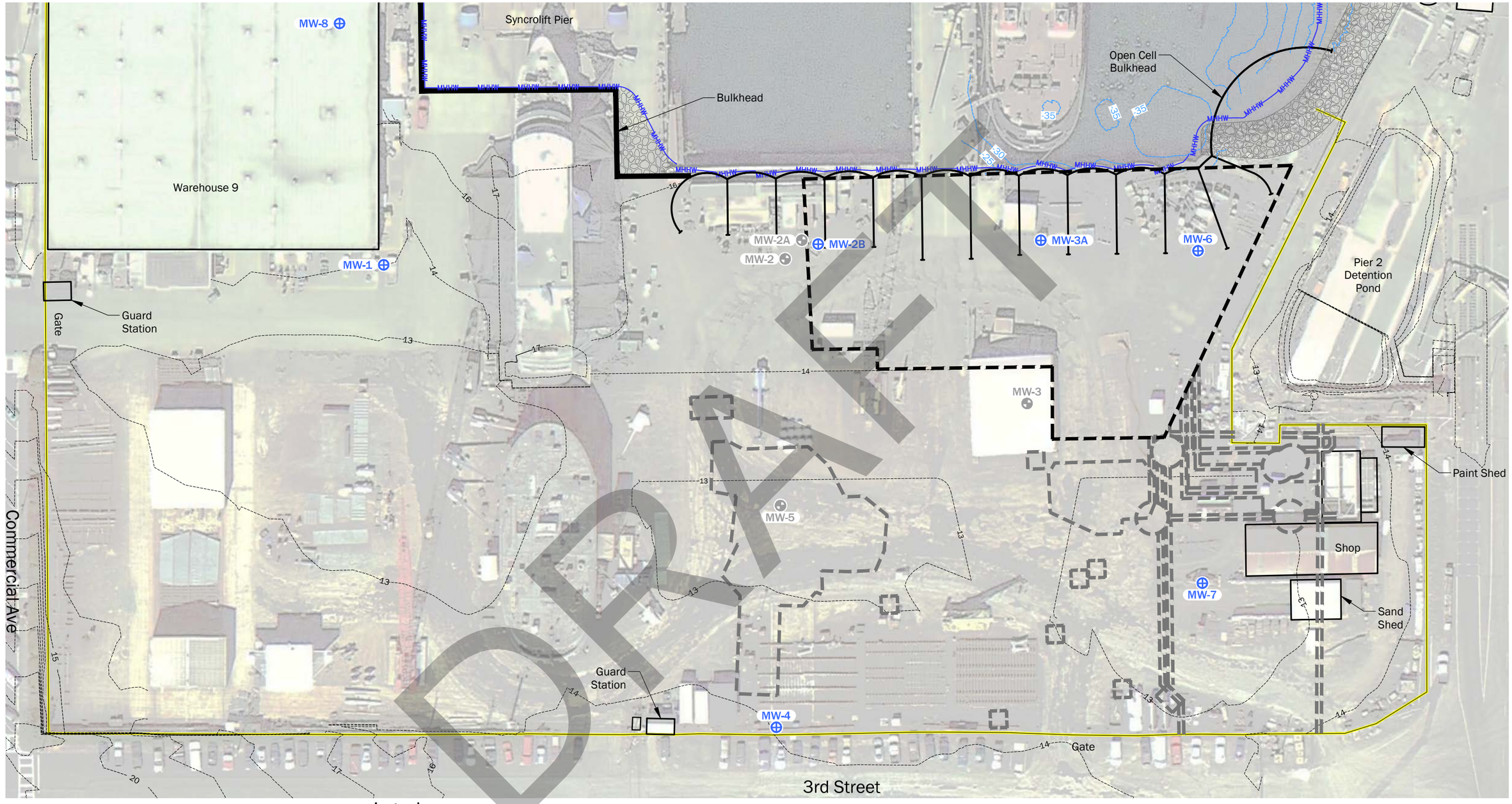
100 0 100
Feet

**Sediment Remedial Investigation and Interim Action**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers | **Figure 12**

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F12_GEI Sediment Locations and Marine Section.dwg TAB:F12 Date Exported: 09/05/19 - 18:45 by hmara






Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- MW-1 — Monitoring Well Location (Active)
- MW-2A — Monitoring Well Location (Abandoned)

N W E S

60 0 60
Feet

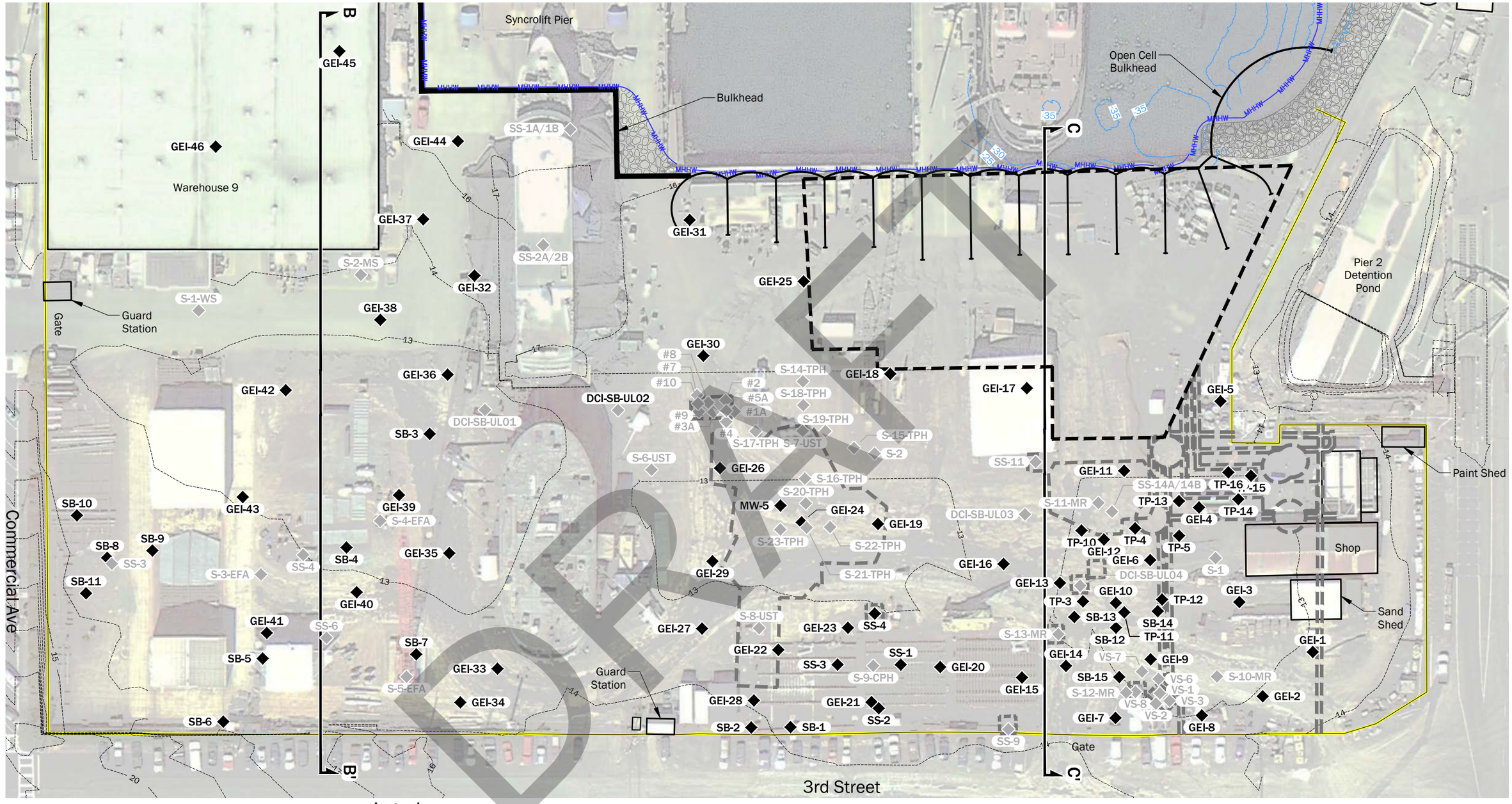
# Groundwater Remedial Investigation Sampling Locations

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 13

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F13_GEI GW Sampling Locations.dwg TABF13 Date Exported: 09/05/19 - 21:42 by hmara




Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- Remedial Investigation Soil Sampling Location
- Historical Soil Sampling Location

B B' Cross Section Location (See Figures 17 and 18)

N W E S

60 0 60
Feet

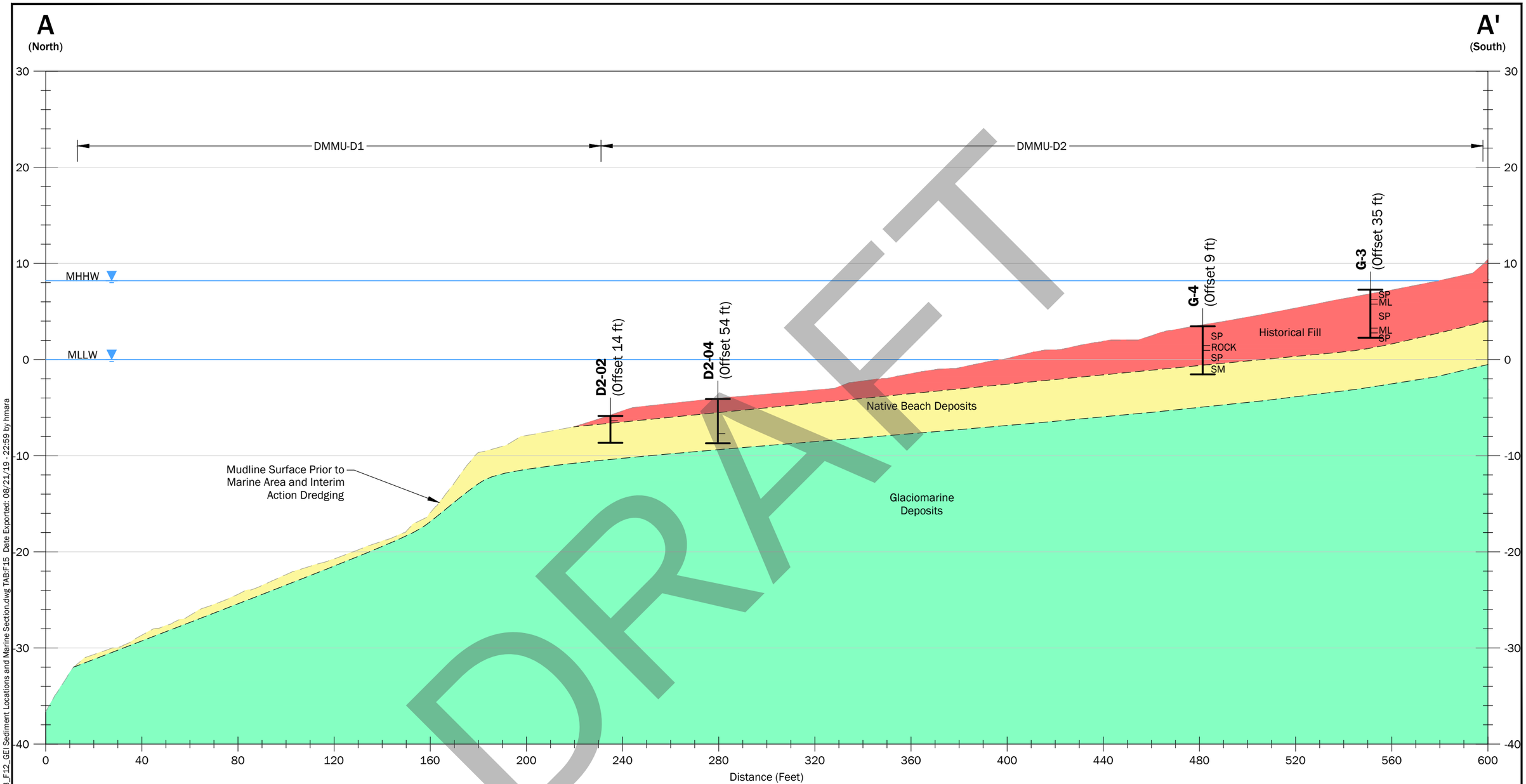
# Soil Remedial Investigation Sampling Locations

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 14

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F14_Soil RI and Upland Sections.dwg TAB:F14 Date Exported: 09/05/19 - 21:42 by hmara

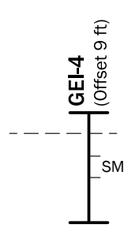





Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NAVD 88, unless otherwise noted.




**Legend**

- Boring
- Inferred Soil Contact
- Soil Classification
- Historical Fill (Layered Sand and Silt/Clay with Occasional Wood Debris) - Not Suitable for Open-Water Disposal
- Native Beach Deposits (Poorly Sorted Sand with Occasional Shell Fragments) - Suitable for Open-Water Disposal
- Glaciomarine Deposits (Glacially Consolidated Very Dense Sand and Hard Silt) - Suitable for Open-Water Disposal

40 0 40
Horizontal Scale in Feet

10 0 10
Vertical Scale in Feet
Vertical Exaggeration: 4X

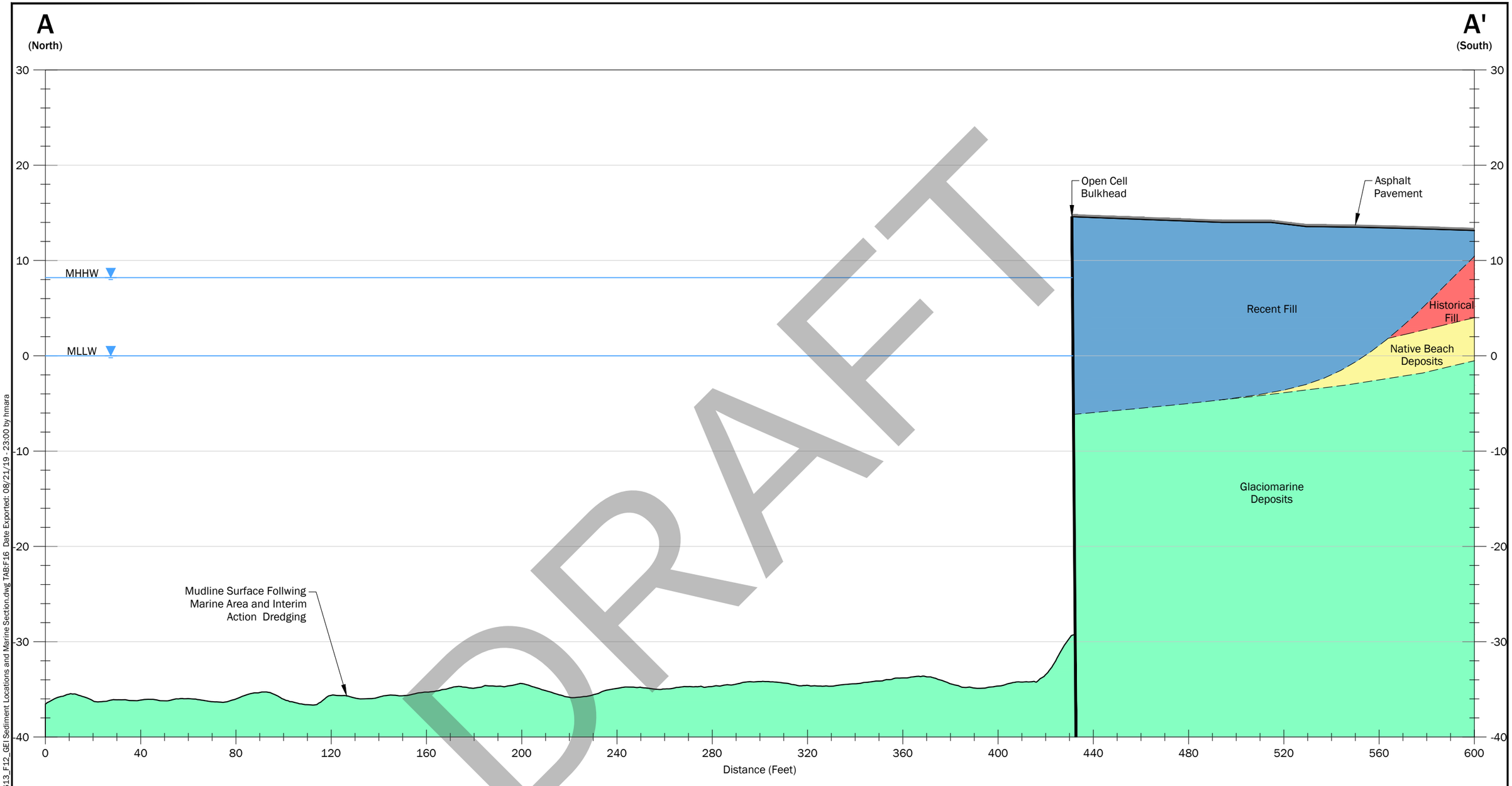
**Cross Section A-A'**
**Pre-Marine Area and Interim Action Dredging**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 15**

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F12_GEI Sediment Locations and Marine Section.dwg TAB:F15 Date Exported: 08/21/19 - 22:59 by hmara






Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NAVD 88, unless otherwise noted.

**Legend**

- Recent Fill (Imported Sand and Gravel)
- Historical Fill (Layered Sand and Silt/Clay with Occasional Wood Debris)
- Native Beach Deposits (Poorly Sorted Sand with Occasional Shell Fragments)
- Glaciomarine Deposits (Glacially Consolidated Very Dense Sand and Hard Silt)

40 0 40
Horizontal Scale in Feet

10 0 10
Vertical Scale in Feet
Vertical Exaggeration: 4X

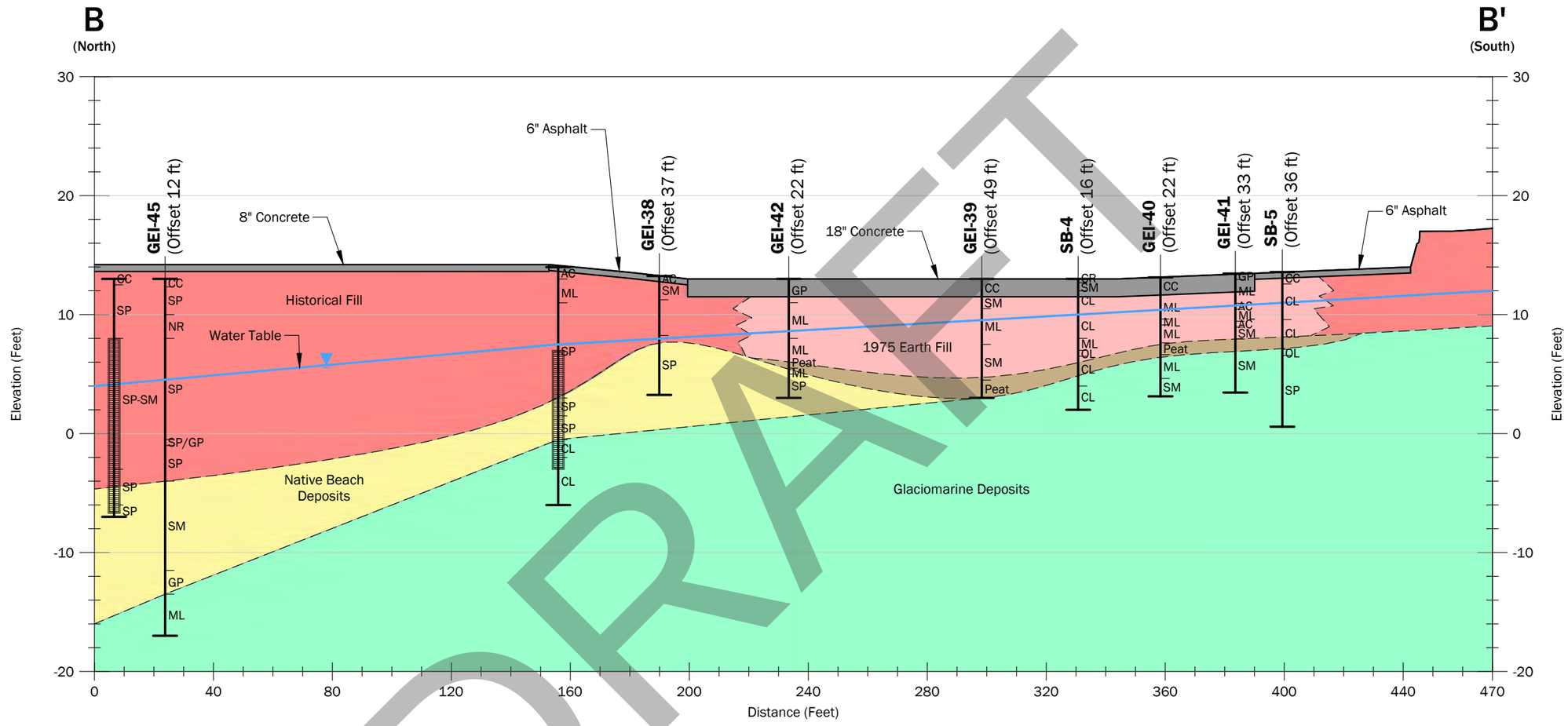
**Cross Section A-A'**
**Post-Marine Area and Interim Action Dredging**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 16**

P:\5\5147006\CAD\13\Draft Final RI\5147006l3_F12_GEI Sediment Locations and Marine Section.dwg TAB:F16 Date Exported: 08/21/19 - 23:00 by hmara






Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NAVD 88, unless otherwise noted.

GEI-45 (Offset 12 ft)
SM

**Legend**

- Boring
- Inferred Soil Contact
- Soil Classification
- Well Screen

- Historical Fill (Layered Sand and Silt/Clay with Occasional Wood, Brick and Concrete Debris)
- 1975 Earth Fill (Layered silt and clay with Variable Sand and Gravel Content)
- Native Saltmarsh Deposits (Organic Silt)
- Native Beach Deposits (Poorly Sorted Sand with Occasional Gravel)
- Glaciomarine Deposits (Glacially Consolidated Very Dense Sand and Hard Silt)

40 0 40
Horizontal Scale in Feet

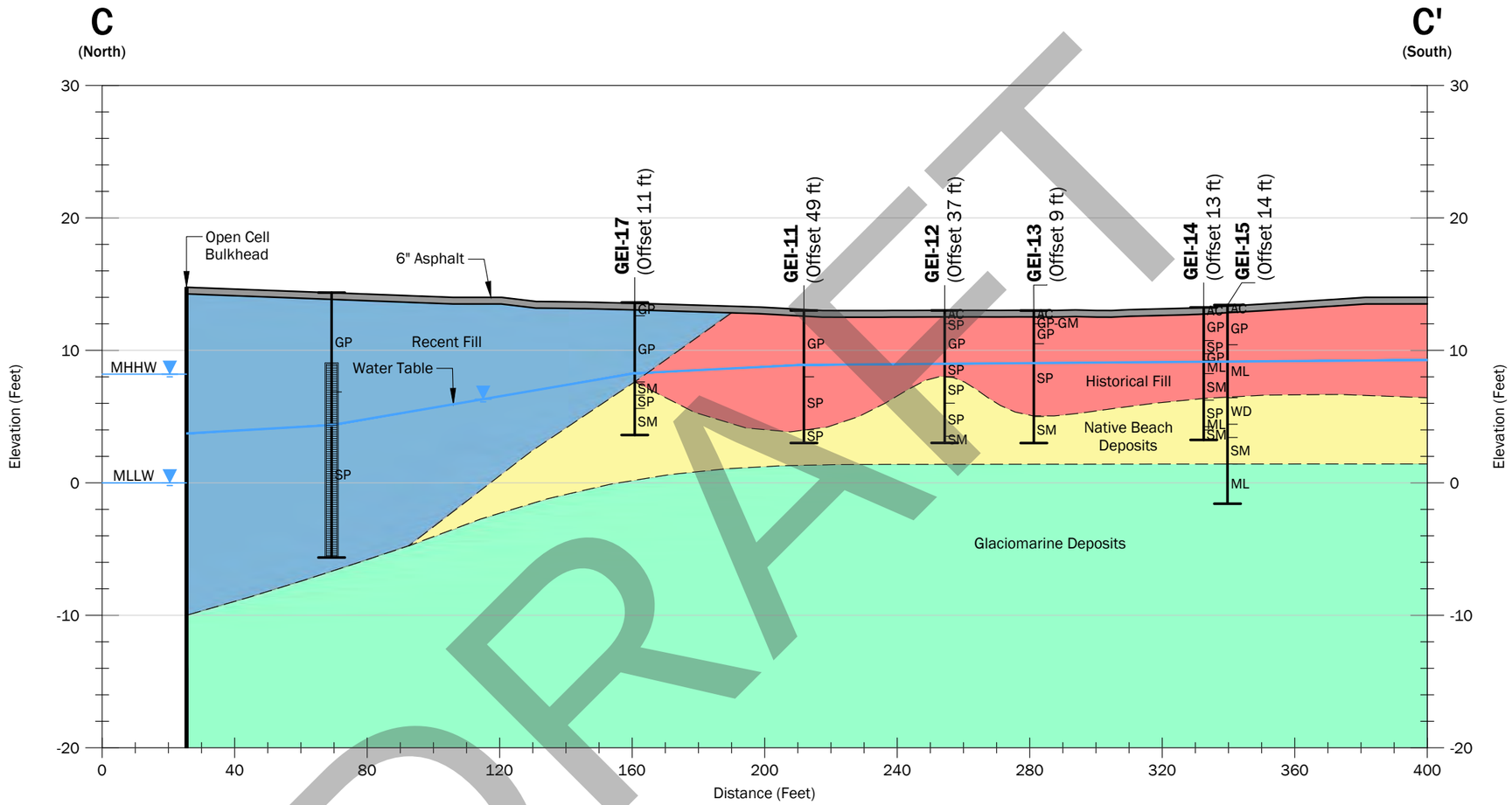
10 0 10
Vertical Scale in Feet
Vertical Exaggeration: 4X

**Upland Cross Section B-B'**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 17**






Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NAVD 88, unless otherwise noted.

GEI-11 (Offset 49 ft)
SM

**Legend**

- Boring
- Inferred Soil Contact
- Soil Classification
- Well Screen
- Historical Fill (Layered Sand and Silt/Clay with Occasional Wood Debris)
- Recent Fill (Imported Sand and Gravel)
- Native Beach Deposits (Poorly Sorted Sand with Occasional Gravel)
- Glaciomarine Deposits (Glacially Consolidated Very Dense Sand and Hard Silt)

40 0 40
Horizontal Scale in Feet

10 0 10
Vertical Scale in Feet
Vertical Exaggeration: 4X

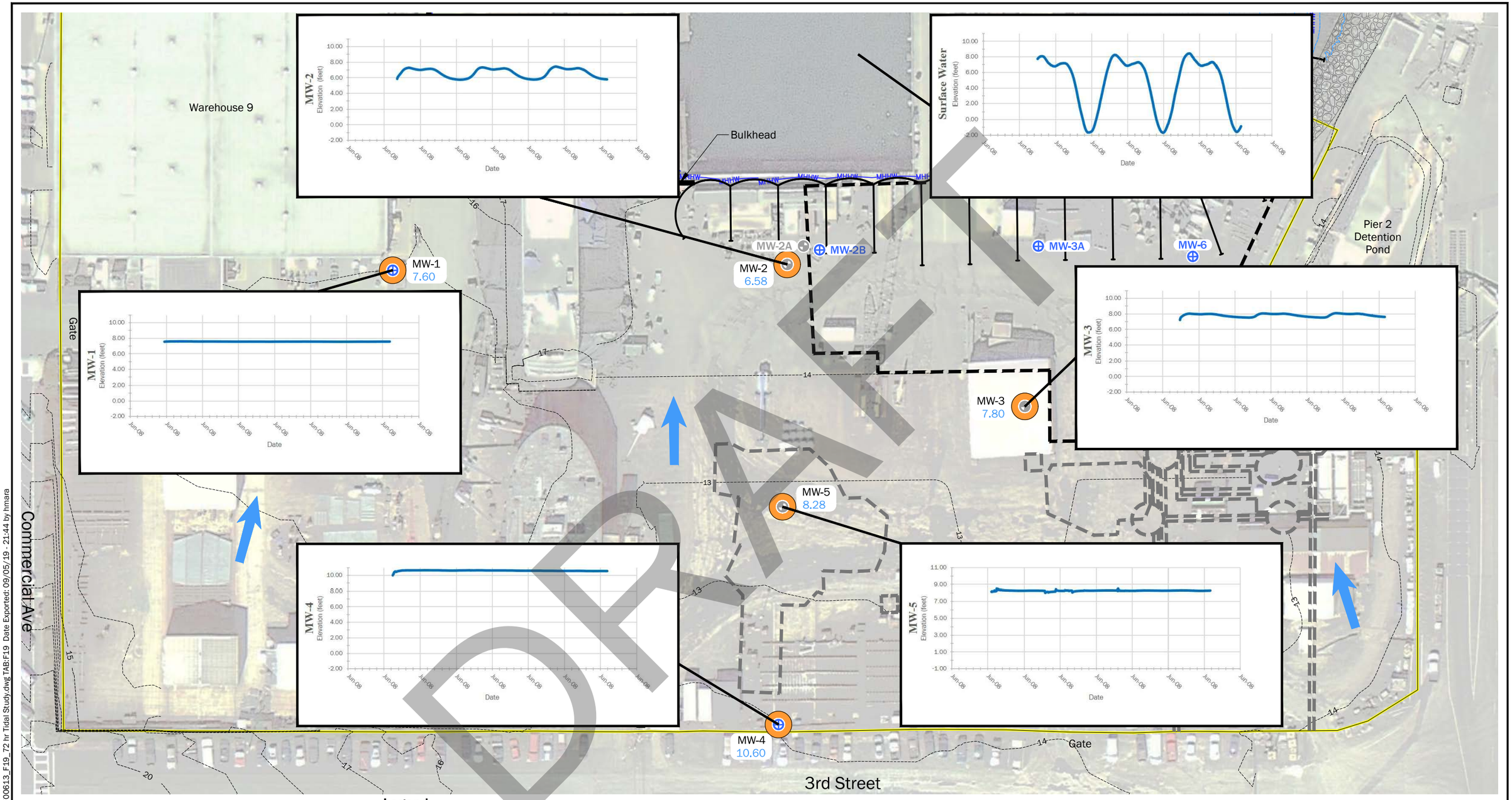
**Upland Cross Section C-C'**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 18**

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F14_Soil RI and Upland Sections.dwg TAB:F18 Date Exported: 08/21/19 - 23:11 by hmara






## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- MW-1 — Monitoring Well Location (Active)
- MW-2A — Monitoring Well Location (Abandoned)
- 7.60 — Average 72-Hour Groundwater Elevation
- Hydraulic Conductivity Tidal Study Location
- Groundwater Flow Direction

N W E S

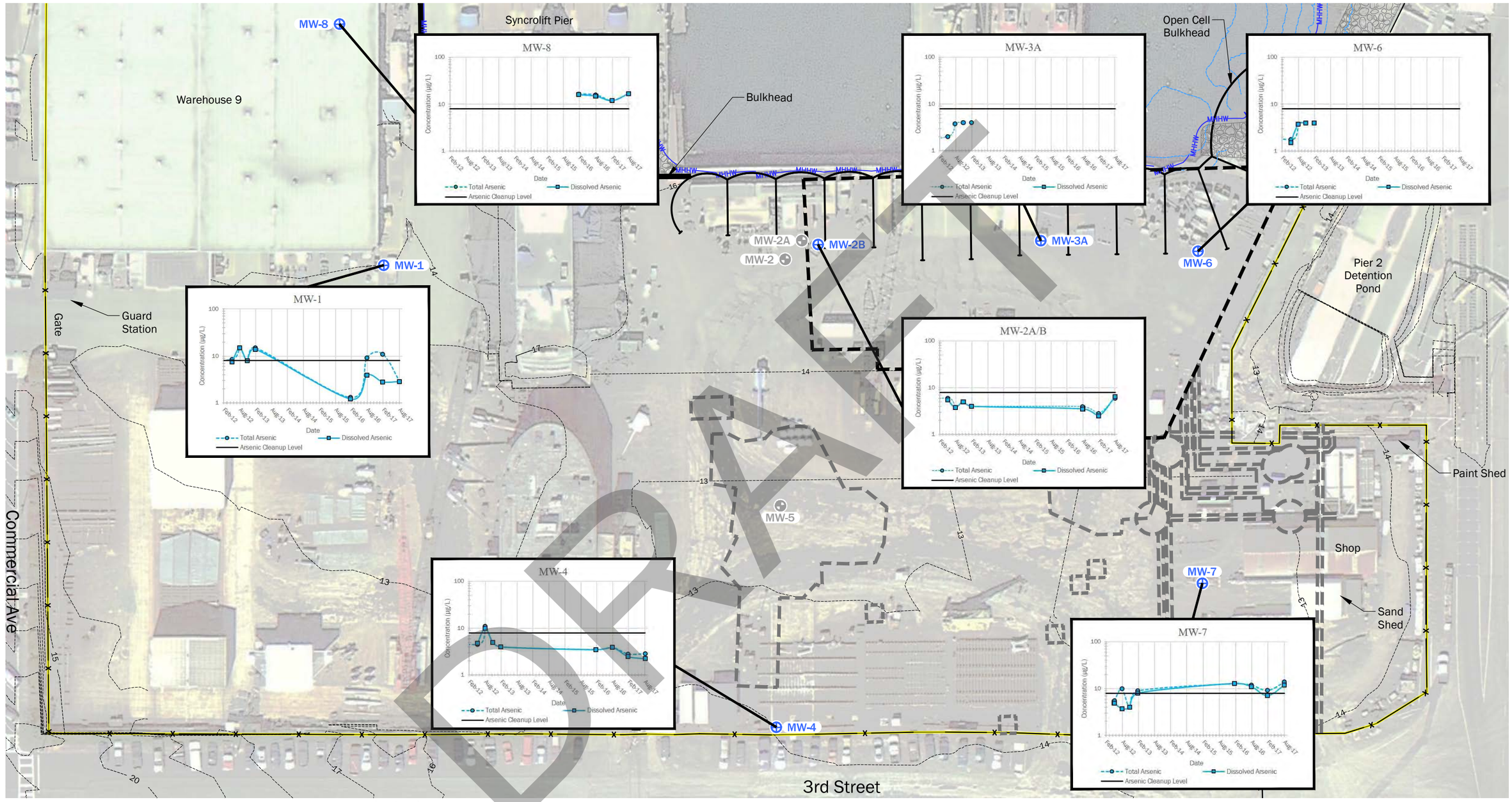
60 0 60
Feet

**72-Hour Tidal Study**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 19**




Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection:
Horizontal Datum: WA State Plane, North Zone, NAD83, US Foot
Vertical Datum: Mean Low Low Water (MLLW)

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- MW-1 Monitoring Well Location (Active)
- MW-2A Monitoring Well Location (Abandoned)

N W E S

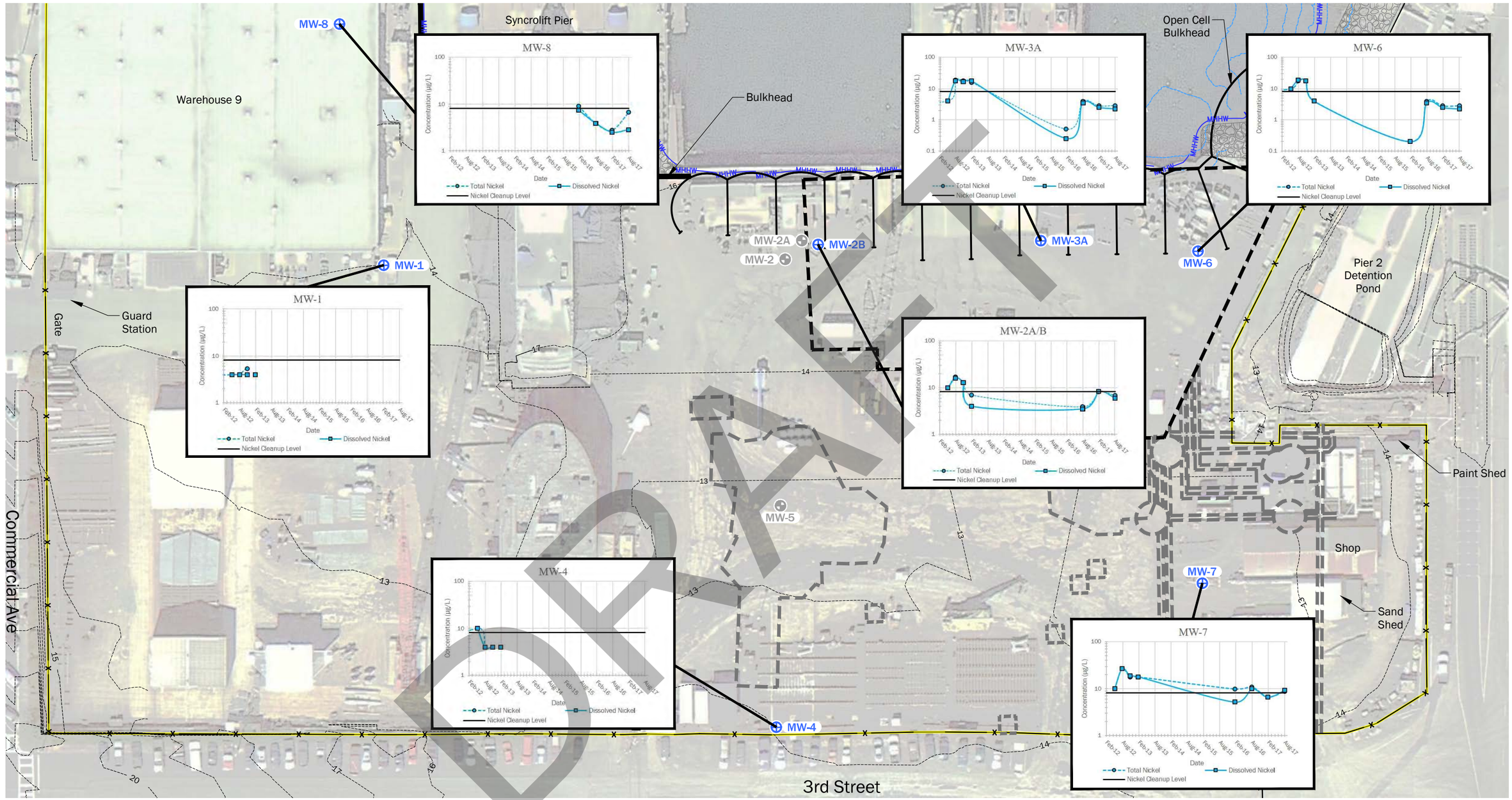
60 0 60
Feet

**Summary of Groundwater Arsenic Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 20**




DRAFT

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection:
Horizontal Datum: WA State Plane, North Zone, NAD83, US Foot
Vertical Datum: Mean Low Low Water (MLLW)

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- MW-1 ⊕ Monitoring Well Location (Active)
- MW-2A ⊕ Monitoring Well Location (Abandoned)

N W E S

60 0 60
Feet

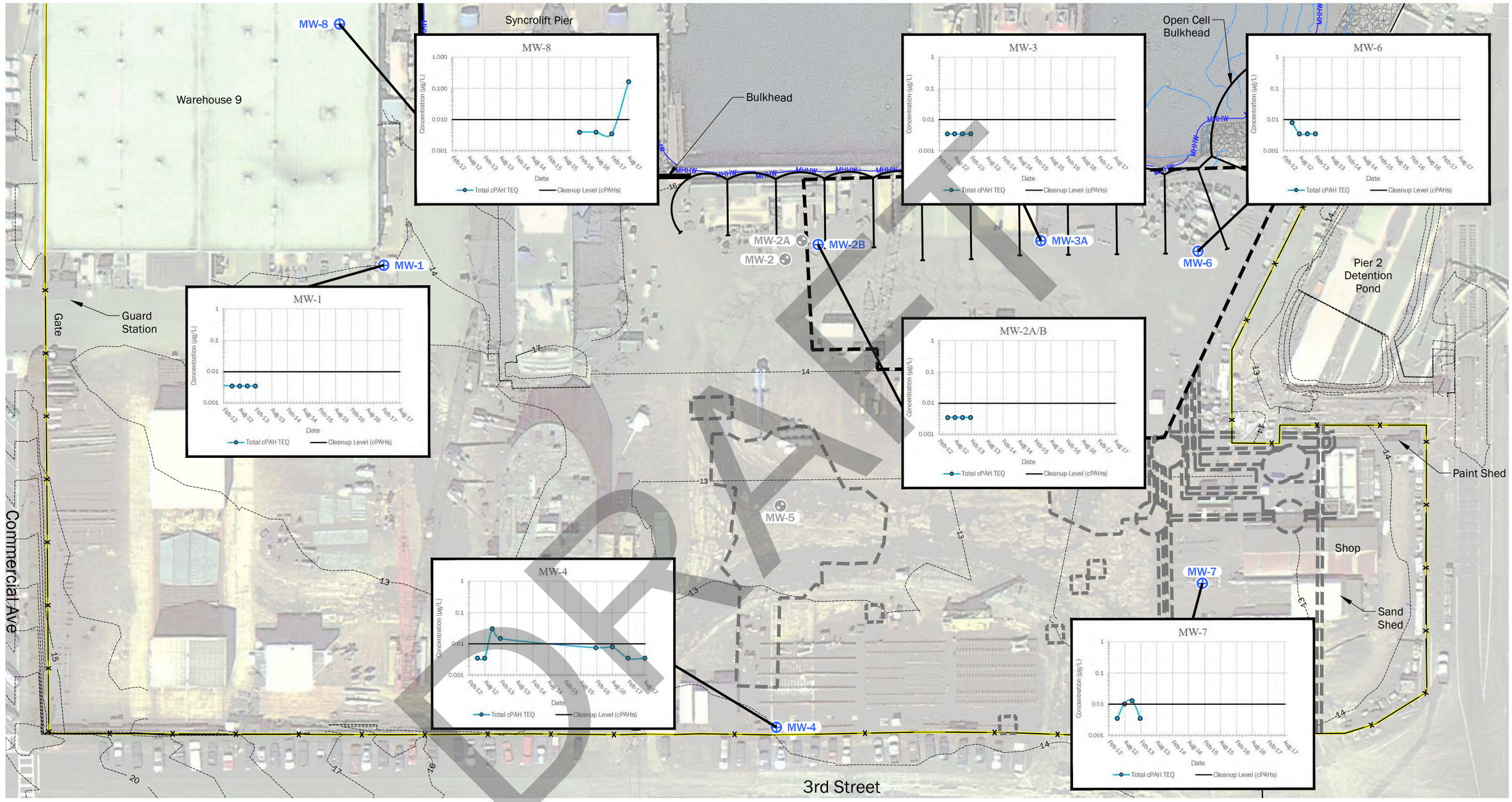
**Summary of Groundwater Nickel Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 21**

P:\5\5147006\CAD\13\DCI FS Report\5147006613_F08_Summary of Nickel in GW.dwg TAB:F08 Date Exported: 09/05/19 - 22:15 by hmara




DRAFT

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection:
Horizontal Datum: WA State Plane, North Zone, NAD83, US Foot
Vertical Datum: Mean Low Low Water (MLLW)

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- MW-1 — Monitoring Well Location (Active)
- MW-2A — Monitoring Well Location (Abandoned)

N W E S

60 0 60
Feet

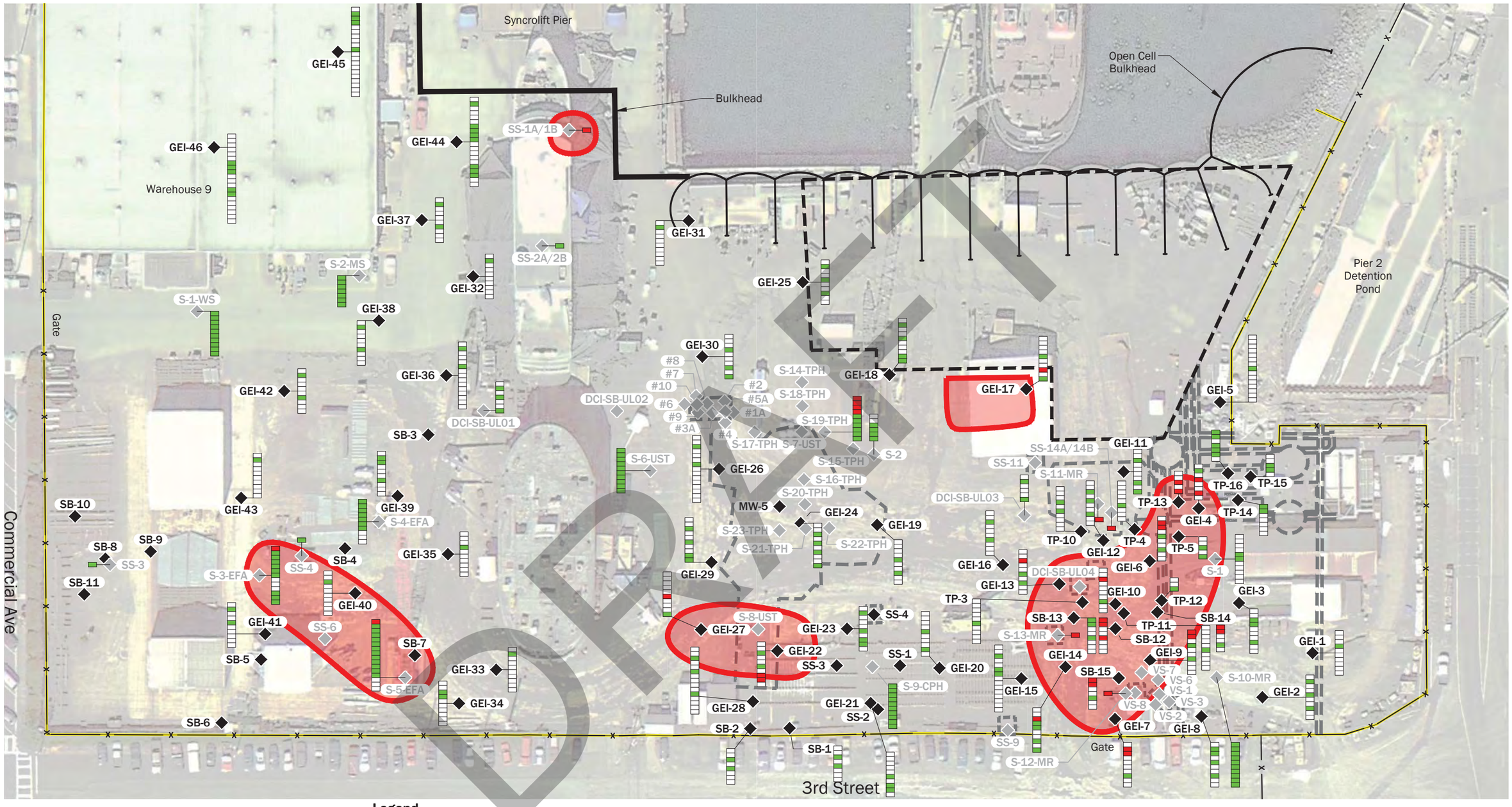
**Summary of Groundwater Total cPAH TEQ Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 22**

P:\5\5147006\CAD\13\DCI FS Report\5147006613_F09_Summary of CPAHs in GW.dwg TAB:F09 Date Exported: 09/05/19 - 22:15 by hmara






Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- Remedial Investigation Soil Sampling Location
- Historical Soil Sampling Location
- Soil Boring - Each Box Represents a 1-Foot Sample Interval
- No Soil Data
- Result Less Than Proposed Cleanup Level
- Result Exceeds Proposed Cleanup Level
- Approximate Extent of Proposed Soil Cleanup Level Exceedance

bgs = below ground surface

N W E S

60 0 60
Feet

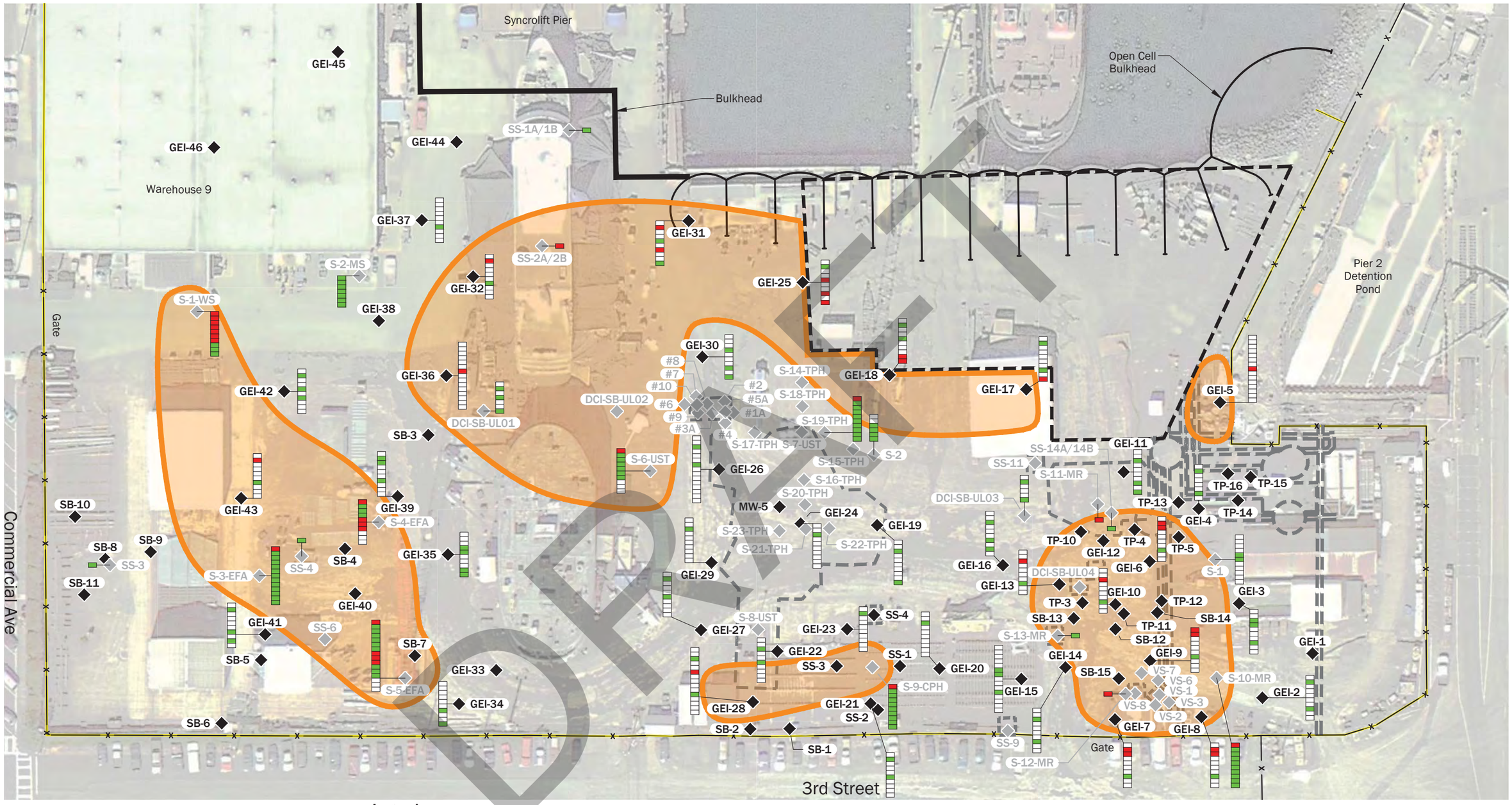
**Summary of Soil Arsenic Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 23

P:\5\5147006\CAD\13\Draft Final RI\5147006l3_F23_Extent of Arsenic Contamination.dwg TAB:F23 Date Exported: 02/27/20 - 15:01 by hmara




DRAFT

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- Remedial Investigation Soil Sampling Location
- Historical Soil Sampling Location
- Soil Boring - Each Box Represents a 1-Foot Sample Interval
- No Soil Data
- Result Less Than Proposed Cleanup Level
- Result Exceeds Proposed Cleanup Level
- Approximate Extent of Proposed Soil Cleanup Level Exceedance

bgs = below ground surface

N W E S

60 0 60
Feet

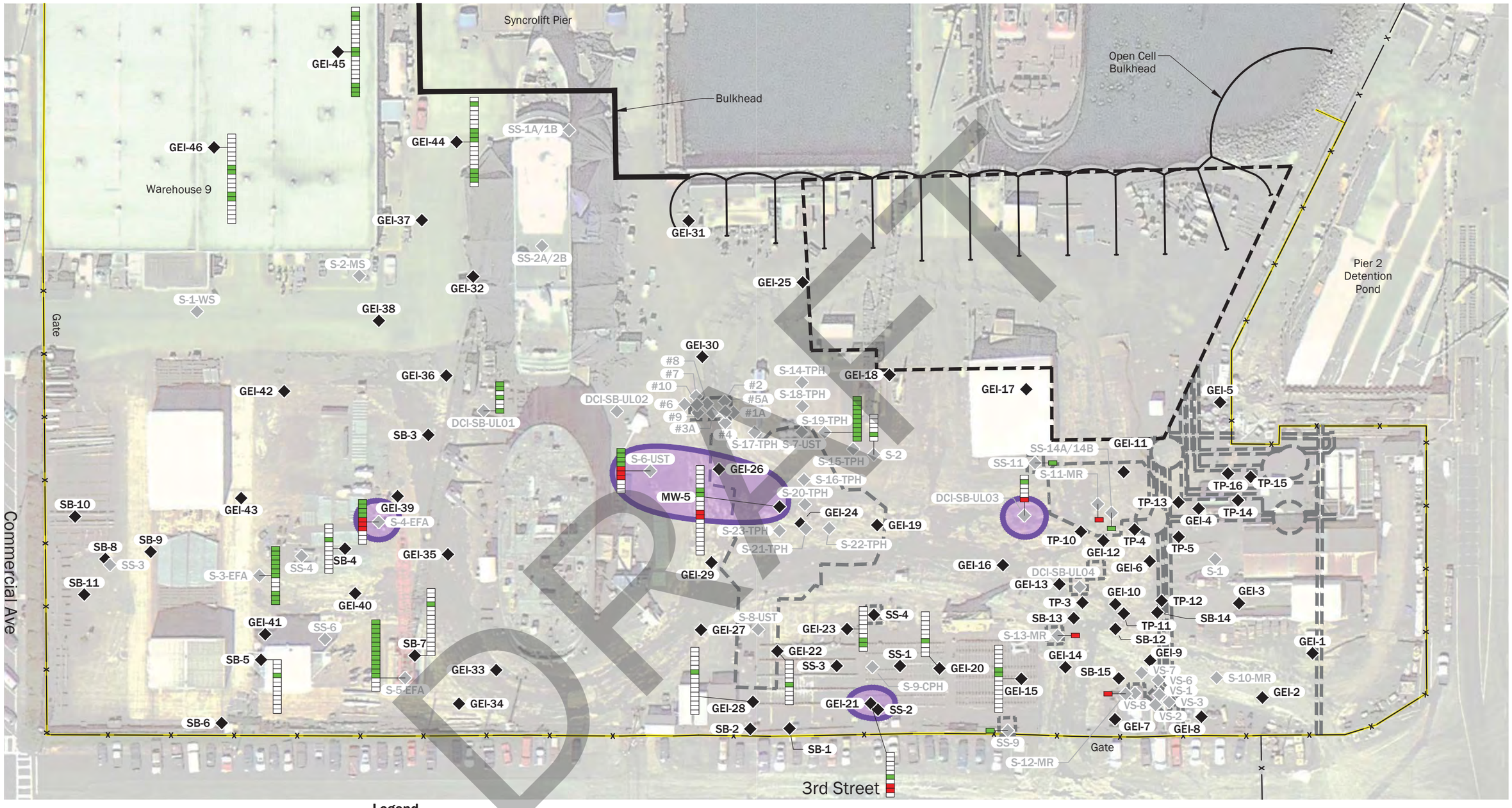
**Summary of Soil Nickel Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 24

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F24_Extent of Nickel Contamination.dwg TAB:F24 Date Exported: 02/27/20 - 15:02 by hmara




Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- Remedial Investigation Soil Sampling Location
- Historical Soil Sampling Location
- Soil Boring - Each Box Represents a 1-Foot Sample Interval
- No Soil Data
- Result Less Than Proposed Cleanup Level
- Result Exceeds Proposed Cleanup Level
- Approximate Extent of Proposed Soil Cleanup Level Exceedance

bgs = below ground surface

N W E S

60 0 60
Feet

**Summary of Soil PAHs Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 25

Syncrolift Pier
Bulkhead
Open Cell Bulkhead
Pier 2 Detention Pond
Warehouse 9
Gate
Commercial Ave
3rd Street
Gate

GEI-45
GEI-46
GEI-44
SS-1A/1B
GEI-37
GEI-31
SS-2A/2B
S-2-MS
S-1-WS
GEI-32
GEI-25
GEI-38
GEI-30
GEI-36
GEI-42
GEI-18
GEI-17
GEI-5
DCI-SB-UL02
DCI-SB-UL01
SB-3
GEI-11
GEI-26
SS-14A/14B
SS-11
S-11-MR
SB-10
GEI-43
GEI-39
S-4-EFA
MW-5
DCI-SB-UL03
TP-16
TP-15
TP-13
TP-14
GEI-4
SB-8
SB-9
SS-3
SS-4
SB-4
GEI-35
S-3-EFA
GEI-24
GEI-19
TP-10
TP-4
TP-5
GEI-12
GEI-16
GEI-6
S-1
SB-11
GEI-29
DCI-SB-UL04
GEI-13
GEI-40
TP-3
GEI-10
GEI-3
TP-12
SB-13
SB-14
GEI-41
SS-6
GEI-27
GEI-23
SS-4
TP-11
S-13-MR
SB-12
GEI-1
SB-7
SB-5
GEI-22
SS-1
GEI-14
GEI-9
GEI-33
SS-3
GEI-20
SB-15
VS-7
S-10-MR
S-5-EFA
S-9-CPH
GEI-15
VS-6
VS-1
GEI-2
GEI-34
VS-8
VS-3
GEI-28
GEI-21
SS-2
VS-2
GEI-7
GEI-8
SB-6
SB-2
SB-1
SS-9
S-12-MR

S-8-UST
S-6-UST
S-7-UST
S-14-TPH
S-18-TPH
S-19-TPH
S-17-TPH
S-15-TPH
S-2
S-16-TPH
S-20-TPH
S-23-TPH
S-22-TPH
S-21-TPH
#8
#7
#10
#2
#5A
#6
#1A
#9
#3A
#4

DRAFT

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3, 4 and 6)
- Previous Marine Area Dredge and Backfill Area (See Figure 7)
- Remedial Investigation Soil Sampling Location
- Historical Soil Sampling Location
- bgs = below ground surface
- Soil Boring - Each Box Represents a 1-Foot Sample Interval
- No Soil Data
- Result Less Than Proposed Cleanup Level
- Result Exceeds Proposed Cleanup Level
- Approximate Extent of Proposed Soil Cleanup Level Exceedance
- Previous Cleanup Action Area Completed to Remove Petroleum Hydrocarbon Contamination (Confirmation Sample Results Could not be Verified to Confirm Removal)

N W E S

60 0 60
Feet

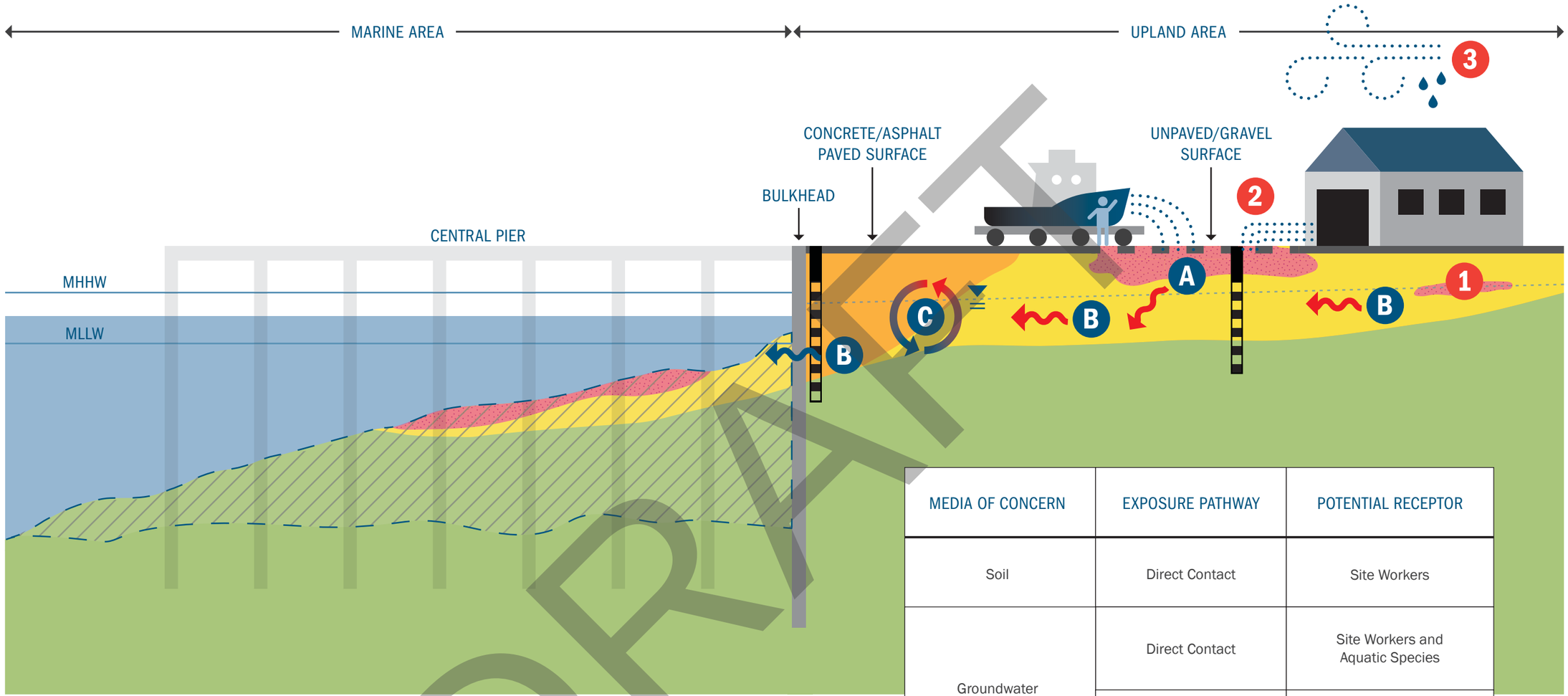
**Summary of Soil Petroleum Hydrocarbon Results**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 26

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F26_Extent of TPH Contamination.dwg TAB:F26 Date Exported: 02/27/20 - 15:05 by hmara




| MEDIA OF CONCERN | EXPOSURE PATHWAY | POTENTIAL RECEPTOR |
|---|---|---|
| Soil | Direct Contact | Site Workers |
| Groundwater | Direct Contact | Site Workers and Aquatic Species |
| | Ingestion | Consumption of Marine Organisms |

## Legend

- Potential Contaminant Transport Pathway
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water
- Monitoring Well

## Stratigraphy

- Imported Clean Fill - Placed Following 2002 Independent Cleanup Action or 2008 Interim Action Activities
- Artificial Fill
- Native Deposits (Glaciomarine Drift and Beach Sands)
- Contaminants
- Removed During 2008 Interim Action and Marine Area Dredging

## Sources of Contamination

1. Historical Contaminated Fill - Fill contains debris including concrete asphalt, brick and wood fragments suggesting that they may have been re-used from other industrial sources
2. Industrial-Related Operations - Direct discharge of paint chips, grinding and blast grit residues to the ground from vessel maintenance and repair activities.
3. Atmospheric Deposition - Ongoing and historic combustion of fossil fuels from residents, machinery (boiler, power, etc.), vehicles, marine vessels, and wood burning.

## Environmental Transport

- A Infiltration and Leaching (Unpaved Areas Only)
- B Shallow Unconfined Aquifer Solute Transport
- C Tidal Mixing



**Current Site Configuration**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

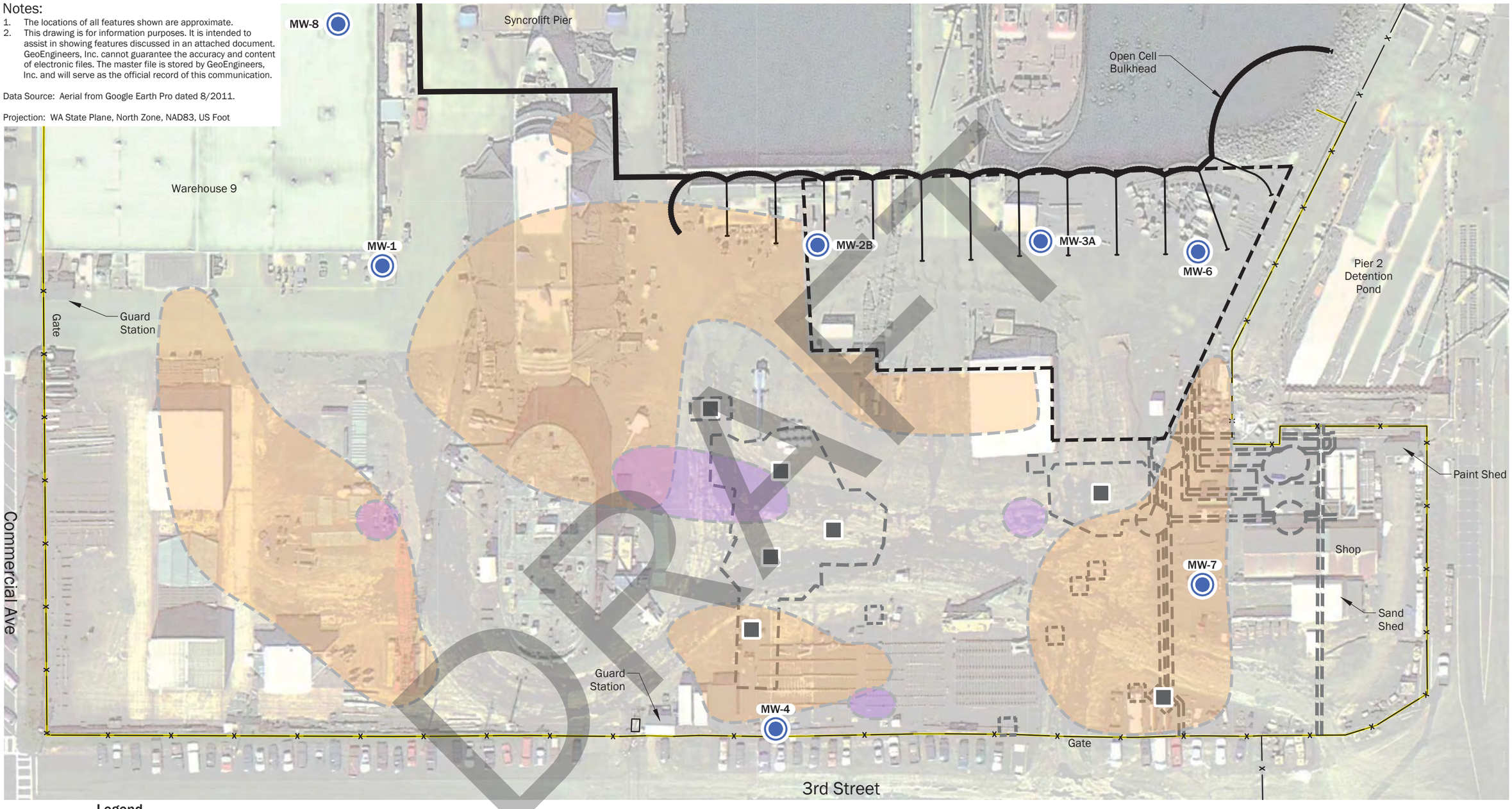
**Figure 27**

## Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot






### Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- x Existing Fence
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- MW-1 Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions

cPAHs = carcinogenic aromatic hydrocarbons

TEQ = toxic equivalency

N W E S

60 0 60
Feet

**Proposed Supplemental Soil Investigation**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 28**

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F28_Proposed Supplemental Soil Investigation.dwg TAB:F28 Date Exported: 02/28/20 - 10:51 by hmara

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

MW-8

Syncrolift Pier

**Containment: Maintain Existing Sheet Pile Wall to Restrict Flow and Discharge of Groundwater to Surface Water**

Open Cell Bulkhead

**Groundwater Monitoring: Monitor Groundwater Conditions at Each Well Location Over Time to Evaluate Compliance with Cleanup Standards and Natural Attenuation**

MW-1

MW-2B

MW-3A

MW-6

**Containment: Install Asphalt Pavement to Further Reduce the Potential for Direct Exposure Stormwater Infiltration and Contaminant Leaching/Migration**

Pier 2 Detention Pond

Gate

Guard Station

**Containment: Maintain Existing Pavement Cover to Prevent Direct Exposure, Stormwater Infiltration and Contaminant Leaching/Migration**

Paint Shed

Shop

MW-7

Sand Shed

Commercial Ave

Guard Station

MW-4

Gate

**Institutional Control: Maintain Existing Fencing and Security Procedures to Restrict Public Access**

**Institutional Control: Install Warning Signs to Notify Workers of Potential Heath Risks of Site Contaminants Remaining In Place**

3rd Street

DRAFT

## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- Existing Fence
- Existing Asphalt/Concrete Pavement
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- Proposed New Asphalt Pavement
- MW-1 Proposed Compliance Groundwater Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions

cPAHs = carcinogenic aromatic hydrocarbons

TEQ = toxic equivalency

N W E S

60 0 60

Feet

**Cleanup Action Alternative 1**
**Containment and Compliance Groundwater Monitoring**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 29

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F29_Cleanup Action Alt 1.dwg TAB:F29 Date Exported: 02/27/20 - 18:45 by hmara

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

MW-8

Syncrolift Pier

**Containment: Maintain Existing Sheet Pile Wall to Restrict Flow and Discharge of Groundwater to Surface Water**

Open Cell Bulkhead

**Groundwater Monitoring: Monitor Groundwater Conditions at Each Well Location Over Time to Evaluate Compliance with Cleanup Standards and Natural Attenuation**

MW-1

MW-2B

MW-3A

MW-6

Pier 2 Detention Pond

Gate

Guard Station

**Containment: Maintain Existing Pavement Cover to Prevent Direct Exposure, Stormwater Infiltration and Contaminant Leaching/Migration**

**Removal: Perform Remedial Excavation to Remove Contaminants Using Standard Earthwork Equipment Followed by Site Restoration**

Paint Shed

Shop

MW-7

Sand Shed

Commercial Ave

Guard Station

MW-4

**Institutional Control: Maintain Existing Fencing and Security Procedures to Restrict Public Access**

Gate

**Institutional Control: Install Warning Signs to Notify Workers of Potential Heath Risks of Site Contaminants Remaining In Place**

3rd Street



## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- Existing Fence
- Existing Asphalt/Concrete Pavement
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- Contaminant Source Area - Area in Which Metals (Arsenic and/or Nickel) Exceed Three Times the Preliminary Soil Cleanup Level
- Soil Removal Area
- Proposed New Asphalt Pavement
- MW-1 Proposed Compliance Groundwater Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions

cPAHs = carcinogenic aromatic hydrocarbons

TEQ = toxic equivalency

N W E S

60 0 60

Feet

**Cleanup Action Alternative 2**
**Partial Source Removal**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 30

P:\5\5147006\CAD\13\Draft Final R\5147006l3_F30_Cleanup Action Alt 2.dwg TABF30 Date Exported: 03/13/20 - 16:25 by hmara

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

MW-8

Syncrolift Pier

Containment: Maintain Existing Sheet Pile Wall to Restrict Flow and Discharge of Groundwater to Surface Water

Open Cell Bulkhead

Groundwater Monitoring: Install Temporary Monitoring Wells and Complete Performance Monitoring in the Source Areas to Verify the Effectiveness of the Cleanup action and Whether the Injection of Additional Chemical Reagents is Necessary to Stabilize Site Contaminants Remaining in Place followed by Groundwater Monitoring at MW-1 through MW-8 Over Time to Evaluate Compliance with Cleanup Standards and Natural Attenuation

Warehouse 9

MW-2B

MW-3A

MW-6

MW-1

Containment: Install Asphalt Pavement to Further Reduce the Potential for Direct Exposure Stormwater Infiltration and Contaminant Leaching/Migration

Gate

Guard Station

Containment: Maintain Existing Pavement Cover to Prevent Direct Exposure, Stormwater Infiltration and Contaminant Leaching/Migration

Paint Shed

Shop

MW-7

Sand Shed

In Situ Treatment: Perform In Situ Soil Treatment Through the Injection of Chemical Reagents to Treat Site Contaminants in Identified Source Areas

Guard Station

MW-4

Gate

Institutional Control: Maintain Existing Fencing and Security Procedures to Restrict Public Access

Institutional Control: Install Warning Signs to Notify Workers of Potential Heath Risks of Site Contaminants Remaining In Place

Commercial Ave

3rd Street

DRAFT

## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- Existing Fence
- Existing Asphalt/Concrete Pavement
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- Contaminant Source Area - Area in Which Metals (Arsenic and/or Nickel) Exceed Three Times the Preliminary Soil Cleanup Level
- Proposed New Asphalt Pavement
- In Situ Treatment Area
- MW-1 Proposed Compliance Groundwater Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions

cPAHs = carcinogenic aromatic hydrocarbons

TEQ = toxic equivalency

N W E S

60 0 60

Feet

**Cleanup Action Alternative 3**
**Source Area In Situ Treatment**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 31

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F31_Cleanup Action Alt 3.dwg TAB:F31 Date Exported: 02/27/20 - 16:15 by hmara

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

MW-8

Syncrolift Pier

**Containment: Maintain Existing Sheet Pile Wall to Restrict Flow and Discharge of Groundwater to Surface Water**

Open Cell Bulkhead

**Groundwater Monitoring: Monitor Groundwater Conditions at Each Well Location Over Time to Evaluate Compliance with Cleanup Standards and Natural Attenuation**

MW-2B

MW-3A

MW-6

MW-1

Pier 2 Detention Pond

Gate

Guard Station

**Containment: Maintain Existing Pavement Cover to Prevent Direct Exposure, Stormwater Infiltration and Contaminant Leaching/Migration**

Paint Shed

Commercial Ave

Shop

MW-7

**Removal: Perform Remedial Excavation to Remove Contaminants Using Standard Earthwork Equipment Followed by Site Restoration**

Sand Shed

Guard Station

MW-4

Gate

**Institutional Control: Maintain Existing Fencing and Security Procedures to Restrict Public Access**

**Institutional Control: Install Warning Signs to Notify Workers of Potential Heath Risks of Site Contaminants Remaining In Place**

3rd Street

## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- Existing Fence
- Existing Asphalt/Concrete Pavement
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- Contaminant Source Area - Area in Which Metals (Arsenic and/or Nickel) Exceed Three Times the Preliminary Soil Cleanup Level
- Soil Removal Area
- MW-1 Proposed Compliance Groundwater Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions

cPAHs = carcinogenic aromatic hydrocarbons

TEQ = toxic equivalency

N W E S

60 0 60

Feet

**Cleanup Action Alternative 4**
**Source Area Removal**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 32**

P:\5\5147006\CAD\13\Draft Final R\5147006l3_F32_Cleanup Action Alt 4.dwg TABLF32 Date Exported: 03/18/20 - 9:30 by hmara

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

MW-8

Syncrolift Pier

Containment: Maintain Existing Sheet Pile Wall to Restrict Flow and Discharge of Groundwater to Surface Water

Open Cell Bulkhead

Groundwater Monitoring: Install Temporary Monitoring Wells and Complete Performance Monitoring in the Source Areas to Verify the Effectiveness of the Cleanup action and Whether the Injection of Additional Chemical Reagents is Necessary is Necessary to Stabilize Site Contaminants Remaining in Place followed by Groundwater Monitoring at MW-1 through MW-8 Over Time to Evaluate Compliance with Cleanup Standards and Natural Attenuation

Warehouse 9

MW-1

MW-2B

MW-3A

MW-6

Containment: Install Asphalt Pavement to Further Reduce the Potential for Direct Exposure Stormwater Infiltration and Contaminant Leaching/Migration

Gate

Guard Station

Containment: Maintain Existing Pavement Cover to Prevent Direct Exposure, Stormwater Infiltration and Contaminant Leaching/Migration

Paint Shed

Shop

MW-7

Sand Shed

In Situ Treatment: Perform In Situ Soil Treatment Throughout the Site by Injection of Chemical Reagents to Treat Site Contaminants

Guard Station

MW-4

Gate

Institutional Control: Maintain Existing Fencing and Security Procedures to Restrict Public Access

Institutional Control: Install Warning Signs to Notify Workers of Potential Heath Risks of Site Contaminants Remaining In Place

Commercial Ave

3rd Street

**Legend**

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- Existing Fence
- Existing Asphalt/Concrete Pavement
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- Proposed New Asphalt Pavement
- In Situ Treatment Area
- MW-1 Proposed Compliance Groundwater Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions
- cPAHs = carcinogenic aromatic hydrocarbons
- TEQ = toxic equivalency

N W E S

60 0 60
Feet

**Cleanup Action Alternative 5**
**Site-Wide In Situ Treatment**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 33

P:\5\5147006\CAD\13\Draft Final RI\5147006I3_F33_Cleanup Action Alt 5.dwg TAB:F33 Date Exported: 02/27/20 - 18:34 by hmara

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Google Earth Pro dated 8/2011.

Projection: WA State Plane, North Zone, NAD83, US Foot

**Groundwater Monitoring: Monitor Groundwater Conditions at Each Well Location Over Time to Evaluate Effectiveness of the Cleanup Action and Compliance with Cleanup Standards**

**Removal: Perform Remedial Excavation to Remove Contaminants Using Standard Earthwork Equipment Followed by Site Restoration**

MW-8
MW-1
MW-2B
MW-3A
MW-6
MW-7
MW-4

Syncrolift Pier
Open Cell Bulkhead
Pier 2 Detention Pond
Paint Shed
Shop
Sand Shed
Gate
Guard Station
Guard Station
Gate
Commercial Ave
3rd Street

## Legend

- Dakota Creek Industries (DCI) Property Boundary
- Previous Upland Soil Excavation and Backfill Area (See Figures 3 and 4)
- Previous Marine Area Dredge and Backfill Area (See Figure 5)
- Existing Bulkhead
- Existing Fence
- Area in Which Metals (Arsenic and/or Nickel) in Soil Exceed The Preliminary Cleanup Level
- Area in Which Total cPAH TEQ in Soil Exceed The Preliminary Cleanup Level
- Soil Removal Area
- MW-1 Proposed Compliance Groundwater Monitoring Well Location
- Proposed Soil Sample Location to Verify the Completeness of Previously Completed Soil Removal Actions

cPAHs = carcinogenic aromatic hydrocarbons
TEQ = toxic equivalency

N W E S

60 0 60
Feet

**Cleanup Action Alternative 6**
**Site-Wide Removal**

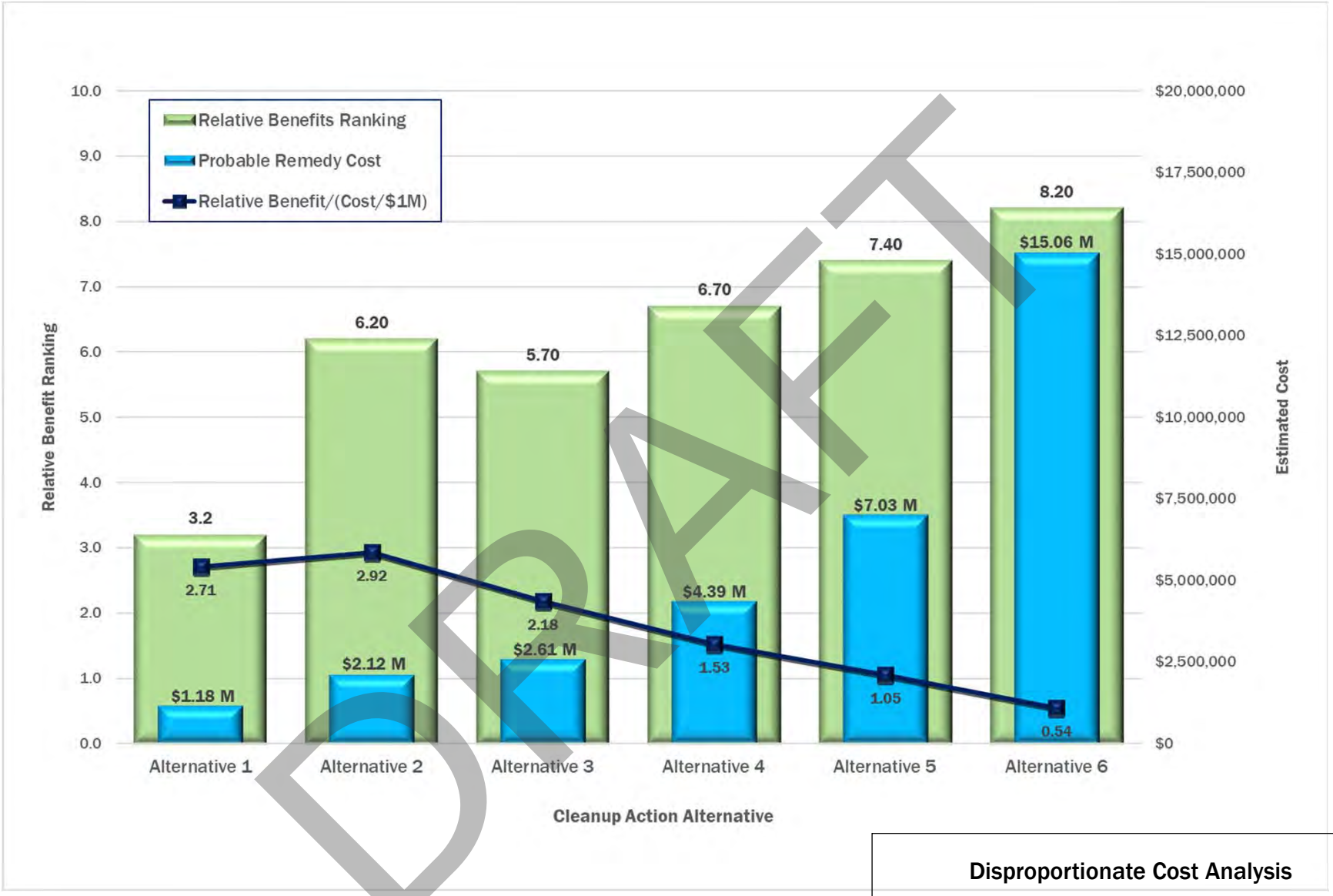
Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 34**



P:\5\5147006\CAD\13\Draft Final RI\5147006l3_F34_Cleanup Action Alt 6.dwg TAB:F34 Date Exported: 02/27/20 - 18:34 by hmara






**Disproportionate Cost Analysis**

Dakota Creek Industries
Anacortes, Washington

GeoEngineers

**Figure 35**

Notes:

1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.