Oakland Bay Sediment Characterization Study, Mason County, Washington

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Abbreviations and Acronyms

CFR  Code of Federal Regulations

cm  centimeter

COC  chain-of-custody

COPC  Constituents of Potential Concern

CRI  color rendering index

CSL  cleanup screening level

DDD  dichlorodiphenyldichloroethane

DDE  dichlorodiphenyldichloroethylene

DDT  dichlorodiphenyltrichloroethane

DGPS  Differential Global Positioning System

DMMP  Dredged Material Management Program

dpm  disintegrations per minute

DQO  data quality objective

EDD  electronic data deliverable

E & E  Ecology and Environment, Inc.

Ecology  Washington State Department of Ecology

ERA  ecological risk assessment

ERI  Electrical resistivity imaging

ft  feet

g  gram

GC/MS  gas chromatography/mass spectroscopy

HCID  hydrocarbon identification

Herrera  Herrera Environmental Consultants, Inc.

HHRA  human-health risk assessment

HPAH  high molecular weight polycyclic aromatic hydrocarbons

in  inch

kg  kilogram

L  liter

LCS  laboratory control sample

LPAH  low molecular weight polycyclic aromatic hydrocarbon

m  meter

MDL  method detection limit

µg  microgram

mg  milligram

MLLW  mean lower low water

MSDS  material safety data sheet

MSMP  Marine Sediment Monitoring Program

MS/MSD  matrix spike / matrix spike duplicate

NAD 83  North American Datum of 1983

nm  nanometer

NWTPH  northwest total petroleum hydrocarbon

OC  organic carbon
oz  ounce
PAH  polycyclic aromatic hydrocarbon
PARCC  precision, accuracy, representativeness, completeness, comparability
PCB  polychlorinated biphenyl
PCP  pentachlorophenol
PE  performance evaluation
ppb  parts per billion
PPE  personal protective equipment
ppt  parts per trillion
PQL  practical quantitation limit
PSDDA  Puget Sound Dredged Disposal Analysis
PSEP  Puget Sound Estuary Program
QA/QC  quality assurance / quality control
RI  Remedial Investigation
RL  reporting limit
RPD  relative percent difference
SAP  Sampling and Analysis Plan
SBP  Sub-Bottom Profiler
SIR  Sediment Investigation Report
SMS  Sediment Management Standards
SOPs  standard operating procedures
SQS  Sediment Quality Standard
ft²  square feet
m²  square meter
SVOC  semi-volatile organic compound
TBT  tributyltin
TCDD  2,3,7,8-tetrachlorodibenzo-p-dioxin
TDL  target detection limit
TEF  toxic equivalent factor
TOC  total organic carbon
TPH  total petroleum hydrocarbons
USEPA  U.S. Environmental Protection Agency
UV  ultraviolet
WAAS  Wide Area Augmentation System
WAC  Washington Administrative Code
WHO  World Health Organization
WWTP  wastewater treatment plant
1.0 Introduction

Oakland Bay is one of seven bays identified as a priority for environmental restoration by the Washington State Department of Ecology (Ecology) as part of the Toxics Cleanup Program’s Puget Sound Initiative. Ecology has identified Oakland Bay for focused investigation related to source control, sediment cleanup and restoration. Ecology initiated this investigation because previous environmental investigations throughout the bay, including the Shelton Harbor area, have documented contamination from historical and current industrial and commercial activities around the bay. Previous sediment quality investigations indicated that contaminant concentrations exceeded Chapter 173-204 Washington Administrative Code (WAC) Sediment Management Standards (SMS). Ecology is directing a sediment characterization investigation, human-health and ecological risk assessments (HHRA and ERA), and a sediment transport study of the bay focusing on the marine sediment environment associated with terrestrial and aquatic contaminant sources. Herrera Environmental Consultants, Inc. (Herrera) developed this Sampling and Analysis Plan (SAP) as a subcontractor to Ecology and Environment, Inc. (E & E) under Ecology’s contract number C0700036 for the purpose of characterizing marine sediment throughout Oakland Bay to support the prioritization of cleanup and restoration actions under the Puget Sound Initiative.

The overall goals for a Puget Sound Initiative baywide study include:

- Determine boundaries where SMS criteria are exceeded.
- Allow relative prioritization of areas for cleanup.
- Provide sufficient physical, chemical, and biological data to identify a range of remedial alternatives that can be considered.

This study will focus on sediment characterization across Oakland Bay. This plan describes the objectives and procedures for data collection efforts to characterize the sediment quality of Oakland Bay. The results of the sediment characterization will be used to assist Ecology in determining whether source control, cleanup, and/or restoration are warranted to minimize actual or potential adverse impacts to people and/or the biotic community. This plan includes the following primary sections:

- Introduction
- Site Background and Objectives
- Organization and Schedule
- Study Design
- Quality Assurance / Quality Control
- Field Procedures
- Laboratory Analytical Methods
- Data Analysis and Reporting

The SAP addresses the major components of Ecology’s Sediment Sampling and Analysis Appendix, Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the
2.0 Site Background and Objectives

Oakland Bay is a shallow estuary located in South Puget Sound, with the City of Shelton and its industrial waterfront and harbor located at the southwest corner of the bay (Figures 2-1 and 2-2). Water depth of the bay ranges between 10 and 35 feet, with shallow and broad intertidal zones exposed during low tides at the north end of the bay and in Shelton Harbor. Due to the restrictive nature of Hammersley Inlet, a long narrow waterway linking the bay to the Puget Sound Basin, the water in Oakland Bay has high refluxing, low flushing, and high retention rates (Ecology 2004b). Eight major freshwater creeks discharge into the bay: Deer, Cranberry, Malaney, Uncle John, Campbell, Johns, Shelton, and Goldsborough. The waters of Shelton Harbor and the northern portions of Oakland Bay are currently listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act because of fecal coliform bacteria levels (Ecology 2004c).

The Shelton waterfront and harbor have been historically and are currently used by a number of timber and wood product manufacturing industries, including saw mills and plywood manufacturing, pulp and paper production, and insulation board and fiber board manufacturing. Over the years, process chemicals and wastewater from wood-product manufacturing processes have either been discharged through onsite industrial stormwater systems or were released due to accidental spills and leaks to the harbor, to Shelton and Goldsborough Creeks, or across upland portions of the waterfront. Discharges and spills of process chemicals and wastewater have included:

- Release of sulfite waste liquor generated from the former Rayonier pulp mill during outgoing tides from the mid-1920s through the early 1930s. It was believed that the release of the liquor to the bay may have been an important factor in declining commercial oyster production in Oakland Bay by the mid-1940s.

- Release of air emission particulates from wood-fired power plants and associated emission stacks operated without air emissions control from Simpson and Rayonier mills along the south shore of Shelton Harbor between the mid-1920s and the late 1950s. Although power plants for the Rayonier pulp mill and burn plant were shut down by 1957, Simpson’s main power plant and its associated stacks continued operating without emission control until 1976, when baghouses were installed.

- Residues from both baghouses were mixed into slurries and discharged to both the former wastewater treatment plant (WWTP) on Pine Street (1976 to 1979) and to the existing plant at Eagle Point (1979 to 1984). WWTP effluent was discharged at two locations immediately beyond the harbor limits. Solids that settled out at each WWTP were disposed of at two public landfills (the Shelton “C Street” Landfill and the Mason County Landfill) and at the Dayton wood waste landfill owned by Simpson. After
1984, all residues generated at the Simpson plant were disposed of at their Dayton wood waste landfill.

- Various chemicals used at a former ITT Rayonier Research Laboratory specializing in cellulose chemistry and silvichemicals produced from wood pulp were discharged to the harbor through the laboratory’s industrial stormwater discharge system from the mid-1930s to the mid-1990s.

- A wood preservative dip tank (location unknown) was referred to in a 1981 Ecology file. A letter stated that approximately 9,400 gallons of dilute Permatox 200 wood preservative was removed and disposed of by spraying it across the Simpson Dayton dry log sort yard. According to a material safety data sheet (MSDS), the preservative contained chlorinated phenols and pentachlorophenol (PCP).

- Residual Bunker C fuel oil releases to soil and groundwater from leaking aboveground storage tanks previously located between Sawmill #3 and Goldsborough Creek were identified in 1991. Limited removal of contaminated soil was conducted; however, residual contamination was left in place along Goldsborough Creek, the railroad tracks, and a metal frame tower.

- Numerous spill incidents reportedly occurred between 1980 and 2004. Most of the reported spills were petroleum products, including hydraulic oil, soluble or biodegradable lube oil, gear oil, and diesel. Other reported spills included polychlorinated biphenyl (PCB)-contaminated oil next to the railroad roundhouse in 1984; resin and veneer wastewater discharged to Shelton Creek in 1987 and 1988; and waste oil contaminated with PCBs adjacent to the plywood plant near Shelton Creek in 1990.

Numerous pilings have been installed in the harbor since the mid-1920s to support over-water railroad spurs used for unloading logs from trains directly into the water, for stabilizing log rafts, and for shoreline bulkheads.

Barges loaded with wood chips used by the pulp mill for processing into pulp, have historically moored in the harbor adjacent to the pulp mill. Logs used in lumber, plywood, and fiber board manufacturing were rafted and stored in the water prior to processing at sawmills and plywood plants from the late 1800s through the late 1960s. By the early 1970s, Simpson shifted its log handling practices from over-water log storage operations to a dry log sort yard located 3 miles west and inland from Shelton. Some log rafting activities have continued in the harbor since the mid-1970s, including the Simpson log truck unloading facility at the north end of the harbor next to the vessel haul-out and marine railway facility, and along the south shore of the harbor adjacent to the Manke log sorting yard. Wood waste is a concern because it can impact aquatic life and sediment quality. Excessive wood waste can lead to anaerobic sediment conditions, leach compounds toxic to aquatic life (e.g., phenols, benzoic acid, and benzyl alcohol), and may not provide an appropriate substrate for benthic organisms.
Figure 2-1. Vicinity map of Oakland Bay in Mason County, Washington.
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Figure 2-2. Site map of Shelton Harbor, Shelton, Washington.
From the early 1900s to late 2005, a bulk fuel storage marine facility operated at the north end of Shelton Harbor (also known as the former Evergreen Fuel site; Figure 2-2). In addition to Evergreen Fuel, three bulk fuel storage marine facilities operated about a half mile northeast of Shelton along the west shore of Oakland Bay (Union Oil, Shell, and ARCO) from the early 1930s to the mid-1980s. No site assessments have been conducted to determine whether petroleum releases have occurred at any of the three bulk fuel facilities.

Tributyltins (TBT), used as an anti-fouling agent on boat bottoms, has been found in sediments collected adjacent to the former Simpson marine railway. The presence of TBT in sediment is likely due to historical and current activities, such as sandblasting, cleaning, and painting of log boom boat bottoms and other boats, conducted in the vicinity of the Shelton Marina.

Shelton Harbor has also received discharges from the city’s former and existing WWTP outfalls; septic systems in various stages of maintenance; from timber industries, commercial businesses, and residential communities; and non-point source runoff from stormwater since the early 1900s. The harbor also receives direct surface water discharge from two freshwater creeks, Shelton and Goldsborough Creeks, both of which flow through and have received industrial stormwater runoff from the Simpson waterfront plant since the early 1940s.

Shellfish harvesting has historically been an important commercial and subsistence activity in Oakland Bay. Commercial shellfish harvesting became an important aquaculture industry starting in the late 1800s. Pollution associated with sulfite waste liquor discharged by the Rayonier pulp mill is believed to have led to declining commercial oyster production by the mid-1940s. Re-populating with oysters and other shellfish in the northern portions of Oakland Bay, including Chapman Cove, and developing a second-generation of shellfish production began in the late 1960s. Over the last 40 years, water quality impacts to Oakland Bay appear to have shifted from industrial effluent to non-point source pollution, including low dissolved oxygen (DO), chlorine from sewage outfalls, sedimentation and siltation, and herbicides. Fecal coliform contamination from excessive infiltration and inflow to the city’s aging sewer and stormwater collection systems, onsite septic systems, and surface water runoff from small farms, has contributed to recent closures of shellfish harvesting in portions of the bay. Fecal coliform contamination is being investigated by other stakeholders and thus is not part of this investigation.

Other sites identified as potential sources of contamination located at a distance from Shelton Harbor and near Oakland Bay or adjacent to creeks that drain into the bay (see Figure 2-1) include:

- Two gasoline service stations operating since the early 1970s, including one station located along SR 3 adjacent to Johns Creek (Bayshore Union 76 gas station) and the other approximately 2,300 feet northeast of the Oakland Bay shoreline (Deer Creek store). Gasoline contamination in soil and groundwater was identified at the Deer Creek station.

- A concrete dip tank that previously contained wood preservatives for treating fence posts was identified at the Calvin J. Moran property
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adjacent to the bay. The concrete tank has reportedly overflowed during periods of heavy rainfall since last used in 1960.

2.1 Previous Investigations

The following sections summarize previous environmental investigations that have been conducted in Shelton Harbor, Oakland Bay, and Hammersley Inlet over the past 20 years. The studies are discussed by general study area (i.e., Shelton Harbor, and Oakland Bay/Hammersley Inlet), then in chronological order based on when the associated sampling activities occurred. Sampling locations from the previous investigations across Shelton Harbor are shown in Figure 2-3; at the Evergreen Fuel, Shelton Yacht Club and Marina, and former Simpson marine railway within Shelton Harbor in Figure 2-4; and in Oakland Bay and Hammersley Inlet in Figure 2-5.

Sediment data generated from these investigations have been evaluated according to the SMS, as will the data generated by the current Oakland Bay Sediment Characterization Study. The SMS 1) establish standards for the quality of surface sediments, 2) establish a process for applying these standards as the basis for management and reduction of pollutant discharges, and 3) provide a management and decision process for the cleanup of contaminated sediments. Sediment chemistry is first evaluated based on threshold criteria that determine the need for further evaluation. Sediment quality standard (SQS) criteria correspond to sediment quality that will result in no acute or chronic adverse effects on biological resources and no significant health risk to humans. If any SQS criteria are exceeded, biological testing (bioassay) is required to determine if adverse biological effects can be measured in test organisms in site sediments. Cleanup screening level (CSL) criteria establish minor adverse effects as the level above which station clusters of potential concern are defined, and at or below which station clusters of low concern are defined. CSL criteria are used to direct sediment cleanup and aid in sediment management decision making.

2.1.1 Shelton Harbor

2.1.1.1  1984-1988 USEPA National Dioxin Study

Between 1984 and 1988, the USEPA conducted a National Dioxin Study to determine the extent of dioxin contamination in the United States and the associated risk to humans and the environment. Simpson volunteered to have their wood-fired power plant tested as part of this study (CH2M Hill 1987). The Simpson power plant was the only wood-fired boiler plant in the area operating at that time. Other wood-fired power plants and associated stacks that previously operated along the south shore of the harbor included the former Rayonier pulp and paper mill; the former Rayonier burn plant above the pulp mill, and the former Simpson/Olympic Plywood plant (Figure 2-3).

In 1986, composite samples composed of five aliquots were collected both from an early former WWTP outfall next to the Evergreen Fuel site and from the existing WWTP outfall east of Eagle