Lower Duwamish Waterway Source Control Action Plan for Glacier Bay Source Control Area

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Lower Duwamish Waterway Source Control Action Plan for Glacier Bay Source Control Area

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Executive Summary

The Lower Duwamish Waterway, located in Seattle, Washington, was added to the National Priorities List (Superfund) by the U.S. Environmental Protection Agency (EPA) on September 13, 2001. Contaminants of concern (COCs) found in waterway sediments include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), mercury and other metals, and phthalates. These COCs may pose threats to people, fish, and wildlife.

In December 2000, EPA and the Washington State Department of Ecology (Ecology) entered into an order with King County, the Port of Seattle, the city of Seattle, and The Boeing Company to perform a Remedial Investigation (RI) and Feasibility Study (FS) of sediment contamination in the waterway. EPA is the lead agency for the RI/FS. Ecology is the lead agency for controlling current sources of pollution to the site, in cooperation with the city of Seattle, King County, the Port of Seattle, the city of Tukwila, and EPA.

Phase 1 of the RI/FS used existing data to identify potential human health and ecological risks, information needs, and high priority areas for cleanup. Seven candidate early action areas (or "Tier 1" sites) were identified. Data collected during Phase 2 of the RI were used to identify additional sites where long-term cleanup actions may be necessary. The Glacier Bay Source Control Area (Glacier Bay) was identified as one of these "Tier 2" sites. A summary of information pertinent to sediment recontamination at Glacier Bay is presented in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007), which serves as the basis for the source control actions described in this Source Control Action Plan (SCAP).

Sections 1 and 2 of this SCAP provide background information about the Lower Duwamish Waterway site and Glacier Bay. Metals (arsenic, mercury, zinc, copper, lead, antimony, tin), dioxins/furans, PCBs, phthalates (bis[2-ethylhexyl]phthalate [BEHP], butylbenzyl phthalate), PAHs, 1,2-dichlorobenzene, pentachlorophenol, benzyl alcohol, and organo-tin compounds are considered to be the major COCs in Glacier Bay sediments. While this SCAP focuses on these COCs, other chemicals that could result in sediment recontamination will be addressed as sources are identified.

Section 3 describes potential sources of contamination that may affect sediments in Glacier Bay, including piped outfalls, spills to the waterway, and releases from adjacent or upland properties; evaluates the significance of these potential sources; and identifies the actions that are planned or underway to control potential contaminant sources. Section 4 discusses monitoring activities that will be conducted to identify additional sources and assess progress. Section 5 describes how source control efforts will be tracked and reported.

Table ES-1 lists the source control actions that have been identified for Glacier Bay. This table includes a brief description of the potential contaminant sources for each property, source control activities to be conducted, parties involved in source control actions for each property or task, and milestone/target dates for completion of the identified action items. The milestones and targets are best case scenarios based on consultation with the identified agencies or facilities. They reflect reasonably achievable schedules, and include the time required for planning, contracting, field work, laboratory analysis, and activities dependent on weather.

A removal action at Glacier Bay was not scheduled at the time this SCAP was prepared.

Table ES-1. Glacier Bay Source Control Actions

Potential Sources	Action Items	Milestones and Parties Involved
Piped Outfalls		
Potential ongoing source: Stormwater discharges from piped outfalls, including the city of Seattle storm drain outfall, may represent an ongoing source of COCs to Glacier Bay. Discharges from private outfalls are addressed below.	Collect inline sediment samples to evaluate whether contaminants are currently being transported to Glacier Bay via this pathway.	SPU – 2007/2008
	If COCs are present in the storm drain line, conduct source tracing to identify sources of contaminants.	SPU – 2008
	Conduct source control inspections of upland sites as needed.	SPU, Ecology – 2007/2008
	Review and update National Pollutant Discharge Elimination System (NPDES) permits as needed.	Ecology-WQ - Ongoing
Alaska Marine Lines		
Potential historic source: Past practices have resulted in soil and groundwater contamination. Cleanup of petroleum-contaminated soils occurred in 1993, however PAHs and dibenzofuran remained in soil at levels of potential concern. The most recent soil and groundwater data were collected in 1994.	Sample groundwater along shoreline to determine whether residual site contaminants are being discharged to Glacier Bay.	AML - 2008
	Confirm location of former USTs that were removed in 1990.	AML - 2007
Potential ongoing source: Concerns were noted during a January 2006 stormwater compliance inspection. Facility operates under Industrial Stormwater General Permit	Conduct follow-up inspection to ensure that concerns/recommendations from January 2006 inspection have been addressed	Ecology – 2007
	Verify that remediation associated with filling of graving dock was completed and all conditions met.	Ecology - 2008
	Oversee and inspect site through Industrial Waste Program	King County – Ongoing
	Continue periodic inspections of this site as needed to ensure compliance with the facility's NPDES permit.	Ecology - Ongoing
Duwamish Shipyard		
Potential historic source: Contaminants have been detected in soil and groundwater and in adjacent waterway sediments, including arsenic, cadmium, copper, mercury, lead, and PAHs.	Negotiate an Agreed Order to address soil and groundwater contamination	Ecology, Duwamish Shipyard – 2007
	Clean out stormwater catch basins and lines, sample solids, and report results. Cleanout and sampling were conducted during July/August 2007; report to Ecology is expected November 2007.	Duwamish Shipyard – November 2007
	Prepare work plans for further site investigations as specified in the Agreed Order	Duwamish Shipyard – 2007
	Conduct site investigations as specified in the Agreed Order Statement of Work	Duwamish Shipyard – 2007/2008
	Review site investigation results and assess potential for sediment recontamination and need for remedial actions	Ecology – 2008/2009

Table ES-1. Glacier Bay Source Control Actions (Continued)

Potential Sources	Action Items	Milestones and Parties Involved
Potential ongoing source: Decommissioning and site investigation/remediation activities may result in transport of contaminants to waterway if appropriate precautions are not taken.	Continue to oversee and inspect this site through Industrial Waste Program	KCIW – Ongoing
	Continue periodic inspections of this site as needed to ensure compliance with the facility's NPDES permit.	Ecology - Ongoing
Glacier Northwest		
Potential historic source: Data collected in 1990 indicates the presence of contaminants of concern in soil and groundwater. Sediment samples collected in 2005 and 2007 from locations near the site contained high levels of dioxins and furans as well as a variety of other contaminants above the Sediment Quality Standards.	Direct current and/or previous property owners/operators to conduct site characterization investigations.	Ecology – 2007
	Prepare work plans for site investigations as specified by Ecology.	Property owner /operator – 2007
	Upon approval of work plans by Ecology, conduct site investigations as specified.	Property owner/operator – 2007/2008
	Review site investigation results and assess potential for sediment recontamination and need for remedial actions	Ecology – 2008/2009
Potential ongoing source: The nature of current activities at the site, and the potential for sediment recontamination from these activities, cannot be determined based on available information.	Conduct a site inspection to evaluate current operations with respect to stormwater and waste management.	Ecology, SPU – 2007
	Verify the storm drainage pathway at the site; if stormwater to the Lower Duwamish Waterway is confirmed, assess the need for stormwater characterization.	SPU, Ecology – 2007
	Conduct periodic source control inspections as needed to verify that current operations do not result in release of contaminants to the Lower Duwamish Waterway.	SPU, Ecology - Ongoing
Former MRI Corporation		
Potential historic source: Past operations at the site, including the presence of unlined lagoons, indicate a potential for contamination of soil and groundwater with metals including tin and zinc, however few samples have been collected. Three soil samples collected in 1997 indicated MTCA exceedances for chromium and lead; no groundwater samples have been collected.	Pursue further investigation of the potential for groundwater transport of contaminants to Glacier Bay or to storm drain lines which discharge to Glacier Bay. Review results and, if the potential for contamination of sediments is confirmed, determine whether remedial action is required.	Ecology – 2008
Potential ongoing source: Available information indicates that the most recent site tenant is Polar Supply, however this could not be confirmed. Current site operations are unknown.	Conduct a site inspection to evaluate current operations at the site with respect to stormwater and waste management.	Ecology, SPU – 2007
	Verify the storm drainage pathway at the site; if stormwater to the Lower Duwamish Waterway is confirmed, assess the need for stormwater characterization.	SPU, Ecology – 2007
	Conduct periodic source control inspections as needed.	SPU, Ecology - Ongoing

Table ES-1. Glacier Bay Source Control Actions (Continued)

Potential Sources	Action Items	Milestones and Parties Involved
Other Upland Sites		
Potential ongoing sources: The Chemithon Corporation has recently indicated that it plans to discharge stormwater to the Lower Duwamish Waterway. Catch basin sediment samples indicate the presence of several chemicals above screening criteria, including PCBs, PAHs, phthalates, methylphenolic compounds, metals, and petroleum hydrocarbons.	Prepare and/or update Stormwater Pollution Prevention Plan (SWPP) and processes to ensure that site activities do not result in transport of contaminants to the Lower Duwamish Waterway.	Chemithon – 2007
	Conduct follow-up inspections and sampling of Chemithon site as needed.	Ecology, SPU – 2007
	Conduct source control inspections at upland properties as needed to promote pollution prevention practices.	Ecology, SPU – Ongoing/as needed
Atmospheric Deposition		
Localized or widely dispersed air pollutants may be deposited within the Glacier Bay drainage basin and contribute to contaminant concentrations in stormwater that discharges to the Glacier Bay Source Control Area.	Evaluate atmospheric deposition to assess whether this pathway is a potential source of phthalates and other contaminants, such as PCBs, in stormwater runoff at Glacier Bay.	Not Scheduled

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Acronyms/Abbreviations

AST	aboveground storage tank
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BMP	best management practice
BTEX	benzene, ethylbenzene, toluene, and xylenes
COC	contaminant of concern
CSCSL	Confirmed and Suspected Contaminated Sites List
CSL	Cleanup Screening Level
CSO	combined sewer overflow
DW	dry weight
EAA	Early Action Area
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
FS	Feasibility Study
KCIW	King County Industrial Waste
LDWG	Lower Duwamish Waterway Group
MCL	Maximum Contaminant Level
MTCA	Washington State Model Toxics Control Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OC	organic carbon
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PSCAA	Puget Sound Clean Air Agency
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SAIC	Science Applications International Corporation
SCAP	Source Control Action Plan
SCWG	Source Control Work Group
SD	storm drain
SIC	standard industrial classification
SKCPH	Seattle-King County Public Health
SMS	Sediment Management Standards
SPU	Seattle Public Utilities
SQS	Sediment Quality Standards
SVOC	semivolatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxic Characteristics Leaching Procedure
TEQ	Toxic Equivalency Quotient
TOC	total organic carbon
TOX	total organic halogens
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSS	total suspended solids

Acronyms/Abbreviations (Cont'd)

USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound
WPCC	Washington Pollution Control Commission
WQC	Water Quality Criteria
WQS	Water Quality Standards
WSDOT	Washington State Department of Transportation

1.0 Introduction

This Source Control Action Plan (SCAP) describes potential sources of contamination that may affect sediments in and adjacent to the Glacier Bay Source Control Area (Glacier Bay).[1] The purpose of this plan is to evaluate the significance of these sources and to determine if actions are needed to minimize the potential for recontamination of Glacier Bay sediments after cleanup. In addition, this SCAP describes:

- Source control actions/programs that are planned or currently underway,
- Sampling and monitoring activities that will be conducted to identify additional sources and assess progress, and
- How these source control efforts will be tracked and reported.

The information in this document was obtained from a variety of sources, including the following documents:

- *Lower Duwamish Waterway, Glacier Bay Source Control Area, Summary of Existing Information and Identification of Data Gaps*, Science Applications International Corporation (SAIC), June 2007, located on Ecology's website: http://www.ecy.wa.gov/programs/tcp/sites/lower_duwamish/sites/glacier_bay/glacier_bay.htm.
- *Lower Duwamish Waterway Source Control Strategy*, Washington State Department of Ecology, January 2004, located on Ecology's website: http://www.ecy.wa.gov/pubs/0409043.pdf

1.1 Organization of Document

Section 1 of this SCAP describes the Lower Duwamish Waterway site, the strategy for source control, and the responsibilities of the public agencies involved in source control for the Lower Duwamish Waterway. Section 2 provides background information on Glacier Bay, including a description of the contaminants of concern (COCs) for sediments. Section 3 provides an overview of potential sources of contaminants that may affect Glacier Bay sediments, including piped outfalls, spills, properties adjacent to Glacier Bay, and upland properties. Section 3 also describes actions planned or currently underway to control potential sources of contaminants, while Sections 4 and 5 describe monitoring and tracking/reporting activities, respectively. References are listed in Section 6, and Figures are presented at the end of the document.

As new information about the sites and potential sources discussed in this document becomes available and as source control progress is made, Ecology will update this SCAP by appending Technical Memoranda to the original SCAP as appropriate.

[1] This SCAP incorporates data published through October 31, 2007. Section 6, Tracking and Reporting of Source Control Activities, describes how newer data will be disseminated.

1.2 Lower Duwamish Waterway Site

The Lower Duwamish Waterway is the downstream portion of the Duwamish River, extending from the southern tip of Harbor Island to just south of Turning Basin 3 (Figure 1). It is a major shipping route for bulk and containerized cargo. Most of the upland areas adjacent to the Lower Duwamish Waterway have been developed for industrial and commercial operations. These include cargo handling and storage, marine construction, boat manufacturing, marina operations, concrete manufacturing, paper and metals fabrication, food processing, and airplane parts manufacturing. In addition to industry, the river is used for fishing, recreation, and wildlife habitat. Residential areas near the waterway include the South Park and Georgetown neighborhoods. Beginning in 1913, this portion of the Duwamish River was dredged and straightened to promote navigation and industrial development, resulting in the river's current form. Shoreline features within the waterway include constructed bulkheads, piers, wharves, buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (Weston 1999). This development left intertidal habitats dispersed in relatively small patches, with the exception of Kellogg Island, which is the largest contiguous area of intertidal habitat remaining in the Duwamish River (Tanner 1991). Over the past 20 years, public agencies and volunteer organizations have worked to restore intertidal and subtidal habitat to the river. Some of the largest restoration projects are at Herring House Park/Terminal 107, Turning Basin 3, Hamm Creek, and Terminal 105.

The presence of chemical contamination in the Lower Duwamish Waterway has been recognized since the 1970s (Windward 2003a). In 1988, the United States Environmental Protection Agency (EPA) investigated sediments in the Lower Duwamish Waterway as part of the Elliott Bay Action Program. Problem chemicals identified by the EPA study included metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), phthalates, and other organic compounds. In 1999, EPA completed a study of approximately 6 miles of the waterway, from the southern tip of Harbor Island to just south of the turning basin near the Norfolk combined sewer overflow (Weston 1999). This study confirmed the presence of PCBs, PAHs, phthalates, mercury, and other metals. These contaminants may pose threats to people, fish, and wildlife.

In December 2000, EPA and the Washington State Department of Ecology (Ecology) signed an agreement with King County, the Port of Seattle, the city of Seattle, and The Boeing Company, collectively known as the Lower Duwamish Waterway Group (LDWG). Under the agreement, the LDWG is conducting a Remedial Investigation (RI) and Feasibility Study (FS) of the Lower Duwamish Waterway to assess potential risks to human health and the environment and to evaluate cleanup alternatives. The RI for the site is being done in two phases. Results of Phase 1 were published in July 2003 (Windward 2003a). The Phase 1 RI used existing data to provide an understanding of the nature and extent of chemical distributions in Lower Duwamish Waterway sediments, develop preliminary risk estimates, and identify candidates for early cleanup action. The Phase 2 RI is currently underway and is designed to fill critical data gaps identified in Phase 1. Based on the results of the Phase 2 RI, additional areas for cleanup may be identified. During Phase 2, a Feasibility Study is being conducted that will address cleanup options for contaminated sediments in the Lower Duwamish Waterway.

On September 13, 2001, EPA added the Lower Duwamish Waterway to the National Priorities List. This is EPA's list of hazardous waste sites that warrant further investigation

and cleanup under Superfund. Ecology added the site to the Washington State Hazardous Sites List on February 26, 2002.

An interagency Memorandum of Understanding, signed by EPA and Ecology in April 2002 and updated in April 2004, divides responsibilities for the site (EPA and Ecology 2002, EPA and Ecology 2004). EPA is the lead for the RI/FS, while Ecology is the lead for source control issues.

In June 2003, the *Technical Memorandum: Data Analysis and Candidate Site Identification* (Windward 2003b) was issued. Seven candidate sites for early action (Early Action Areas [EAAs], or "Tier 1" sites) were recommended (Figure 1). The sites are:

- Area 1: Duwamish/Diagonal combined sewer overflow (CSO) and storm drain (SD)
- Area 2: West side of the waterway, just south of the First Avenue S. Bridge, approximately 2.2 miles from the south end of Harbor Island
- Area 3: Slip 4, approximately 2.8 miles from the south end of Harbor Island
- Area 4: South of Slip 4, on the east side of the waterway, just offshore of the Boeing Plant 2 and Jorgensen Forge properties, approximately 2.9 to 3.7 miles from the south end of Harbor Island
- Area 5: Terminal 117 and adjacent properties, approximately 3.6 miles from the south end of Harbor Island, on the west side of the waterway
- Area 6: East side of the waterway, approximately 3.8 miles from the south end of Harbor Island
- Area 7: Norfolk CSO/SD, on the east side of the waterway, approximately 4.9 to 5.5 miles from the south end of Harbor Island

Of the seven recommended EAAs, five either had sponsors to begin investigations or were already under investigation by a member or group of members of the LDWG. These five sites are: Slip 4, Terminal 117, Boeing Plant 2, Duwamish/Diagonal CSO/SD, and Norfolk CSO/SD. EPA is the lead for managing cleanup at Terminal 117 and Slip 4. The other three early action cleanup projects were begun before the current Lower Duwamish Waterway RI/FS was initiated. Cleanup at Boeing Plant 2, under EPA Resource Conservation and Recovery Act (RCRA) management, is currently in the planning stage. The Duwamish/Diagonal and Norfolk CSO/SD cleanups are under King County management as part of the Elliott Bay-Duwamish Restoration Program. Cleanup at Duwamish/Diagonal was partially completed in March 2004; a partial sediment cleanup was conducted at Norfolk CSO/SD in 1999. Early action cleanups may involve members of the LDWG or other parties as appropriate. Planning and implementation of early action cleanups is being conducted concurrently with the Phase 2 investigation.

Data collected during Phase 2 of the RI is being used to identify additional sites where long-term cleanup actions may be necessary. Some of the tentative "Tier 2" sites coincide with Potential Priority Areas as defined in the *Draft Preliminary Screening of Alternatives for the Lower Duwamish Waterway Superfund Site* (RETEC 2006). The draft memorandum, dated September 27, 2006, identified potentially actionable areas within the Lower Duwamish Waterway for which remedial alternatives were to be developed. The Glacier Bay Source Control Area encompasses Potential Priority Areas 3, 4, and 5 as described in that document.

The tentative Tier 2 Areas (T2As) are shown on Figure 2.

Further information about the Lower Duwamish Waterway can be found at:
http://yosemite.epa.gov/r10/cleanup.nsf/sites/lduwamish and
http://www.ecy.wa.gov/programs/tcp/sites/lower_duwamish/lower_duwamish_hp.html.

1.3 Lower Duwamish Waterway Source Control Strategy

The Lower Duwamish Waterway Source Control Strategy (Ecology 2004) describes the process for identifying source control issues and implementing effective source controls for the Lower Duwamish Waterway. The basic plan is to identify and manage sources of potential contamination and recontamination in coordination with sediment cleanups. The goal of the strategy is to minimize the potential for recontamination of sediments to levels exceeding the Lower Duwamish Waterway sediment cleanup goals and the Sediment Management Standards (WAC 173-204). Existing administrative and legal authorities will be used to perform inspections and require necessary source control actions.

The strategy is being implemented through the development of a series of detailed, area-specific SCAPs that will be coordinated with sediment cleanups, beginning with the EAAs. Each SCAP will document what is known about the area, the potential sources of recontamination, actions taken to address them, and how to determine when adequate source control is achieved for an area. Because the scope of source control for each site will vary, it will be necessary to adapt each plan to the specific situation at that site. The success of this strategy depends on the coordination and cooperation of all public agencies with responsibility for source control in the Lower Duwamish Waterway area, as well as prompt compliance by the businesses that must make necessary changes to control releases from their properties.

The source control strategy focuses on controlling contamination that affects Lower Duwamish Waterway sediments. It is based on the principles of source control for sediment sites described in EPA's *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites; February 12, 2002* (EPA 2002), and Ecology's Sediment Management Standards (WAC 173-204). The first principle is to control sources early, starting with identifying all ongoing sources of contaminants to the site. EPA's Record of Decision (ROD) for the site will require that sources of sediment contamination to the entire site be evaluated, investigated, and controlled as necessary. Dividing source control work into specific SCAPs and prioritizing those plans to coordinate with sediment cleanups will address the guidance and regulations and will be consistent with the selected remedial actions in the EPA ROD.

Source control priorities are divided into four tiers. Tier 1 consists of source control actions associated with the EAAs identified to date. Tier 2 consists of source control actions associated with any final, long-term sediment cleanup actions identified through the Phase 2 RI and the EPA ROD. Tier 3 consists of source identification and potential source control actions in areas of the waterway that are not identified for cleanup, but where source control may be needed to prevent future contamination. Tier 4 consists of source control work identified by post-cleanup sediment monitoring (Ecology 2004). This document is a SCAP for a Tier 2 Source Control Area.

Further information about the Lower Duwamish Waterway Source Control Strategy can be found at: http://www.ecy.wa.gov/biblio/0409052.html and http://www.ecy.wa.gov/programs/tcp/sites/lower_duwamish/lower_duwamish_hp.html.

1.4 Source Control Work Group

The primary public agencies responsible for source control for the Lower Duwamish Waterway are Ecology, the city of Seattle, King County, Port of Seattle, city of Tukwila, and EPA. Because the city of Tukwila has no jurisdiction over the areas that drain to Glacier Bay, they are not directly involved in source control activities for the Glacier Bay Source Control Area.

In order to coordinate among these agencies, Ecology formed the Source Control Work Group (SCWG) in January 2002. The purpose of the SCWG is to share information, discuss strategy, actively participate in developing SCAPs, jointly implement source control measures, and share progress reports on source control activities for the Lower Duwamish Waterway area. The monthly SCWG meetings are chaired by Ecology. All final decisions on source control actions and completeness will be made by Ecology, in consultation with EPA, as outlined in the April 2004 Ecology/EPA Lower Duwamish Waterway Memorandum of Understanding (EPA and Ecology 2004).

Other public agencies with relevant source control responsibilities include the Washington State Department of Transportation, Puget Sound Clean Air Agency, and the Seattle/King County Department of Public Health. These agencies are invited to participate in source control with the SCWG as appropriate (Ecology 2004).

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2.0 Glacier Bay Source Control Area

The Glacier Bay Source Control Area is located along the western side of the Lower Duwamish Waterway Superfund Site between 1.2 and 1.6 miles from the southern end of Harbor Island (TT2A 3, 4, & 5 as shown in Figure 2). Sediments in the Glacier Bay Source Control Area have accumulated chemical contaminants from numerous sources, both historical and potentially ongoing. These chemicals may have entered the Lower Duwamish Waterway through direct discharges, spills, bank erosion, groundwater discharges, surface water runoff, atmospheric deposition, or other non-point source discharges.

In the late 1800s and early 1900s, extensive topographic modifications were made to the Duwamish River to create a straightened channel; many of the current side slips are remnants of old river meanders. The Glacier Bay triangle appears to be one of these (Booth and Herman 1998). Dredged material was likely used to fill in the area south of Glacier Bay.

The upland areas adjacent to Glacier Bay and the Lower Duwamish Waterway have been industrialized for many decades. Historical and current commercial and industrial operations in the vicinity of Glacier Bay include cargo handling and storage, vessel repair and maintenance, concrete manufacturing, lumber milling, charcoal production, manufacture of glues and resins, and tin reclamation.

Three properties are located directly adjacent to the Glacier Bay Source Control Area (Figure 3). From north to south, these properties are: Alaska Marine Lines, Duwamish Shipyard, Inc. (Duwamish Shipyard), and Glacier Northwest, Inc. (Glacier Northwest). To the north of these properties are Chemithon and Lafarge Corporation, and to the south is Port of Seattle Terminal 115, including the former MRI Corporation, which leased the northwestern portion of Terminal 115. To the west of these properties is West Marginal Way SW; across this roadway to the west is additional property owned by Alaska Marine Lines as well as green space owned by the city of Seattle Parks Department and several privately-owned parcels.

Groundwater in the Duwamish Valley is typically encountered within about 10 feet of the ground surface and under unconfined conditions (Windward 2003a). The general direction of groundwater flow is toward the Lower Duwamish Waterway, although the direction may vary locally depending on the nature of the subsurface material, and temporally, based on proximity to the waterway and the influence of tidal action. Numerous private outfalls are present along the shoreline in this area.

2.1 Contaminants of Concern

Several environmental investigations have included the collection of sediment data near Glacier Bay, including a National Oceanic and Atmospheric Administration (NOAA) sediment characterization of the Duwamish River (NOAA 1998), an EPA Site Inspection (Weston 1999), and the Lower Duwamish Waterway Phase 2 RI (Windward 2005a, 2005b, 2007).

Sediment data are detailed in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007). Chemical data were compared to the Washington State Sediment Management Standards (SMS), which include both the Sediment Quality Standards (SQS)

and Cleanup Screening Levels (CSLs) (WAC 173-204). Sediments that meet the SQS criteria have a low likelihood of adverse effects on sediment-dwelling biological resources. However, an exceedance of the SQS numerical criteria does not necessarily indicate adverse effects or toxicity, and the degree of SQS exceedance does not correspond to the level of sediment toxicity. The CSL is defined as the maximum chemical concentration and level of biological effects permissible at a cleanup site, to be achieved by year 10 after cleanup has been completed. The CSL is greater than or equal to the SQS and represents a higher level of risk to benthic organisms than SQS levels. The SQS and CSL values provide a basis for identifying sediments that may pose a risk to some ecological receptors. The SMS for most organic chemicals are based on total organic carbon (OC)-normalized concentrations.

As described in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007), surveys conducted during 1998 and 1999 included collection of surface sediment samples at 13 locations within the Glacier Bay Source Control Area. More recently, sediment sampling conducted as part of the Phase 2 RI included 15 surface sediment samples collected during two rounds of sampling in 2005 and 21 samples collected from five coring locations in 2006. Sediment sampling locations are shown in Figure 4.

Based on the results of sediment sampling conducted near Glacier Bay, contaminants of concern (COCs) were identified. Chemicals that exceeded the SQS in at least one surface or subsurface sediment sample offshore of the Glacier Bay Source Control Area are considered COCs. In addition, although no sediment quality standards have been promulgated, dioxins and furans are considered to be COCs at Glacier Bay due to their presence in high concentrations, particularly within the Glacier Bay triangle (offshore of Glacier Northwest). In addition, the presence of organo-tin compounds at various locations, particularly offshore of Alaska Marine Lines and Duwamish Shipyard, warrant their inclusion as COCs.

The following chemicals are considered to be COCs at Glacier Bay with regard to potential sediment recontamination:

Metals	**Organics**
Arsenic	Dioxins/furans
Mercury	PCBs
Zinc	Phthalates (BEHP, butyl benzyl phthalate)
Copper	PAHs
Lead	1,2-Dichlorobenzene
Antimony	Pentachlorophenol
Tin	Benzyl alcohol
	Organo-tin compounds

2.1.1 Metals

In general, the areas adjacent to Duwamish Shipyard had the highest concentrations of metals and the highest SQS exceedances, particularly at sample location SS48. Arsenic at this location was detected at 807 mg/kg dry weight (DW), which exceeded the SQS by a factor of 14. Samples from subsurface sediment locations SC26 and SC28 similarly contained the

highest metals concentrations, particularly arsenic (67 to 1,890 mg/kg DW with exceedance factors of 1.2 to 33) and mercury (0.69 to 4.3 mg/kg DW with exceedance factors of 1.7 to 11). Other SQS exceedances for metals were found adjacent to Alaska Marine Lines (arsenic, copper, zinc) and Glacier Northwest (zinc). In general, greater exceedances are associated with the deeper intervals (5 feet or more in depth) from each core. In addition, elevated levels of inorganic tin (4 to 137 mg/kg) were detected at various locations, with the highest concentration detected at location 690, along the southeastern edge of the Glacier Bay triangle (Figure 4).

2.1.2 PAHs

All SQS exceedances for PAHs were detected in sediment samples collected adjacent to the Duwamish Shipyard property. Exceedances were relatively minor, except for fluoranthene which was detected in surface sediment sample 686 (DR120) at 14 mg/kg DW (504 mg/kg OC) and in subsurface sediment sample SC26 at 10 mg/kg DW (532 mg/kg OC). Both samples exceeded the SQS for fluoranthene by a factor of 3.3. The subsurface sediment sample from SC26 (6 to 8 feet) exceeded the SQS for a majority of the PAH compounds analyzed.

2.1.3 Phthalates

Phthalates were detected at concentrations above the SQS in surface and subsurface sediments near Alaska Marine Lines, Duwamish Shipyard, and Glacier Northwest. Exceedance factors ranged from 1.1 to 4.3, with the highest SQS exceedances at subsurface sample location SC26 (BEHP at 3.8 mg/kg DW, 202 mg/kg OC) and surface sample location 692 (DR 126; butyl benzyl phthalate at 0.46 mg/kg DW, 15 mg/kg OC).

2.1.4 PCBs

PCBs in surface sediments were highest in samples adjacent to Glacier Northwest, with concentrations to 0.81 mg/kg DW and 66 mg/kg OC, which exceeded the SQS value by a factor of 5.5. In subsurface sediments, however, SQS exceedances for PCBs were observed adjacent to Duwamish Shipyard (locations SC26 and SC28, with concentrations to 3.2 mg/kg DW [199 mg/kg OC] and exceedance factors of 1.3 to 17) and Alaska Marine Lines (locations SC24 and SC25, with concentrations to 0.8 mg/kg DW [49 mg/kg OC] and exceedance factors of 1.2 to 4.1).

2.1.5 Other SVOCs

Pentachlorophenol was detected in surface sediment near Glacier Northwest (location SSB4a) at 0.41 mg/kg DW, slightly above the SQS value. Pentachlorophenol in subsurface sediment was detected above SQS values at locations SC26 and SC28, near Duwamish Shipyard (0.41 to 0.8 mg/kg). In addition, 1,2-dichlorobenzene and benzyl alcohol were detected in subsurface sediment adjacent to Duwamish Shipyard at levels above the SQS values.

2.1.6 Organo-tin Compounds

Monobutyltin, dibutyltin, tributyltin, and tetrabutyltin were detected in sediments along the Glacier Bay Source Control Area shoreline. Concentrations of tributyltin ranged from 0.14 to

3.0 mg/kg DW; the highest concentration was detected at location SS46, offshore of Alaska Marine Lines. This was also the highest tributyltin concentration detected anywhere in the Lower Duwamish Waterway (Windward 2005b).

2.1.7 Dioxins/Furans

Concentrations of dioxins/furans detected during the Phase II RI were higher in the vicinity of the Glacier Bay Source Control Area than at any other location within the Lower Duwamish Waterway (Windward 2005b). Mammalian dioxin/furan toxic equivalency quotients (TEQs) ranged from 17 to 2,080 ng/kg DW. The highest concentrations of dioxins/furans were detected at location SS56, SS57, and SS58, all adjacent to the Glacier Northwest property.

3.0 Potential Sources of Sediment Recontamination

Chemicals in Glacier Bay sediments may have entered the waterway through direct discharges, bank erosion, groundwater discharges, surface water runoff, spills, and other non-point discharges associated with historical and potentially ongoing sources. This section discusses current and historical land uses and the results of environmental investigations on properties adjacent to or discharging to the Glacier Bay Source Control Area (Figure 3).

Piped outfalls may be a source of contaminants to Glacier Bay sediments. One public and numerous private outfalls discharge to the area of interest (Figure 5); these are discussed in Section 3.1 below.

Adjacent properties may contribute contamination to Glacier Bay through discharge of contaminated groundwater to the waterway, by soil erosion from the banks of the waterway, by surface runoff, by direct release from outfall pipes, or as a result of spills. If COCs from an adjacent site reach the waterway, they could recontaminate Glacier Bay sediments. The three adjacent properties (Alaska Marine Lines, Duwamish Shipyard, and Glacier Northwest) are described in Sections 3.2 to 3.4.

Upland properties may also be a source of contaminants to Glacier Bay sediments. Potential pathways include discharges to piped outfalls, discharge of contaminated groundwater to the waterway, or infiltration of contaminated groundwater into a stormwater system that discharges to the waterway. Upland properties are described in Sections 3.5 through 3.7.

Adjacent and upland properties are shown in Figure 6.

Air pollution can enter the Lower Duwamish Waterway directly or through stormwater, thus becoming a possible source of sediment contamination to Glacier Bay. Atmospheric deposition is discussed in Section 3.8.

3.1 Piped Outfalls

The Lower Duwamish Waterway area is served by a combination of separated storm drain and sanitary sewer, and combined sewer systems. Storm drains convey stormwater runoff collected from streets, parking lots, roof drains, and residential, commercial, and industrial properties to the waterway. In the Lower Duwamish Waterway, there are both public and private storm drain systems. Most of the waterfront properties are served by privately owned systems that discharge directly to the waterway. The other upland areas are served by a combination of private and publicly owned systems.

Storm drains entering the Lower Duwamish Waterway carry runoff generated by rain and snow. A wide range of chemicals may become dissolved or suspended in runoff as rainwater flows over the land. Urban areas may accumulate particulates, dust, oil, asphalt, rust, rubber, metals, pesticides, detergents, or other materials as a result of urban activities. These can be flushed into storm drains during wet weather. Storm drains can also convey materials from businesses with permitted discharges (i.e., National Pollutant Discharge Elimination System [NPDES] industrial stormwater permits), vehicle washing, runoff from landscaped areas, erosion of contaminated soil, groundwater infiltration, and materials illegally dumped into the system.

The sanitary sewer system collects municipal and industrial wastewater from throughout the Lower Duwamish Waterway area and conveys it to King County's West Point wastewater treatment plant, where it is treated before being discharged to Puget Sound. The smaller trunk sewer lines, which collect wastewater from individual properties, are owned and operated by the individual municipalities (e.g., cities of Seattle and Tukwila) and local sewer districts. The large interceptor system that collects wastewater from the trunk lines is owned and operated by King County. A King County interceptor extends along the east side of West Marginal Way SW, adjacent to the west side of the Glacier Bay upland properties (Figure 5).

Some areas of the Lower Duwamish Waterway are also served by combined sewer systems, which carry both stormwater and municipal/industrial wastewater in a single pipe. These systems were generally constructed before about 1970 because it was less expensive to install a single system rather than separate storm and sanitary systems. During large storm events, the volume of stormwater can sometimes exceed the capacity of the combined sewer system. The collection system designed for the West Point treatment plant contains relief points called combined sewer overflows (CSOs) to control the amount of combined sewage and stormwater that could enter the system and especially the Elliott Bay Interceptor. The CSOs prevent the combined system from backing up and creating flooding problems. During large storm events, these CSOs release a mixture of stormwater and sanitary sewage to the waterway. There are no CSOs discharging to Glacier Bay.

According to the city of Seattle's 2004 Comprehensive Drainage Plan, the Glacier Bay area is served by a partially separated drainage system, which means that the area is served by both separated storm drains and combined sewers (SPU 2005).

One city of Seattle storm drain outfall is located at the southeast corner of the Glacier Bay triangle (Figure 5). Lateral storm drain lines connect several of the surrounding facilities to the main north-south line; however, the extent of the area draining to the Glacier Bay outfall could not be identified at the time this document was written. Storm drainage from Port of Seattle (Terminal 117), Glacier Northwest, Duwamish Shipyard, Alaska Marine Lines, and properties to the west of West Marginal Way SW appear to flow toward this outfall (Figure 5).

Private outfalls to the Lower Duwamish Waterway are identified at Duwamish Shipyard, the Alaska Marine Lines graving dock, and along Glacier Northwest property (Figure 3). These are described in more detail in Sections 3.2 to 3.4 below.

3.1.1 NPDES Permits

In 2003, the city of Seattle conducted a comprehensive survey of outfall or outfall-like structures terminating in the Lower Duwamish Waterway. The survey identified 227 outfalls or structures. Forty-two of the structures are publicly-owned outfalls (city, county, Port of Seattle, Washington State Department of Transportation [WSDOT]), 101 were identified as privately owned outfalls, and 84 were listed as "unknown." Many of these discharges are permitted under the NPDES. There are six types of NPDES permits covering the Lower Duwamish Waterway:

Phase I Municipal Stormwater Permit

Stormwater runoff collected in municipal separate storm sewers and discharged to surface waters is required to have a NPDES permit under the federal Clean Water Act. Phase I of the municipal stormwater program went into effect in 1990 and applies to municipalities with populations of more than 100,000, including the city of Seattle.

The original Phase I permit was issued in 1995; it was reissued on January 17, 2007. The new permit represents a significant shift in approach to stormwater monitoring. Monitoring in the new permit is required for both whole water and in-line stormwater solids, to be collected during wet and dry seasons. Contaminants to be monitored include the State's SMS list, as well as toxicity testing for whole water effluent and receiving sediments. The permit requires all permittees to monitor one stormwater drainage/outfall representing one of each type of land use: residential, commercial, industrial. Complete monitoring requirements are in Special Condition S.8 of the permit which is available on-line at: http://www.ecy.wa.gov/programs/wq/stormwater/municipal/phase_I_permit/ph_i-permit.html.

In addition to the expanded monitoring described above, the Phase I permit also contains more traditional requirements such as system maintenance, business inspections, education/outreach, best management practices (BMPs), and the development of municipal stormwater regulations/code.

Before this permit was reissued and as the Superfund sediment RI process was beginning, the city of Seattle and King County formed a joint program to conduct the source control inspection process throughout the 20,000 acres of the Lower Duwamish Waterway drainage basin. The City's source control authorities come from the City Stormwater, Grading, and Drainage Control Code (SMC 22.800), which was established in part to meet the requirements of its NPDES municipal stormwater permit. King County's source control authorities stem from their authorized pretreatment program and attendant industrial and hazardous waste management programs as well as from the Phase 1 NPDES requirements.

The joint Lower Duwamish Waterway city-county source control program initiated in 2003 is an aggressive effort to reduce the amount of pollution entering public storm drains and sanitary/combined sewer systems that discharge to the Lower Duwamish Waterway. Lower Duwamish source control activities generally go beyond what is required under the NPDES program. In particular, the level of source tracing and characterization being conducted through the joint program far exceeds what is required by NPDES.

Phase II Municipal Stormwater Permit

This permit includes any city of Tukwila outfall. Glacier Bay is not located within the city of Tukwila.

Industrial Stormwater General Permit

This permit covers 112 industries within the natural drainage basin of the Lower Duwamish Waterway. Coverage under the Industrial Stormwater General Permit requires a facility to monitor its stormwater discharge for copper, zinc, oils, and total suspended solids. The

permit covers Alaska Marine Lines (SO3-001365) and The Chemithon Corporation (SO3-000033) within the Glacier Bay Source Control Area.

Sand & Gravel General Permit

This permit provides coverage for discharges of process water, stormwater, and mine dewatering water associated with sand and gravel operations, rock quarries, and similar mining activities, including stockpiles of mined materials, concrete batch operations, and hot mix asphalt operations. The Sand & Gravel Permit generally requires a facility to monitor for pH, turbidity, total suspended solids, total dissolved solids, temperature, oils, and flow rate. Glacier Northwest previously operated under the Sand & Gravel General Permit. Currently, there are no facilities in the Glacier Bay Source Control Area which are covered under this permit.

Boatyard General Permit

This permit covers a commercial business engaged in the construction, repair, and maintenance of small vessels, 85 percent of which are 65 feet or less in length, or revenues which constitute more than 85 percent of gross receipts. The Boatyard General Permit requires monitoring for copper, oils, and total suspended solids. These permits do not specifically require monitoring of the solids portion of stormwater flow. There are no permitted boatyards in the Glacier Bay Source Control Area.

Individual Permit

The city of Seattle and King County CSO systems are covered under individual NPDES permits. The permits require the permittee to implement and document nine minimum controls for CSOs. These are technology-based requirements to reduce the potential for releases from the CSOs that would cause adverse impacts to the receiving waters. Dry weather overflows are prohibited. In addition, the permittee must monitor CSO outfalls to characterize CSO impacts and the efficacy of CSO controls. This includes collection of data to document existing baseline conditions, evaluate the efficacy of technology-based control, and determine the baseline conditions upon which a long-term control plan will be based. Additional water quality based requirements apply to controlled CSOs (such as the Norfolk CSO). There are no CSOs discharging to Glacier Bay.

Individual permits are also issued to some businesses in the Lower Duwamish drainage basin. While the permits limit and control the discharge of a number of pollutants, they do not necessarily control contaminants that pose a threat to the sediments, such as PCBs, phthalates, arsenic, mercury and PAHs. An industrial individual permit is written for a specific activity or facility to regulate discharges at a specific location. Duwamish Shipyard, located within the Glacier Bay Source Control Area, has operated under NPDES Permit No. WA0030937, but this permit was cancelled on June 29, 2007. The Duwamish Shipyard, Inc. property will be addressed under an Industrial Stormwater General Permit held by Alaska Marine Lines.

3.1.2 Source Control Actions

Stormwater discharges from piped outfalls may represent an ongoing source of COCs to Glacier Bay. Discharges from private outfalls are addressed in Sections 3.2 to 3.4. To

minimize the potential for discharge of COCs from the city of Seattle storm drain outfall, the following source control actions will be conducted:

- SPU will collect inline sediment samples to evaluate the levels of COCs with respect to sediment recontamination in this drainage basin.
- If COCs are present in the storm drain line, SPU will conduct source tracing to identify sources of contaminants.
- SPU and Ecology will conduct source control inspections of upland sites as needed (see Section 3.7).
- Ecology's Water Quality Program will continue to review and update NPDES permits as needed.

3.2 Alaska Marine Lines

Alaska Marine Lines (AML) is the current owner/operator of a containerized freight barge terminal and warehouse located at 5600-5610 West Marginal Way SW (Figure 3). Lynden Incorporated is the parent company of AML, which purchased the property in 1989 and began operations at this location in December 1993 (AML 2001).

It is bordered on the north by the LaFarge Corporation and The Chemithon Corporation, on the east by the Duwamish Waterway, on the south by Duwamish Shipyard, and on the west by West Marginal Way SW. The shoreline of the Alaska Marine Lines property is approximately 510 feet in length (City of Seattle 2006a).

The site is underlain by 4 to 5 feet of silty clay, which overlies fine to medium sand (Dames and Moore 1991c). Groundwater is present at approximately 5 feet below ground surface (bgs). Groundwater flows toward the Duwamish Waterway and is tidally influenced.

3.2.1 Current Site Use

The main operations at the facility include loading of barges and transportation/storage of containerized freight cargo. Site facilities include an onsite fueling station, truck scales, vehicle washing and steam cleaning area, and dry and liquid cargo storage. The entire surface of the site is sealed with an impervious surface. In 1999, AML expanded the property by purchasing the northwest portion of the Duwamish Shipyard property (Anchor 2006b).

The site operates under the following permits:

EPA RCRA ID number:	WA0000062323
NPDES Industrial Stormwater General Permit:	SO3-001365D
King County Waste Discharge Authorization to Sanitary Sewer (Minor):	459

In 2005, AML filed plans with Ecology and the U.S. Army Corps of Engineers (USACE) to strengthen the existing graving dock gates and fill the 1.34-acre graving dock in order to expand the container storage area. Construction activities were approved by the City of Seattle Department of Planning and Development in March 2006 under application number

3003301 (City of Seattle 2006b). The hydraulic project approval was issued by the Washington Department of Fish and Wildlife in June 2006 (WDFW 2006).

Shoreline modifications were scheduled to be completed by February 15, 2007 (Spearman Engineering 2007). Plans included cleaning of the graving dock by pressure washing and mechanical and hand sweeping prior to the fill activities. Washwater from this activity was to be placed in a holding tank at Duwamish Shipyard and processed in accordance with Duwamish Shipyard's NPDES permit. Sweepings were to be disposed of at an upland site (Spearman Engineering 2006e).

Approximately 42,000 cubic yards of clean structural soil was used to fill the graving dock area in early 2007. The area was paved and includes a stormwater drainage system (Ecology 2006g). According to an amendment to Ecology Administrative Order #3680, AML agreed to replant native vegetation during the first growing season following the completion of the remediation activities (Ecology 2007d).

3.2.2 Past Site Use

The graving dock was constructed for Todd Shipyard and probably built by General Construction Company. Plans for the construction of the graving dock were dated November 26, 1943. Permits suggest the initial graving dock was constructed in October 1945 and expanded to its current (2006) configuration in 1954 (Spearman and Williwaw 2005).

In 1993, the property was re-graded and paved (Spearman Engineering 1993b) and a new barge terminal was constructed (Spearman Engineering 1993c). AML planned to remove a timber wharf and replace it with a concrete wharf (USEPA 1993). In addition, AML leased a portion of the Duwamish Waterway property and installed a new storm drain system to collect and treat runoff from the leased area and West Marginal Way SW (Duwamish Shipyard 1994b).

In 1999, AML purchased the portion of the Duwamish Shipyard property that had been under lease to AML.

3.2.3 Stormwater Drainage

According to a 2005 city of Seattle map, there are at least five piped outfalls to the Duwamish Waterway on or near the AML property (Figure 3). Most site runoff is directed to a sand filter system, including stormwater runoff under the truck scales. The sand filter system discharges to the Duwamish Waterway. A portion of the stormwater from the upland northwest corner of the site is directed to the city of Seattle storm drainage system (Figure 5).

Stormwater runoff from the fueling pad is conveyed to an oil/water separator, after which it is delivered to the sanitary sewer. The conveyance line to the oil/water separator has a valve to allow diversion of clean stormwater to the city storm drain system and shutoff in the event of a significant fuel spill (AML 2001). Similarly, runoff from the truck wash pad is directed through an oil/water separator and to the sanitary sewer system in accordance with a King County waste discharge authorization (No. 459). A control valve prevents entry of stormwater into the discharge system when not in use (AML 2001).

In 1993, plans were filed with Ecology to redevelop the site and discharge stormwater through filtration trenches to the Duwamish Waterway (AML 1993). Two stormwater outfalls were to be constructed in the Duwamish Waterway (Ecology 1993m).

In early 2007, as part of filling the graving dock, AML added a stormwater treatment system consisting of two underground vaults; the first includes a hydrodynamic separator device for pre-treatment removal of large size fraction particulates and associated pollutants, and the second downstream vault contains modular pre-packaged canisters with filter media (Ecology 2006g). The underground vaults are situated at the site low point (Spearman Engineering 2006b). Approximately 1.7 acres of existing area were scheduled to be repaved and the existing stormwater treatment sand filter for the repaved area was to be abandoned. The new system will sheet flow across the paved site to the southeastern quadrant of the graving dock (Spearman Engineering 2006b).

Ecology summarized its review of AML's 2005 stormwater monitoring data in a Stormwater Compliance Inspection Report dated January 30, 2006 (Ecology 2006d). AML reported monitoring data for first, second, and fourth quarters of 2005. Total zinc concentrations exceeded discharge limits for all reported quarters. Turbidity exceeded discharge limits during the second and fourth quarters. Oil and grease and total suspended solids (TSS) concentrations exceeded discharge limits during the fourth quarter. Ecology directed AML to inspect and clean all catch basins, sand filters, and other stormwater drainage treatment systems and to clean up all areas of the site that had an accumulation of sediment and other material (Ecology 2006d). No follow-up inspection has been conducted.

3.2.4 Environmental Sampling/Cleanup

The following investigations have been conducted at the AML site:

- Site Assessment for USTs, conducted in 1990 by Dames and Moore for Alaska Marine Lines (Dames and Moore 1991a, 1991b, 1991c)
- Site Assessment Report, prepared in August 1993 by Environmental Services, Ltd. for Duwamish Shipyard (described in Hart Crowser 1994)
- Independent Remedial Action Report, Alaska Marine Lines Parcel, Duwamish Shipyard, prepared in 1993 and 1994 by Hart Crowser for Duwamish Shipyard (Hart Crowser 1994)

These investigations are described below. Analytical results and figures showing sample locations are provided in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007).

In September 1990, Dames and Moore conducted a soil vapor survey, which indicated the possible release of petroleum hydrocarbons to the subsurface from two underground storage tanks (USTs) and/or the associated piping (Dames and Moore, 1991c). Three soil samples and one groundwater sample were collected from the excavation. Samples were analyzed for total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, and total xylenes (BTEX), and leachable lead. Analysis of these samples indicated that the onsite soils and groundwater were contaminated with gasoline- and diesel-range hydrocarbons and BTEX. The lateral and vertical extent of contaminated soil and groundwater were not investigated.

Excavated soil was backfilled and compacted into the excavation and covered with filter fabric followed by 80 cubic yards of crushed rock. Approximately 300 gallons of groundwater were pumped from the excavation and disposed of at a Northwest EnviroService Inc. facility.

No site maps indicating the locations of the USTs, soil samples, or temporary groundwater monitoring wells were found in the files reviewed by SAIC. It is not clear whether these USTs were situated on this AML property, or on the AML properties across West Marginal Way SW (Section 3.7).

In 1993, a site assessment was conducted on a portion of property owned at that time by Duwamish Shipyard and leased to AML (Hart Crowser 1994). AML subsequently purchased this property in 1999. AML used the leased property for container storage. Site assessment activities included installation of five test pits and five soil borings. Four soil borings were converted to monitoring wells. All samples were analyzed for petroleum hydrocarbons; additionally, the soil samples from two test pits were analyzed for volatile organic carbon (VOC) and semivolatile organic carbon (SVOC) compounds.

Gasoline-, diesel- and lube oil-range hydrocarbon concentrations were reported in the soil samples from two test pits and four soil borings. VOCs including methylene chloride, acetone, and BTEX, and SVOCs including naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, carbazole, fluoranthene, pyrene, benzo(a)anthracene, chrysene, BEHP, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene were reported in the test pit samples.

Groundwater samples were collected from four monitoring wells and one soil boring and analyzed for petroleum hydrocarbons; gasoline-, diesel-, and heavy-oil range hydrocarbons were reported in samples collected from three wells and the soil boring grab sample.

In October 1993, Hart Crowser oversaw excavation of approximately 650 cubic yards of petroleum-contaminated soil identified in the 1993 site assessment. The excavation took place on the portion of the Duwamish Shipyard property leased to AML. Twelve confirmation samples were collected from the bottom and sidewalls of the excavation. Petroleum hydrocarbon concentrations exceeding the Model Toxics Control Act (MTCA) Method A cleanup levels were reported in eight of the 12 confirmation samples. SVOCs were reported above cleanup levels in two soil samples (five samples were analyzed for SVOCs).

In January and February 1994, Hart Crowser performed additional site assessment activities that included the installation of three soil borings on the AML property adjacent to the graving dock (area downgradient from the October 1993 excavation). One soil boring was converted to a groundwater monitoring well. Eight soil samples were collected from the borings. Groundwater sampling was conducted twice, once when the groundwater elevation was relatively low and once when the groundwater elevation was relatively high.

Soil samples were analyzed for diesel- and oil-range hydrocarbons, PAHs, and total organic carbon (TOC). Three samples were submitted for soil leachate extract analysis. Analysis of the soil samples indicated that soils were contaminated with diesel- and oil-range hydrocarbons and PAHs. TOC ranged from 0.3 to 2.5 percent. Petroleum hydrocarbons and

PAHs were reported in the soil leachate analysis results; however, concentrations did not exceed MTCA Method A (petroleum hydrocarbon) or Method B (PAH) groundwater cleanup levels.

Groundwater samples were analyzed for TSS, diesel- and oil-range hydrocarbons, BTEX, and PAHs. Analysis of the groundwater samples indicated that the groundwater sample collected from well MW-4 (immediately west of the graving dock) was contaminated with diesel-range hydrocarbons and PAHs including naphthalene, acenaphthylene, 1-methylnaphthylene, 2-methylnaphthalene, acenaphthene, fluorene, phenanthrene, anthracene, and pyrene. Concentrations of these analytes were generally lower in the sample collected during a period of relatively high groundwater elevation. The reported concentrations for each analyte were below the respective MTCA cleanup levels.

3.2.5 Potential for Future Releases to Glacier Bay

Sediment samples collected in the Lower Duwamish Waterway near the AML site in 2005 contained arsenic, copper, zinc, BEHP, and PCBs at concentrations above the SQS. In addition, high levels of organo-tin compounds were detected in sediment near the site.

Past activities at the AML site have resulted in soil and groundwater contamination. Site soil and groundwater concentrations were compared to screening levels which were developed to assist in the identification of upland properties that may pose a potential risk of recontamination of sediments at Slip 4 (SAIC 2006).

The screening levels incorporate a number of conservative assumptions, including the absence of contaminant dilution and ample time for contaminant concentrations in soil, sediment, and groundwater to achieve equilibrium. In addition, the screening levels do not address issues of contaminant mass flux from upland to sediments nor do they address the area or volume of sediment that might be affected by upland contaminants. Because of these assumptions and uncertainties, these screening levels are most appropriately used for one-sided comparisons. If contaminant concentrations in upland soil or groundwater are below these screening levels, then it is unlikely that they will lead to exceedance of marine sediment CSLs. However, upland concentrations that exceed these screening levels *may or may not* pose a threat to marine sediments; additional site-specific information must be considered in order to make such an assessment.

Contaminants have been detected in soil at concentrations above soil-to-sediment screening levels. Although petroleum-contaminated soils were excavated in 1993, contaminants remain at levels of potential concern with regard to recontamination of Lower Duwamish Waterway sediments. In particular, PAHs (acenaphthene, benzo[g,h,i]perylene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene) and dibenzofuran were detected in soils at concentrations above screening levels subsequent to the cleanup action. These residual contaminants may be transported to the Lower Duwamish Waterway by leaching to groundwater and subsequent transport to the waterway or by infiltration into the storm drain system.

Decommissioning the graving dock and elimination of vessel repair activities significantly reduces the potential for future releases of hazardous and toxic materials to the environment from this site.

Although operations at other areas of the site, such as fueling, vehicle washing, and cargo storage, may present an ongoing contaminant pathway from storm drains to the outfalls connected to the Lower Duwamish Waterway, the facility operates under an Industrial Stormwater General Permit and conducts quarterly monitoring as required under the permit. AML has been directed to ensure its Storm Water Pollution Prevention Plan (SWPPP) is updated with a BMP for regular maintenance of the sediment removal units and filter cartridge replacement media in the new stormwater drainage system (Spearman Engineering 2006b). AML should continue review of its sample pollutant source-monitoring plan and ensure that effluent samples and results are compliant with the plan and are within NPDES discharge limits.

3.2.6 Source Control Actions

Past practices at this facility have resulted in soil and groundwater contamination with petroleum hydrocarbons and related contaminants, including PAHs. Although petroleum-contaminated soils were excavated in 1993, PAHs and dibenzofuran remained in the soil at levels of potential concern subsequent to the cleanup. The most recent soil and groundwater data were collected from this site in 1994. Additional data are needed to determine whether residual historical contamination poses a risk of sediment recontamination via groundwater transport.

The facility currently operates under an NPDES Industrial Stormwater General Permit. A January 2006 compliance inspection identified several concerns and recommendations; no follow-up inspection has been conducted. Operations at this facility will be monitored to ensure compliance with permit requirements and stormwater BMPs to prevent release of contaminants to the Lower Duwamish Waterway.

The following source control actions will be conducted:

- Alaska Marine Lines will sample groundwater along the shoreline to determine whether residual site contaminants are being discharged to Glacier Bay.
- Alaska Marine Lines will confirm the locations of two former USTs that were removed in 1990.
- Ecology will verify that remediation activities associated with filling of the graving dock have been completed by Alaska Marine Lines and that all conditions associated with this work have been met.
- Ecology will conduct a follow-up inspection to ensure that concerns and recommendations identified during the January 2006 stormwater compliance inspection have been addressed.
- King County will continue to oversee and inspect this site through the Industrial Waste Program.
- Ecology's Water Quality Program, along with Seattle Public Utilities (SPU) and King County Industrial Waste (KCIW), will evaluate the need for stormwater characterization from this facility due to runoff/overflow during heavy rainfall events.

3.3 Duwamish Shipyard

Duwamish Shipyard, Inc. is the current owner of the property located at 5658 West Marginal Way SW in Seattle. Duwamish Shipyard operated a shipyard at the site from 1941 until April 1, 2007. The site is located near the Duwamish River in an industrial area of Seattle (Figure 2). It is bordered on the north by Alaska Marine Lines, on the east by the Duwamish Waterway, on the south by Glacier Northwest, Inc., and on the west by West Marginal Way SW.

The site has been paved since 1995, and all existing site buildings have concrete floors (Hart Crowser 1996b). The site is underlain by silt and sand to 10 feet bgs, the maximum depth explored at the site. Organic silt is present between 9 and 10 feet bgs in many areas of the site (Anchor 2006b). This silt layer may be the same unit that is observed between 8 and 13 feet bgs at the Glacier Northwest site. Groundwater occurs between 3 and 6 feet bgs (Anchor 2006b, Kuroiwa 2000). This shallow groundwater may be a perched zone and does not appear to be tidally influenced.

The King County parcel number is 1924049028 (9028 on Figure 6). The parcel is 4.93 acres in size and is zoned for industrial use. According to tax records, there are four buildings on the site.

The site operated under the following permits and registrations:

EPA RCRA ID Number:	WAD009244997
NPDES Permit:	WA0030937 (Cancelled on June 29, 2007)
METRO Waste Discharge Permit:	7704-01 (effective 10/16/00) 7704-02 (effective 10/19/05)
Clean Air Act ID Number:	5303300106

The site is listed on Ecology's Confirmed and Suspected Contaminated Sites List (CSCSL) due to confirmed contamination of soil, sediment, and groundwater and suspected contamination of sediments[2]. A Site Hazard Assessment was conducted by Seattle-King County Public Health (SKCPH) in 2007 to estimate the potential threat to human health and/or the environment posed by this site relative to other Washington state sites. The Duwamish Shipyard was assigned a hazard ranking of 2, where 1 represents the highest relative risk and 5 the lowest (SKCPH 2007).

3.3.1 Current Site Use

The Duwamish Shipyard ceased operations on April 1, 2007, and is currently leased by AML for equipment and container storage. Ecology and Duwamish Shipyard, Inc. are currently negotiating an Agreed Order to conduct an RI/FS at the site. This section describes recent site use prior to closure of shipyard operations.

The facility specialized in repair and maintenance of floating vessels and equipment (Standard Industrial Classification [SIC] code 3731). Services included machine and electrical work,

[2] Department of Ecology – Toxics Cleanup Program, Integrated Site Information System, Confirmed and Suspected Contaminated Sites List, June 7, 2007.

carpentry, steel fabrication, pipe fitting, sandblasting, pressure washing, and painting. The facility included two steel dry docks and a graving dock; these were last used in early 2007. The graving dock was leased from AML; it was filled in early 2007 to allow AML to expand their freight terminal operations.

Until its recent closure, Duwamish Shipyard serviced approximately 60 to 65 vessels per year (SKCPH 2007). Repair services included machine and electrical work, carpentry, steel fabrication, sand blasting, pressure washing, and painting.

Wastewater generated from pressure washing of vessels at the dry docks was collected in a sump and pumped on shore to a treatment system prior to discharge to the King County sanitary sewer. Wastewater generated from pressure washing from the graving dock area was collected in a containment system to prevent wastewater from seeping through the tide gates to the Duwamish Waterway (Anchor 2006b).

Surface drainages were not allowed to enter the property (Anchor 2006b). A stormwater system was installed on the site in the 1970s. The system consisted of 10 catch basins fitted with inserts and oil sorbent pillows. From the catch basins, stormwater runoff from the paved parking and active industrial areas was directed to a 10-inch-diameter trunk line. The line discharged to a sump, and stormwater was pumped through a centrifugal separator to remove grit. After grit was removed, the stormwater was discharged to the Duwamish River via Stormwater Outfall 005 (Figure 7). The system was operated under Duwamish Shipyard's individual NPDES permit (Anchor 2006b).

Dry dock flood water was generated when work was completed on a vessel and the dry dock was flooded with river water in order to float the vessel back into the river. Duwamish Shipyard employed BMPs to ensure that materials accumulated on the floor of the dry dock during service (e.g., spent abrasive grit, oil, paints, solvents) were removed prior to flooding the dry dock.

The results of two acute bioassay tests performed on effluent grab samples, graving dock floodwater samples, and dry dock floodwater samples during 1996-1998 did not observe toxicity (Parametrix 1996a, 1996b, 1997a, 1997b, 1997c, 1997d, 1998; Ecology 1996f, 1997d, 1997i, 1997j, 1998a, 1998b, 1998c, 1998f).

The site was inspected by Ecology on June 25, 2007. The site inspection report was not available for review at the time this document was prepared.

3.3.2 Past Site Use

Detailed information on past site use is provided in *Summary of Existing Information and Data Gaps* (SAIC 2007). Relevant information is summarized briefly below.

The Larsen family purchased the site in 1939 with the intent to establish a shipyard. The property has remained in the Larsen family's possession. In 1999, a portion the northwest corner of the property was sold to AML, which had leased that portion of the property since 1993 (Duwamish Shipyard 1994b).

Duwamish Shipyard specialized in repairing and maintaining floating vessels and equipment. Services included machine and electrical work, carpentry, steel fabrication, pipe fitting,

sandblasting, pressure washing, and painting. The majority of the vessels serviced were wooden fishing boats until the 1950s. From the 1960s to 2007, most vessels repaired and maintained at Duwamish Shipyard had steel hulls. The facility occasionally serviced vessels with aluminum or fiberglass hulls, but discontinued services for wood hull vessels (Anchor 2006b).

3.3.3 Environmental Sampling/Cleanup

The following investigation reports have been prepared for the Duwamish Shipyard site:

- Results of Sampling and Analysis Sediment Monitoring Plan, prepared in August 1993 by Hart Crowser for Duwamish Shipyard, Inc. (Hart Crowser 1993c)
- Site Assessment Report, prepared in August 1993 by Environmental Services, Ltd. for Duwamish Shipyard, Inc. (as described in Hart Crowser 1994)
- Independent Remedial Action Report, Alaska Marine Lines Parcel, Duwamish Shipyard, prepared in 1993 and 1994 by Hart Crowser for Duwamish Shipyard (Hart Crowser 1994)
- Dry Dock and Graving Dock Discharge Metals Report, prepared in 1996 by Hart Crowser for Duwamish Shipyard (Hart Crowser 1996c)
- 1997 Dry Dock and Graving Dock Discharge Metals Report, prepared in 1997 by Hart Crowser for Duwamish Shipyard (Hart Crowser 1998b)
- Independent Remedial Action Report, Underground Storage Tank Closure, prepared in June and August 2000 by RK Kuroiwa for Duwamish Shipyard, Inc. (Kuroiwa 2000)
- Preliminary Investigation Data Report, prepared in September 2006 by Anchor Environmental, LLC for Duwamish Shipyard, Inc. (Anchor 2006b)

These investigations are described in *Summary of Existing Information and Data Gaps* (SAIC 2007), which includes analytical results for sediment, soil, catch basin solids, and groundwater samples and figures showing sampling locations. Results are summarized briefly below.

In 1993, Hart Crowser collected four surface sediment samples inside the upstream and downstream property lines, within the marine railway slip, and between the two dry docks (Hart Crowser 1993c). A reference sample was collected upstream of the Duwamish Shipyard. Two acute bioassays and one chronic marine sediment bioassay were performed on the four sediment samples collected within the shipyard property. The sediment samples were analyzed for priority pollutant metals, SVOCs, organo-tin compounds, TOC, and grain size.

Hart Crowser reported that statistically significant mortality was measured in all sediments for the acute 10-day amphipod mortality bioassay and for two samples in the acute larval mortality/abnormality bioassay. Hart Crowser reported statistically non-significant mortality in the chronic 20-day juvenile polychaete bioassay. Ecology did not agree with Hart Crowser's interpretation of the data and found the mortality rates to be significant for all bioassays (Ecology 1994c, 2003a, Ecology [date unknown]).

Analysis of the sediment samples indicated detections of 10 of 14 priority pollutant metals; arsenic, copper, lead, and zinc exceeded the CSL. Arsenic (1,130 mg/kg DW) exceeded the SQS by a factor of 20 and zinc (4,440 mg/kg DW) exceeded the SQS by a factor of 11 in SS-2, near Dry Dock No. 1. PAHs above the SQS were detected in the two samples near Dry

Dock No. 1. Phthalates (BEHP and butylbenzyl phthalate) were also detected above the SQS. Butyltins were detected in all sediment samples. TOC ranged from 1.41 to 2.74 percent in the samples. Samples SS-1 and SS-2, which had SQS exceedances, are near the location of sediment sample LDW-SS48, collected during the Lower Duwamish Waterway Phase II RI (Figure 4).

In 1993, a site assessment was conducted on a portion of property owned by Duwamish Shipyard and leased to Alaska Marine Lines. This property was sold to AML in 1999. In October 1993, Hart Crowser oversaw excavation of approximately 650 cubic yards of petroleum contaminated soil identified in the 1993 site assessment. The results of the investigations are discussed in Section 3.2.3.

Hart Crowser conducted monthly sampling of four outfalls associated with Duwamish Shipyard from January to November 1996 (Hart Crowser 1996c). Outfalls 001 and 002 were associated with the dry docks and Outfalls 003 and 004 were associated with the graving dock (Figure 7). Samples were analyzed for copper, lead, and zinc. Copper concentrations in the samples consistently exceeded the Water Quality Standards (WQS) acute criteria for all sampling locations, including background samples. Zinc concentrations slightly exceeded the WQS criteria in four samples and greatly exceeded WQS criteria in one sample collected at Outfall 003. Lead concentrations were below the WQS criteria for all samples. No effluent limits for copper, lead, or zinc were set in Duwamish Shipyard's NPDES permit.

Hart Crowser continued to conduct monthly sampling of the four outfalls from January to November 1997 (Hart Crowser 1998b). Copper concentrations in the samples continued to consistently exceed the WQS acute criteria for all sampling locations, including background samples. Lead and zinc concentrations were below the WQS criteria for all samples.

In June 2000, petroleum-contaminated soil was discovered during the removal of two 3,000-gallon unleaded gasoline USTs, one 3,000-gallon diesel UST, and one 1,000-gallon unleaded gasoline underground storage tank (UST) (Kuroiwa 2000). The area was over-excavated in August 2000 to remove petroleum-contaminated soil, resulting in an excavation area approximately 30 by 40 feet wide and 7 feet deep. Eighteen confirmation samples were collected from the sidewalls and bottom of the excavation. Soil samples were analyzed for gasoline-, diesel-, and oil-range hydrocarbons, BTEX, and total lead. Gasoline-range hydrocarbons, diesel-range hydrocarbons, and benzene were reported at concentrations above the MTCA Method A cleanup levels in sidewall and bottom samples.

During the initial UST excavation, approximately 60 cubic yards of soil was stockpiled on site. The soil was treated and re-sampled. Analysis of the soil samples indicated that petroleum hydrocarbons, BTEX, and lead concentrations were below MTCA cleanup levels. The stockpiled soil was used as backfill in the UST excavation. Approximately 20 cubic yards of petroleum-contaminated soil generated during the over-excavation activities was removed from the site. Groundwater removed from the open excavation was collected by Duwamish Shipyard for onsite treatment or removed from the site for treatment.

In 2006, Anchor advanced 12 soil borings and collected 24 soil samples (two from each boring) and collected 12 groundwater samples (one from each boring) (Anchor 2006b). Anchor redeveloped two existing groundwater monitoring wells and collected two

groundwater samples (one from each well). Anchor also collected solids samples from the 10 stormwater catch basins and the stormwater system sump.

The following contaminants were reported above MTCA cleanup levels in soil: gasoline- and diesel-range hydrocarbons, benzene, total arsenic, cadmium, lead, and benzo(a)pyrene . Copper, mercury, zinc, PAHs (acenaphthene), and phthalates (BEHP and butyl benzyl phthalate) were reported above the SQS and CSL values in the catch basin sample. Arsenic, chromium, lead, benzo(a)pyrene, benzene, and vinyl chloride concentrations reported in groundwater exceeded MTCA cleanup levels. No marine surface water criteria exceedances were noted for the nearshore groundwater samples.

Ecology reviewed the preliminary report and directed Duwamish Shipyard to do the following (Ecology 2007a):

- Clean out stormwater catch basins and lines, sample solids and report results. Duwamish Shipyard conducted cleanout and sampling in July/August 2007; a report to Ecology is expected in November 2007.
- Review existing sampling results and add three monitoring wells with additional soil and groundwater sampling.
- Prepare a work plan for proposed additional sampling, including analyses for tributyl tin.
- Prepare a sediment evaluation work plan for nearshore sediment.

3.3.4 Potential for Future Releases to Glacier Bay

Sediment samples collected in the Lower Duwamish Waterway near the Duwamish Shipyard site in 2005 contained arsenic, antimony, copper, lead, mercury, zinc, PAHs, BEHP, butylbenzyl phthalate, 1,2-dichlorobenzene, benzyl alcohol, pentachlorophenol, and PCBs at concentrations above the SQS (Section 2.1). Arsenic, mercury, and PCBs exceeded the SQS by more than a factor of 10.

Site soil and groundwater concentrations were compared to MTCA Cleanup Levels and to screening levels which were developed to assist in the identification of upland properties that may pose a potential risk of recontamination of sediments at Slip 4 (SAIC 2006)[3]. Arsenic is present in site soils (to 48 mg/kg DW) and groundwater (to 84 µg/L) at concentrations above the MTCA Cleanup Level (Anchor 2006b). Lead also exceeds MTCA Cleanup Levels and sediment screening levels in both soil (to 4,940 mg/kg DW) and groundwater (to 55 ug/L). Benzo(a)pyrene exceeds the sediment screening level in soil (to 7.9 mg/kg DW) and groundwater (to 3.5 ug/L). VOCs (benzene, vinyl chloride) and petroleum hydrocarbons exceed MTCA Cleanup levels in soil and/or groundwater.

Low levels of PCBs (Aroclor 1260) are present at concentrations to 0.3 mg/kg DW in site soils; they do not exceed the MTCA Cleanup Level or sediment screening levels, and were not detected in groundwater or in the catch basin solids sample.

Catch basin sediment sample results were compared to SQS and CSL values. (It should be noted that the SQS and CSL values do not apply to catch basin sediments. It is important to note that any comparison of this kind is most likely conservative given that sediments

[3] See discussion of screening levels in Section 3.2.5.

discharged from storm drains are highly dispersed in the receiving environment and mixed with the natural sedimentation taking place in the system.) Mercury was detected in the catch basin solids sample at 1.05 mg/kg DW, above the SQS of 0.41 mg/kg DW. Copper, zinc, PAHs, and phthalates were also detected in catch basin sediments at concentrations above the SQS.

Based on these comparisons, historic soil and groundwater contamination at this site may represent a potential source of sediment recontamination.

3.3.5 Source Control Actions

A variety of contaminants have recently been detected in soil and groundwater at this facility and in adjacent sediments as a result of historical shipyard operations. These contaminants include arsenic, cadmium, copper, mercury, lead, and PAHs.

Duwamish Shipyard prepared a Preliminary Investigation Data Report in 2006 that summarizes current upland conditions, and received comments from Ecology to address remaining data gaps. These will be addressed in future communications with Ecology, including development of an Agreed Order and an accompanying investigation work plan. As part of the work plan, Ecology has directed Duwamish Shipyard to clean out catch basins and lines, sample and report results, install monitoring wells, and perform additional upland sampling and nearshore sediment evaluation. Data from these activities will be reviewed and an assessment of the potential for sediment recontamination from this property will be documented.

The following source control actions will be conducted:

- Ecology and Duwamish Shipyard will negotiate an Agreed Order to address soil and groundwater contamination at this site.
- Duwamish Shipyard will clean out catch basins and lines, resample the catch basins, and report results, as requested by Ecology. (Note: Duwamish Shipyard conducted cleanout and sampling in July/August 2007; a report is scheduled to be submitted to Ecology in November 2007.)
- Duwamish Shipyard will prepare work plans for further site investigations, as specified in the Agreed Order, including installation of monitoring wells and additional upland soil and nearshore sediment sampling.
- Upon approval of the work plans by Ecology, Duwamish Shipyard will conduct site investigations as specified in the work plans.
- Ecology will review site investigation results, assess the potential for sediment recontamination from this property, and determine whether remedial action is required to mitigate this potential.
- King County will continue to oversee and inspect this site through the Industrial Waste Program.
- Ecology's Water Quality Program will continue periodic inspections of this site as needed to ensure compliance with the facility's NPDES permit.

3.4 Glacier Northwest, Inc.

Glacier Northwest, Inc. (Glacier Northwest) is the current owner/operator of a cement terminal located at 5900 West Marginal Way SW in Seattle. The site has been historically referred to by Glacier Northwest as the West Marginal Way Plant and Marginal Way Truck Stop. The property has had many previous owners and tenants, including Carlisle Lumber Company, the U.S. Army, Reichhold Chemical Company, the Port of Seattle, Kaiser Cement Company, Lone Star Northwest, Inc., and Ash Grove Cement West, Inc. In this report, all of these names refer to the site located at 5900 West Marginal Way SW.

The site is located near the Duwamish River in an industrial area of Seattle (Figure 2). The site is bordered on the north by Duwamish Shipyard, on the east by the Lower Duwamish Waterway, on the south by Terminal 115, and on the west by West Marginal Way SW.

The site is covered by approximately 1 foot of crushed gravel over approximately 3 to 5 feet of mixed sand, gravel, and sawdust fill. Alluvial sand and silt underlies the fill to a depth of approximately 8 feet bgs. An organic silt and clay unit is present throughout the site between approximately 8 and 13 feet bgs. Alluvial sand is present beneath the organic silt and clay unit (Hart Crowser 1995).

A perched groundwater unit forms seasonally above the organic silt and clay layer which acts as an aquitard. When present, the perched groundwater is encountered beneath the site between 4 and 13 feet bgs. A deeper groundwater unit is present in the alluvial sand layer beneath the silt/clay aquitard. Groundwater in the deeper zone generally flows to the northeast toward the Duwamish River (Hart Crowser 1995).

The site is located on King County parcel number 1924049029 (labeled 9029 in Figure 6). The area of the site is approximately 18.2 acres. There are two buildings on the site.

The site is listed on Ecology's CSCSL due to the confirmed presence of metals and phenols in surface water, groundwater, and soil, and the suspected presence of halogenated organics in groundwater, phenols in sediment, and petroleum hydrocarbons in all four media[4].

The site has operated under the following permits and registrations:

EPA RCRA ID number (cement terminal):	WAD151474368
EPA RCRA ID number (truck stop):	WAH000007773
NPDES Sand and Gravel General Permit:	WAG-50-0016 (effective May 19, 2000, cancelled December 4, 2001)
NPDES Sand and Gravel General Permit:	WAG-50-3347 (effective December 4, 2001, cancelled January 25, 2006)

NPDES Permit WAG-50-0016 covered operation of a ready-mix concrete batch plant as a portable plant (Glacier Northwest 2001) and allowed discharge to groundwater via infiltration through the unpaved areas of the site. NPDES Permit WAG-50-3347 covered the ready-mix concrete batch plant and allowed discharge of stormwater to the Duwamish River (Ecology

[4] Department of Ecology – Toxics Cleanup Program, Integrated Site Information System, Confirmed and Suspected Contaminated Sites List, June 7, 2007.

2001c). As early as February 2005, Ecology and Glacier Northwest documents indicate that the plant was inactive (Ecology 2006c).

In October 2005, Glacier Northwest requested cancellation of its NPDES Sand and Gravel General Permit No. WAG 50-3347. In the letter requesting cancellation of the permit, Glacier Northwest stated that operations at the site ceased "several years ago" and the portable concrete batch plant was removed from the site and returned to its owner (Glacier Northwest 2005).

3.4.1 Current Site Use

According to Glacier Northwest's website, Portland Type I, II, and III cement is produced at the terminal. However, an October 2005 letter from Glacier Northwest stated that concrete operations at the site had ceased.

A 2000 Notice of Intent indicates that the site was being used by tenants for construction and lumber yard operations. Other site activities included truck parking, and office, shop, and warehouse operations. Over 50 ready-mixed concrete trucks were parked daily at the facility and were maintained in an onsite shop. Glacier Northwest had several silos, a large dock, and railhead for storage and transfer of bulk cement (Glacier Northwest 2000).

3.4.2 Past Site Use

Information on past site use is detailed in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007). Past site ownership is listed in the following table and summarized briefly below:

Dates	Owner/Operator	Site Use
Prior to 1927	Privately owned	Unknown
1930 to 1943	King County	Undeveloped; timber operations, placement of Duwamish River dredge material
1943	Carlisle Lumber Company	Lumber plant
1943 to 1944	U.S. Army	Charcoal and whetlerite filter manufacturing, operated by Crown Zellerbach
1945 to 1960	U.S. Army – Leased to Reichhold Chemical, Inc.	Production of adhesives, glues, formaldehyde, and wood-preserving resins
1960 to 1964	U.S. Army	Site was inactive
1964 to 1968/1969	Port of Seattle – Leased to Kaiser Cement Company	Cement terminal and dock
1968/1969 to 1987	Kaiser Cement Company	Cement terminal and dock
1987 to 2000	Lone Star Northwest, Inc. – Cement terminal portion of site leased to Ash Grove Cement West, Inc.; remainder of property leased for storage	Cement terminal and dock; storage of construction debris and heavy equipment
2000 to present	Lone Star Northwest changed company name to Glacier Northwest, Inc.	Cement terminal and dock; construction and lumberyard operations

From 1943 to 1947, the site was used by the U.S. Army to produce charcoal and whetlerite filters used in gas masks during World Wars I and II (Walk 2003). Several forms of whetlerite were produced during this time period; whetlerite A (copper-impregnated carbon) was the standard filter material at the beginning of World War II. By 1943, copper, silver, and chromium were being added to the carbon to make whetlerite ASC, which provided greater protection against phosgene, hydrogen cyanide, and arsine. Waste whetlerite ASC is considered a hazardous waste, primarily due to the presence of chromium VI (Walk 2003).

Reichhold Chemical, Inc. (Reichhold) leased the site from the U.S. Army from about 1945 to 1960, and manufactured adhesives and water-soluble glues used in paper making (Reichhold Chemicals 1949), formaldehyde, wood-preserving resins such as phenol formaldehyde, and pentachlorophenol. Hydrochloric acid was produced as a by-product of pentachlorophenol manufacturing (Reichhold Chemicals 1987).

Pentachlorophenol production may have been performed at the site for only a short time. Reichhold records dated 1956 indicate plans to move this production to another location (Reichhold Chemicals 1956). Reichhold also produced plastic polymers for the automobile industry (Ecology 1990d).

A number of releases or spills occurred at the site prior to late 1955; a 1955 Washington Pollution Control Commission (WPCC) memo reported a complaint made by the Department of Fisheries of a green-colored material being discharged from the sanitary sewage outfall in to the Duwamish River. A downstream sample contained 18,000 mg/L total phenols, and over 300 dead fish were reported within a 30-minute period (Nielson 1955, WDF 1955).

A 50-foot by 150-foot by 6-foot deep impounding basin and an adjacent 50-foot by 10-foot by 10-foot deep control basin were constructed sometime around 1955. The control basin contained combined wastewater from the formaldehyde plant and kettle room. Wastewater was treated with lime or alkali (Reichhold Chemicals 1987). The wastewater was discharged from the control basin through a deep water outfall to the Duwamish River. The WPCC directed Reichhold to test the formaldehyde and phenol content of the control basin hourly, and to pump the wastewater to the impounding basin if phenol concentrations exceeded 1 ppm (Reichhold Chemicals 1955c, Eldridge 1955c). There is no indication that sludge from the lagoons was removed prior to closure. Two 20,000-gallon wooden tanks were also installed in late 1955 to remove and/or dilute phenol in wastewater prior to discharge to the Duwamish River (Reichhold Chemicals 1955b).

Reichhold moved the operations to Tacoma in 1958, but did not dismantle the plant at this site (Parametrix 1990, Hart Crowser 1995). In 1961, WPCC reported that Reichhold was using the Seattle site for offices and laboratory procedures only (WPCC 1961).

Reichhold estimated the following production capacities (WPCC 1956a, Reichhold Chemicals 1987).

Product	Quantity	Frequency
Adhesives	Unknown	Unknown
Formaldehyde	52,000 lbs/day	350 days/year
P-F Resins	56,000 lbs/day	270 – 280 days/year

Product	Quantity	Frequency
Pentachlorophenol	5,000 lbs/day	350 days/year
Hydrochloric acid	13,000 lbs/day	350 days/year

From 1964 to 1968 or 1969, the site was owned by the Port of Seattle and leased to Kaiser Cement Company. The former Reichhold plant was demolished and the site was leveled in 1965. The cement terminal and dock were constructed during this time (USEPA 1987b, Seattle Army Chemicals Plant 1986, Ecology 1990d, Hart Crowser 1995). From 1965 to 1969, Kaiser installed silo structures for cement storage, truck receiving and loading areas, offices, a marine dock, and a conveyor gallery for trans-shipment of cement materials from barges to the upland storage areas (Ecology 1990d).

Kaiser Cement Company purchased the property in 1968 or 1969 and continued operations of the cement terminal until 1987. Prior to 1974, a 0.3-acre pit was constructed in the southeast portion of the site, which was apparently used for waste concrete slurry disposal (Figure 8). By 1974 the entire site was filled and paved over (Harper-Owes 1985).

Aerial photographs from 1984 show that an area approximately 5 acres in size was re-graded and filled at the south and southwest portions of the site. At that time, Kaiser leased all or portions of the site to a modular construction company and a concrete recycling company. In 1985, the site was a hard surface graveled parking area used for the storage of shipping containers. In 1987, Kaiser Cement Company sold the site to Lone Star Northwest, Inc (Hart Crowser 1995, Parametrix 1985b, Parametrix 1990, Seattle Army Chemicals Plant 1986).

Lone Star leased the cement terminal portion of the site to Ash Grove Cement West, Inc. immediately following the purchase of the property in April 1987 (Lone Star Industries 1987, Lone Star Northwest 1989). Ash Grove reportedly used a 0.2-acre area in the southwest portion of the site for waste concrete slurry disposal and stored waste concrete in the southern portion of the site. Lone Star leased the remainder of the property to a company storing large mobile containers. The site was used to store construction debris and heavy equipment until June 1990. Prior to 1990 the south and southwest portions of the site were covered with a gravel/rock surface fill (Hart Crowser 1995, Parametrix 1990). In 1991, Ash Grove's lease expired.

In October 1990, Lone Star notified Ecology that elevated levels of pentachlorophenol were discovered in a groundwater sample collected at the property (Lone Star Northwest 1990) during a site characterization study performed by Parametrix, Inc. in May 1990, and confirmed in subsequent sampling performed in June and July 1990 (Ash Grove 1991). Lone Star traced the contamination to Reichhold and stated, "It is evident the contamination results from wastewater associated with the manufacture of pentachlorophenol" (Lone Star Northwest 1991).

According to an Ecology inspection report, the site was used to receive, store, and distribute bulk cement during this time period. The facility discharged cement truck washwater (exterior of trucks only) without an NPDES permit and stormwater to the Duwamish River. Ecology advised Lone Star to obtain an NPDES permit for the truck washwater or discharge it to the sanitary sewer. On the day of the inspection, turbid discharge was traced to a neighboring lumber yard also owned by Lone Star. Turbid stormwater was created by truck traffic coming

into the lumber yard from an unpaved yard. Traffic over the unpaved yard allowed silt or clay to migrate upwards through the gravel surface and reach stormwater (Ecology 1994e).

In 1995, a Notification of Dangerous Waste Activities was filed with Ecology for the "Lone Star Northwest/Reichhold Chemical MTCA Cleanup" (Lonestar NW/Reichhold Chemical MTCA Cleanup 1995). The EPA ID Number associated with this notification is WAR000006221 (USEPA 1995). A 1998 letter from Lone Star indicates that the cleanup actions would include well installation, ozone sparging, arsenic fixation, and sampling and analysis. These activities were to take place between October 1998 through 2001 (Reichhold Chemicals 1998). In 2000, Lone Star Northwest changed its name to Glacier Northwest. No reports documenting the performance or results of these proposed cleanup actions were found in the available files.

3.4.3 Environmental Sampling/Cleanup

The following investigations have been conducted at the Glacier Northwest site:

- Draft Defense Environmental Restoration Account Inventory Project Report, Seattle Army Chemicals Plant, conducted in 1986 by USACE, Seattle District (Seattle Army Chemicals Plant 1986)
- Kaiser Property Environmental Audit, conducted in 1985 by Parametrix, Inc. for the Port of Seattle (Parametrix 1985b)
- Phase II Site Assessment, conducted in 1990 by Parametrix, Inc. for Lone Star Northwest (Parametrix 1990, ARI 1990)
- Request for Initial Review of Proposed RI/FS for Independent Cleanup Reichhold/Lone Star Site, conducted in 1995 by Hart Crowser for Lone Star Northwest (Hart Crowser 1995)
- Data Report: Survey and Sampling of Lower Duwamish Waterway Seeps, prepared by Windward Environmental, LLC for the Lower Duwamish Waterway Group (Windward 2004)

These investigations are described in detail in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007), including analytical results for soil, groundwater, and seep samples and figures showing sample locations. No information on cleanup actions at this site was available, although groundwater remediation had been scheduled to take place between 1998 and 2001 (Reichhold Chemicals 1998).

During the summer of 1955, the Department of Fisheries conducted live box experiments in the vicinities of sewer outfalls near the Reichhold plant (WPCC 1955a). Highly toxic conditions were observed on several occasions, which coincided with accidental slug discharges from the plant.

The U.S. Army Corps of Engineers, Seattle District, evaluated the site in 1986 under the Defense Environmental Restoration Program, and concluded that no further action was necessary under this program (USACE 1987).

In 1985, Parametrix (for Port of Seattle) advanced six soil borings in and around the impoundment operated by Reichhold (note that an Ecology letter dated 4/25/1988 indicates

that these borings may actually have been upgradient of the impoundment [Ecology 1988e]), five soil borings in a truck washout area operated by Kaiser, eight soil borings in and around the tank farm area operated by Reichhold, and 10 borings in other areas of the property (Parametrix 1985b). Two borings were advanced to 15 feet bgs; all other borings were advanced to 5 feet bgs. Four composite soil samples were generated from 24 samples collected from 12 borings for laboratory analysis. The samples were analyzed for priority pollutant metals, SVOCs, VOCs, pesticides, and PCBs.

Metals, di-n-butyl phthalate, BEHP, aldrin, alpha-BHC, and dieldrin were detected in one or more of the soil samples. No VOCs were detected in the soil samples, although high organic vapor concentrations were detected using monitoring equipment during the field activities. The suspected cause for the high organic vapor readings was a mixture of carbon dioxide and methane gas released during the decomposition of the sawdust used in fill material at the site.

In May 1990, Parametrix (for Lone Star Northwest) installed three groundwater monitoring wells (B-1 through B-3) and five 1.5-foot deep soil test pits (TP-1 through TP-3) at the site (Parametrix 1990). Discrete soil samples at 4 and 8 feet bgs from the monitoring well borings and a composite sample of each boring were collected for laboratory analysis. The discrete soil samples were analyzed for TPH and total organic halogens (TOX). The composite samples were analyzed for total metals and Toxic Characteristics Leaching Procedure (TCLP) metals. One soil sample was collected at the bottom of each test pit. Samples from test pits TP-1 through TP-3 were analyzed for TPH, TOX, and TCLP metals. Samples from test pits TP-4 and TP-5 were analyzed for TPH and TOX. Arsenic, TPH, and TOX were reported in the soil. TCLP metals results were below the Ecology dangerous waste classification limits.

Groundwater samples were collected from the wells following development. The samples were analyzed for VOCs, SVOCs, and dissolved metals. Additional groundwater samples were collected from wells B-2 and B-3 two weeks after well installation and were analyzed for pentachlorophenol.

Pentachlorophenol was detected above Ecology cleanup guidelines in groundwater near the former acid neutralization pond. Arsenic and silver were reported in groundwater above MTCA Cleanup Levels and state and federal Maximum Contaminant Levels (MCLs) in the eastern portion of the site. Phenolic compounds (2-chlorophenol, 2,4-dichlorophenol, and 2,4,6-trichlorophenol) and naphthalene were detected in the groundwater sample collected from well B-2. These compounds are associated with wood preservatives. VOCs were not detected in groundwater at the site.

Also in May 1990, Hart Crowser (for Lone Star Northwest) collected groundwater samples from three seeps identified at the site (Hart Crowser 1995). The seeps appeared to reflect discharges from the perched groundwater zone along the shoreline adjacent to the site. The samples were collected after a relatively low tide event to allow for maximum drainage of seawater from the sampling locations and as late as possible during the rising tide before inundation of the sampling location. Seep samples were analyzed for arsenic, silver, SVOCs, and total petroleum hydrocarbons (SW-01 and SW-02 only). A sufficient sample volume could not be collected from Seep SW-03 to allow for TPH analysis of the sample. Silver, pentachlorophenol, and TPH were not detected in the seep samples and were below ambient surface water quality criteria and MTCA Cleanup Levels. Arsenic concentrations were also below chronic and acute water quality criteria as of 1995; however, the concentrations

reported at seeps SW-01 and SW-02 are above current chronic and acute water quality criteria. The copy of the figure showing the locations of the seep sampling points in this report is incomplete; therefore, SAIC cannot determine where the seeps were located on the shoreline.

Hart Crowser also reviewed the soil and groundwater data collected by Parametrix in 1985 and 1990. This review concluded that site soils did not pose a direct contact hazard and contained relatively low concentrations of leachable contaminants.

During the Lower Duwamish Waterway RI, two seeps (Seeps 61 and 62) were identified along the shoreline of the Glacier Northwest property (Windward 2004). The area was characterized as having a higher general seepage level as indicated by numerous rivulets flowing along the shoreline. Seeps 61 and 62 were selected for sampling because the water associated with Seep 61 was discolored and a sulfide odor was observed during the seep reconnaissance survey, and dioxins/furans had been detected in the sediment near Seep 62. The seep samples were analyzed for metals, mercury, SVOCs, VOCs, PCBs as Aroclors, organochlorine pesticides, TOC, dissolved organic carbon, and TSS. VOCs and SVOCs were not detected in the seep samples. Organochlorine pesticides were not detected in either sample; however, the reporting limits for the sample from Seep 61 were elevated and greater than the marine chronic water quality criteria (WQC) for some pesticides. Arsenic, cadmium, lead, mercury, silver, and zinc concentrations were reported in the seep samples. The arsenic concentrations reported for Seep 61 exceeded the chronic and acute WQC; the marine chronic WQC exceedance factor was 2.0. Copper was not detected in either of the seep samples, however the reporting limits were greater than the chronic and acute WQC.

3.4.4 Potential for Future Releases to Glacier Bay

Sediment samples collected in the Lower Duwamish Waterway near the Glacier Northwest site in 2005 and 2007 contained arsenic, zinc, phthalates (butylbenzyl phthalate), and PCBs at concentrations above the SQS. High levels of dioxins and furans were also detected in this area. In addition, a seep sample collected in 2004 contained arsenic above the marine chronic WQS.

Past activities at the Glacier Northwest site have resulted in soil and groundwater contamination. Soil and groundwater concentrations were compared to MTCA Cleanup Levels and to screening levels which were developed to assist in the identification of upland properties that may pose a potential risk of contamination of sediments at Slip 4 (SAIC 2006)[5]. In 1990, mercury and zinc were detected in soil at the site at concentrations above the soil-to-sediment screening levels. In addition, arsenic, chromium, and TPH were present above MTCA Cleanup Levels. In groundwater samples collected in 1990, pentachlorophenol was detected at concentrations up to 3,000 µg/L, which is several orders of magnitude higher than the groundwater-to-sediment screening level and MTCA Cleanup Level. In addition, silver and 2,4-dichlorophenol were present at concentrations above the groundwater-to-sediment screening level, and arsenic and chromium were present above the MTCA Cleanup Level.

[5] See discussion of screening levels in Section 3.2.5.

Groundwater at the site is shallow, and the area reportedly has a high general seepage level. Therefore, residual contamination in soil and groundwater may be transported to the Lower Duwamish Waterway via groundwater discharge. The most recent soil and groundwater data available for this site is from 1990; current soil and groundwater concentrations are unknown.

Because COCs are present in soil and groundwater at concentrations of potential concern, high levels of dioxins have been detected in sediments directly offshore of this site, groundwater at the site is shallow, and the area reportedly has a high level of seepage, this site may pose a potential for recontamination of Glacier Bay sediments via groundwater.

Little is known about Glacier Northwest's current site activities; the site does not currently have coverage under an NPDES permit.

3.4.5 Source Control Actions

As described above, the most recent available soil and groundwater data indicate the presence of COCs (including mercury, zinc, arsenic, chromium, silver, pentachlorophenol, and 2,4-dichlorophenol) at concentrations of potential concern with respect to sediment recontamination. Additional data on contaminant concentrations in soil and groundwater are needed in order to evaluate the potential for groundwater from this site to recontaminate Glacier Bay sediments.

The following source control actions will be conducted:

- Ecology will direct the current and/or previous property owners/operators to conduct site characterization investigations.
- The current and/or previous property owners/operators will prepare work plans for site investigations as specified by Ecology, including installation and sampling of monitoring wells and upland soil, seep, and nearshore sediment sampling as necessary.
- Upon approval of work plans by Ecology, the current and/or previous property owners will conduct site investigations as specified in the work plans.
- Ecology will review site investigation results, assess the potential for sediment recontamination from this property, and determine whether remedial action is required to mitigate this potential.
- Ecology and SPU will conduct a site inspection to evaluate current operations at the site with respect to stormwater and waste management.
- SPU will verify the storm drainage pathway at the site. If stormwater discharge to the Lower Duwamish Waterway is confirmed, Ecology's Water Quality Program and SPU will assess the need for stormwater characterization.
- Ecology and SPU will conduct periodic inspections of the site as needed to verify that current operations do not result in the release of contaminants to the Lower Duwamish Waterway.

3.5 MRI Corporation

The MRI Corporation (MRI) was a tin reclamation facility located on the northwestern portion of Terminal 115 which operated from 1963 to 1997/1998. M & T Chemicals, later MRI, leased approximately 1.88 acres from the Port of Seattle at Terminal 115 in 1963.

According to a Port of Seattle Marine Facilities site plan dated June 2004, the most recent tenant is Polar Supply. Polar Supply's lease at the property ends on December 31, 2009. Contact information for Polar Supply was not found by SAIC. It is not known if Polar Supply still occupies the site.

The tin reclamation facility had several names:

- 1963 to approximately 1978 – M & T Chemicals
- Approximately 1978 to approximately 1991 – MRI Corporation (affiliated with American Can) (E&E 1988)
- Approximately 1991 to 1997 – MRI Division of Proler International Corporation, Proler International, Proler Recycling (these names appear to have been used interchangeably) (METRO 1991d)
- 1997 to 1998 – Schnitzer Steel Industries, Inc.

In this report, all of these names refer to the former tin reclamation facility located at Terminal 115; however, the site is generally referred to as "MRI." The site is occasionally referred to as "MST Chemicals" in Ecology's files. This nomenclature appears to have been the result of a clerical error; the business was never known under this name (SKCPH 1998).

The site is located near the Duwamish River in an industrial area of Seattle (Figure 2). It is bordered on the north by Glacier Northwest, on the east by the Duwamish Waterway, on the south by Highland Park Way SW, and on the west by West Marginal Way SW.

The site is underlain by artificial fill that ranges from 8 to 12 feet in thickness. The artificial fill is underlain by localized alluvial silts and clays 20 to 25 feet in thickness. Depth to groundwater is greater than 15 feet and generally flows toward the Duwamish River. Terminal 115 was developed by filling the site with dredged sediments and imported fill materials. The terminal was completed in 1966 (E&E 1988, Herrera 1994).

M & T Chemicals is listed on the CSCSL for suspected contamination of soil, sediment, and groundwater by metals and corrosive wastes[6]. The only operational permit found on file was METRO Waste Discharge Permit No. 7067.

3.5.1 Current Site Use

According to the most recent available information, the current site tenant is Polar Supply. No additional information on current site use was available. The site contains a 9,697-foot warehouse.

According to a 2004 Port of Seattle map, there are two outfalls at the northeast property boundary that connect to storm drains extending from the former MRI property. A city of Seattle storm drain map (Figure 5) indicates that storm drains from this site discharge to the east-west main storm drain line that flows into the Duwamish at the southeast edge of the Glacier Bay Source Control Area.

[6] Department of Ecology – Toxics Cleanup Program, Integrated Site Information System, Confirmed and Suspected Contaminated Sites List (June 7, 2007)

3.5.2 Past Site Use

Detailed information on past site use is presented in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007), and is summarized below.

The site was used for tin reclamation processes beginning in 1963. Tin was reclaimed from scrap steel and recycled tin cans. Between 1991 and 1997, MRI generated an average of 2,200 tons of de-tinned steel and metal ingot per month (METRO 1991d). Beginning in 1997 or 1998, Schnitzer initiated closure of the tin reclamation and recycling operations at the site. The most recent recycling operation involved stripping steel cans and glass sludge (dross) of tin. Reclaimed tin was smelted and sold as ingots.

Raw materials such as large volumes of loose cans and baled steel scrap were temporarily stored at the site. Wastes stored at the site included spent plating solutions and black mud filtrate discharge. The steel was collected and sold for re-use. Black mud was dewatered using a filter press and stockpiled on site. The dewatered black mud was either sold for further tin reclamation or sent to the landfill (SKCPH 1998).

Site facilities included 15 storage and processing tanks, a magnetic separator, debris bin, steel shredding machine, can washer, and two 23,000-gallon storage tanks. Stormwater flowed to a central sump and was pumped to the two 23,000-gallon storage tanks or to the sanitary sewer in case of a heavy rain (METRO 1991d). A can washer was installed in 1991 and used collected stormwater to remove foodstuffs from tin cans. The system recycled the washwater by filtering the suspended solids and returning the water to the two 23,000-gallon storage tanks (METRO 1991d).

A 1987 Toxic Substances Control Act (TSCA) Site Inspection was conducted to evaluate the possible use of PCBs at the site. The site inspector found no transformers containing PCBs or evidence of PCB use at the site, but noted that the containment for the bulk chemical tank farm was inadequate in the event of a catastrophic spill; additionally, a storm drain was present approximately 50 feet downgradient of the tank farm (Ecology 1987b, 1987c, 1987d, 1987e). Ecology subsequently directed MRI to submit plans to address the containment area by the end of April 1997.

Before 1972, spent plating solution and black mud were discharged to two settling and evaporation lagoons located in the eastern portion of the site (Figure 9). The unlined lagoons were approximately 2,000 to 3,600 square feet in total area and approximately 6 feet deep. Approximately 3,500 gallons of black mud were discharged to the ponds each week. The accumulated mud was periodically excavated and sold for further tin reclamation. In 1972, the lagoons were abandoned when the dewatering filter press was installed at the site. At this time, the lagoons were cleaned out and the excavated mud was sold for further tin reclamation. Documentation that provided the volume of mud sold was not available for review. The lagoons were filled with gravel at a later date (E&E 1988, Harper-Owes 1985, SKCPH 1998).

From 1962 to 1975, 5,000 pounds of lacquer sludge was produced per year. The lacquer sludge is described as “highly alkaline with vinyls, epoxy’s [sic] and trace tin and lead” on a hazardous waste inventory prepared by the MRI plant manager. The lacquer sludge was

disposed to municipal landfills. Tin- and lead-bearing sludges are also listed on the hazardous waste inventory (M&T Chemicals 1980).

From 1972 to 1991, the entire eastern area of the site was paved, including the lagoons. Black mud was stockpiled onsite and periodically sold for further tin reclamation, although no mud was sold from 1987 to 1991. Analytical results for waste characterization samples of the black mud indicated that the material could be classified as a nonhazardous waste. The mud was accepted for disposal to a regular landfill (SKCPH 1998). Spent electrowinning solution was stored in a 15,000-gallon tank. The solution was analyzed for metals and pH before being discharged to the METRO sanitary sewer in 3,200-gallon batches approximately every 5 days (METRO 1991d). Spent electrowinning solution that was outside the METRO discharge limit for pH or metals was neutralized with sulfuric acid or sodium hydrosulfide (METRO 1991d).

Black mud filtrate consisting of paper pulp from can labels, paint from labels, lacquer solids from the interior of cans, residual food stuffs, dirt and debris, tin compounds, aluminum oxide, and other precipitated metals was discharged directly to the METRO sanitary sewer (METRO 1991d).

Stormwater from roof drains of the warehouse discharged to the Duwamish River via local storm sewers (METRO 1991g). MRI estimated a maximum of 4,000 gallons of stormwater per day were discharged to the Duwamish River (METRO 1991d). All other site wastewater and stormwater was apparently discharged to the METRO sanitary sewer, until 1991 when the new can washer system that used recycled stormwater was installed at the site. After 1991 all stormwater was collected and used in the can washing system (METRO 1991d).

3.5.3 Environmental Sampling/Cleanup

The following investigations have been conducted at the MRI Corporation site:

- Waste Characterization Program, conducted in February 1991 by ENSR Consulting and Engineering for MRI Corporation (ENSR 1991)
- Site Hazard Assessment, conducted in October and November 1997 by the Seattle-King County Department of Public Health (SKCPH 1998)

These investigations are described in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007), which includes analytical results for sediment, soil, and groundwater samples. No cleanup actions are known to have been conducted at the site.

In February 1991, ENSR collected 36 samples of black mud from two stockpiles (ENSR 1991). The estimated volume of the stockpiles was 200 cubic yards. The samples were analyzed for corrosivity (pH) and RCRA TCLP metals. One composite sample was analyzed for ignitability and reactivity characteristics. No analytes were detected above the maximum concentration limits listed in WAC 173-303-090 (ENSR 1991).

In November 1997, SKCPH conducted a Site Hazard Assessment for this site. They collected three soil samples from the unpaved railroad spur area (SKCPH 1998). The samples were collected between 5 and 6 inches below ground surface. Chromium (8.4 to 33 mg/kg DW) and lead (36 to 470 mg/kg DW) were detected at concentrations above the MTCA Method A

cleanup levels. Zinc (76 to 330 mg/kg DW) and tin (170 to 880 mg/kg DW) were elevated, but were not at or near the Method B cleanup levels. A hazard ranking of 5 was assigned to the MRI site, where 1 represents the highest risk to human health and/or the environment relative to other Washington state sites and 5 the lowest.

3.5.4 Potential for Future Releases to Glacier Bay

Although past operations at the site, including the presence of unlined lagoons, indicate a potential for contamination of soil and groundwater with metals including tin and zinc, little environmental investigation has been conducted at this site to assess whether contaminants are present. Three soil samples were collected in 1997, which indicated elevated levels of zinc and tin and MTCA exceedances for chromium and lead; however, no site characterization has been performed and no groundwater samples have been collected. Zinc, lead, and tin were identified as contaminants of concern for the Glacier Bay Source Control Area (see Section 2.1). Therefore, this site may be a potential source for recontamination of Glacier Bay sediments.

No information was found in the available files describing the operations performed at the site by the most recent tenant, Polar Supply. Current operations at the site may present a potential contaminant pathway from the storm drain to the outfalls connected to the Duwamish River.

3.5.5 Source Control Actions

The following source control actions will be conducted:

- Ecology and SPU will conduct a site inspection to evaluate current operations at the site with respect to stormwater and waste management.
- SPU will verify the storm drainage pathway at the site. If stormwater discharge to the Lower Duwamish Waterway is confirmed, Ecology's Water Quality Program and SPU will assess the need for stormwater characterization.
- Ecology will pursue further investigation of the potential for groundwater transport of contaminants to Glacier Bay or to storm drain lines which discharge to Glacier Bay. If groundwater samples are collected, they will be analyzed for contaminants of concern with respect to sediment recontamination in the Glacier Bay Source Control Area.
- Ecology will review results of any sampling conducted, assess the potential for sediment recontamination from this property, and will work with the Port of Seattle to determine whether remedial action is required to mitigate this potential.
- Ecology and SPU will conduct periodic inspections of the site as needed to verify that current operations do not result in the release of contaminants to the Lower Duwamish Waterway.

3.6 The Chemithon Corporation

The Chemithon Corporation is located at 5430 West Marginal Way SW. The site is bordered by La Farge Cement Plant on the north and east, Alaska Marine Lines on the south, and West Marginal Way SW on the west.

Chemithon manufactures chemical process equipment for the production of anionic detergents, process equipment for the power generation industry, and other chemical process equipment (Chemithon 2003). In addition, Chemithon operates a research pilot plant facility for the testing of new products and equipment. The facility operates under Industrial Stormwater General Permit Number SO3-000033 and RCRA ID number WAD009244898.

3.6.1 Current Site Use

Chemithon operates a machine shop and a fabrication, welding, and assembly shop, as well as a research pilot plant facility (Chemithon 2003). A 2006 site plan shows that the site is covered with buildings and asphalt/concrete pavement. There are four manufacturing buildings, a research and development building, and three office buildings on the site. Covered storage areas are present on the north side of the property, including an aluminum SO_2 shed and barrel storage area. A gas pump station is located at the northeast corner of the property. A diesel fuel shed, aboveground storage tank (AST), and a transformer on a concrete pad are present at the southwest corner of the property.

Hazardous substances used at the site include solvents, paints, and petroleum naphtha; in 2005, approximately 183 pounds of hazardous waste were generated (Chemithon 2006c). Diesel fuel is stored in a 250-gallon AST. SPU referred the site to the Seattle Fire Department following an April 2006 site inspection, stating that the AST may not meet regulatory requirements (SPU 2006b). An oil/water separator is located near the AST (SPU 2006b).

Materials stored outside include containerized products, used equipment, and equipment and materials awaiting disposal or recycling. The storage areas are paved and covered. Berms or other barriers protect the storage areas from stormwater runoff (SPU 2006a). Metal shaving bins are stored inside or outside in covered storage. Used coolants, hydraulic oil, and gear oil are stored in drums (SPU 2006c).

Forklift and outside equipment pad washwater drains to the sanitary sewer. Wastewater (heating or cooling water with some concentrations of laundry detergent) and small amounts of stormwater drain to the sanitary sewer.

There are 20 stormwater catch basins on the site that are cleaned on an “as needed” basis, but are pumped at least every 2 years. A 2006 SPU site inspection found that the catch basins were over 60 percent full of sediment and plant materials (SPU 2006a, 2006b). Soap was present in the catch basins. Stormwater was directed from the catch basins to a sump, located at the southeast corner of the property, which discharged to the sanitary sewer. An outfall that discharged stormwater from the sump to the Duwamish River had been sealed off.

In October 2006, King County Wastewater Treatment Division directed Chemithon to stop discharging stormwater runoff to the sanitary sewer. Chemithon has an NPDES stormwater permit but has not been discharging to the Duwamish River. Chemithon plans to collect four samples of the water for three months to characterize water quality including pH, turbidity, zinc, oil and grease, and TOC. Chemithon cleaned out the catch basins prior to sampling. Chemithon is discussing the sampling results with the King County Wastewater Treatment Division and Ecology prior to modifying the stormwater drainage system (Chemithon 2006b).

3.6.2 Past Site Use

No information on past use of this site was identified.

3.6.3 Environmental Sampling/Cleanup

SPU collected catch basin sediment samples in May, October, and November 2006 and catch basin sediment samples, a catch basin solid sample, and a water sample in February 2007 from the site (ARI 2006a, 2006b, 2006c and 2007). The following chemicals (with maximum detected concentration shown in parenthesis) exceeded the SQS in catch basin sediments:

- Arsenic (150 mg/kg DW)
- Benzo(a)anthracene (310 mg/kg OC)
- Benzo(a)pyrene (251 mg/kg OC)
- Benzo(b)fluoranthene (217 mg/kg OC)
- Benzo(k)fluoranthene (236 mg/kg OC)
- Bis(2-ethylhexyl)phthalate (492 mg/kg OC)
- Butylbenzyl phthalate (142 mg/kg OC)
- Chrysene (345 mg/kg OC)
- Indeno(1,2,3-cd)pyrene (108 mg/kg OC)

In addition, 2,4-dimethylphenol, 2-methylnaphthalene, 2-methylphenol, 4-methylphenol, Aroclor 1254, Aroclor 1260, arsenic, BEHP, butylbenzylphthalate, lead, mercury, and zinc exceeded soil-to-sediment screening levels[7] in the single catch basin solids sample that was collected. In the water sample, copper (46 ug/L) exceeded the marine chronic and acute water quality standards. The sample data are provided in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007).

3.6.4 Potential for Future Releases to Glacier Bay

The Chemithon Corporation plans to discharge stormwater to the Lower Duwamish Waterway. Catch basin samples collected by SPU found several chemicals exceeded screening criteria including PCBs, methylphenolic compounds, phthalates, PAHs, copper, lead, mercury, zinc, and petroleum hydrocarbons. Results of follow-up inspections and sampling are needed to assess the potential for sediment recontamination from this facility.

3.6.5 Source Control Actions

The following source control actions will be conducted at this site:

- The Chemithon Corporation will prepare and/or update its Stormwater Pollution Prevention Plan and processes to ensure that site activities do not result in transport of contaminants to the Lower Duwamish Waterway via the stormwater conveyance system.

[7] See discussion of screening levels in Section 3.2.5.

- Ecology and SPU will conduct follow-up inspections and sampling as needed to verify that current operations do not result in the release of contaminants to the Lower Duwamish Waterway and to ensure compliance with the industrial stormwater general permit.

3.7 Other Upland Properties

Other upland sites may contribute contamination to Glacier Bay through stormwater and other discharges to piped outfalls and through contaminated groundwater that may infiltrate into a stormwater system that discharges to the inlet. If COCs from an upland site reach the waterway, they could recontaminate the sediments. Additional upland properties are shown in Figure 6, and include:

- Alaska Marine Lines Parcels 9050, 9093, 9090, 9081, and 9115
- Wise Property
- Klier DV
- Allen Property
- City of Seattle Parks Department
- Sayler Property

These upland properties are described in *Summary of Existing Information and Identification of Data Gaps* (SAIC 2007). No specific concerns have been identified with regard to the potential for sediment recontamination associated with these properties.

3.7.1 Source Control Actions

The following source control actions will be conducted:

- SPU will conduct site inspections as needed to promote pollution prevention practices and to ensure that these properties do not represent a potential for recontamination of Glacier Bay sediments.

3.8 Atmospheric Deposition

Air pollution can enter the Lower Duwamish Waterway directly or through stormwater, thus becoming a possible source of sediment contamination to Glacier Bay. Air pollution can be localized, resulting from paint overspray, sandblasting, and fugitive dust and particulates caused by loading/unloading of raw materials such as sand, gravel, and concrete. Air pollution can also be widely dispersed from vehicle emissions, industrial smokestacks, and other sources.

King County and SPU have been monitoring atmospheric deposition to assess whether it is a potential source of phthalates, particularly BEHP, in stormwater runoff (King County and SPU 2005). Passive deposition samplers (i.e., stainless steel bowls that drain into a glass bottle) were placed at four locations in the Lower Duwamish Waterway area as well as in surrounding neighborhoods to collect samples of both wet and dry atmospheric deposition. Results showed PAHs, butyl benzyl phthalate, and BEHP in the Duwamish Valley at concentrations two to three times higher than outside the valley during the winter months

(King County and SPU 2005). This finding is consistent with previous sampling results by Puget Sound Clean Air Agency (PSCAA) showing atmospheric particulate concentrations trending higher during fall/winter months than during spring/summer months.

The King County/SPU study (2005) concluded that the Lower Duwamish sample results compared well with studies conducted within the same airshed (i.e., Georgia Basin) and with other regions (i.e., Great Lakes and Roskilde Fjord [Denmark] studies). PAH values observed in Lower Duwamish samples (0.006 to 0.28 ug/m^2/day) were comparable to the average values reported for the Georgia Basin airshed (0.004 to 0.36 ug/m^2/day). The Lower Duwamish Waterway BEHP values (0.23 to 3.5 ug/m^2/day) were higher than the Georgia Basin average values (0.3 to 0.6 ug/m^2/day), but were comparable with the results from the Denmark study (0.068 to 2.16 ug/m^2/day). The study noted that further atmospheric deposition testing was needed to evaluate the reproducibility of results and to perform correlations with existing atmospheric measurements (e.g., particulate concentrations).

3.8.1 Source Control Actions

Atmospheric deposition should be further evaluated to assess whether it is a potential source of phthalates (particularly BEHP) and other contaminants, such as PCBs, in stormwater runoff. However, at this time, there are no available resources to address this issue.

King County and SPU have set up a special work group to deal with phthalate issues. Members of the phthalate work group include staff from KCIW, King County Hazardous Waste, King County Environmental Laboratory, and SPU. Any future work to assess atmospheric deposition as a potential source of phthalates and other contaminants in stormwater will consider the findings and recommendations of the Phthalate Work Group.

4.0 Monitoring

Monitoring efforts by SPU, Ecology, KCIW, and PSCAA will continue to assist in identifying and tracing ongoing sources of COCs present in Lower Duwamish Waterway sediments. This information is being used to focus source control efforts on specific problem areas within the Glacier Bay drainage basin and to track the progress of the source control program. The following types of samples will continue to be collected:

- Inline sediment trap samples from storm drain systems,
- Onsite catch basin sediment samples, and
- Soil and groundwater samples as necessary.

If monitoring data indicate that additional sources of sediment recontamination are present, then Ecology will identify additional source control activities as appropriate.

Because source control is an iterative process, monitoring is necessary to identify trends in concentrations of COCs. Monitoring is anticipated to continue for some years. Any decisions to discontinue monitoring will be made jointly by Ecology and EPA, based on the evidence. At this time, Ecology plans to review the progress and data associated with the source control action items for each SCAP annually, and will periodically prepare Technical Memoranda to update the SCAPs.

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5.0 Tracking and Reporting of Source Control Activities

Ecology is the lead for tracking, documenting, and reporting the status of source control to EPA. In turn, source control activities will be documented by the appropriate agency performing the source control work. The agencies will provide reports to Ecology, who will provide waterway-wide and basin-specific reports.

The management of information and data is divided into two levels. The first level is documentation and tracking, where information is organized so that Ecology can track and manage source control activities at a given source or within a given basin. The second level is reporting to EPA. Please refer to the Lower Duwamish Source Control Strategy for further details (Ecology 2004).

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Note: Reference notations are used as listed in Summary of Existing Information and Identification of Data Gaps (SAIC 2007) to minimize confusion between the two documents.

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Figures

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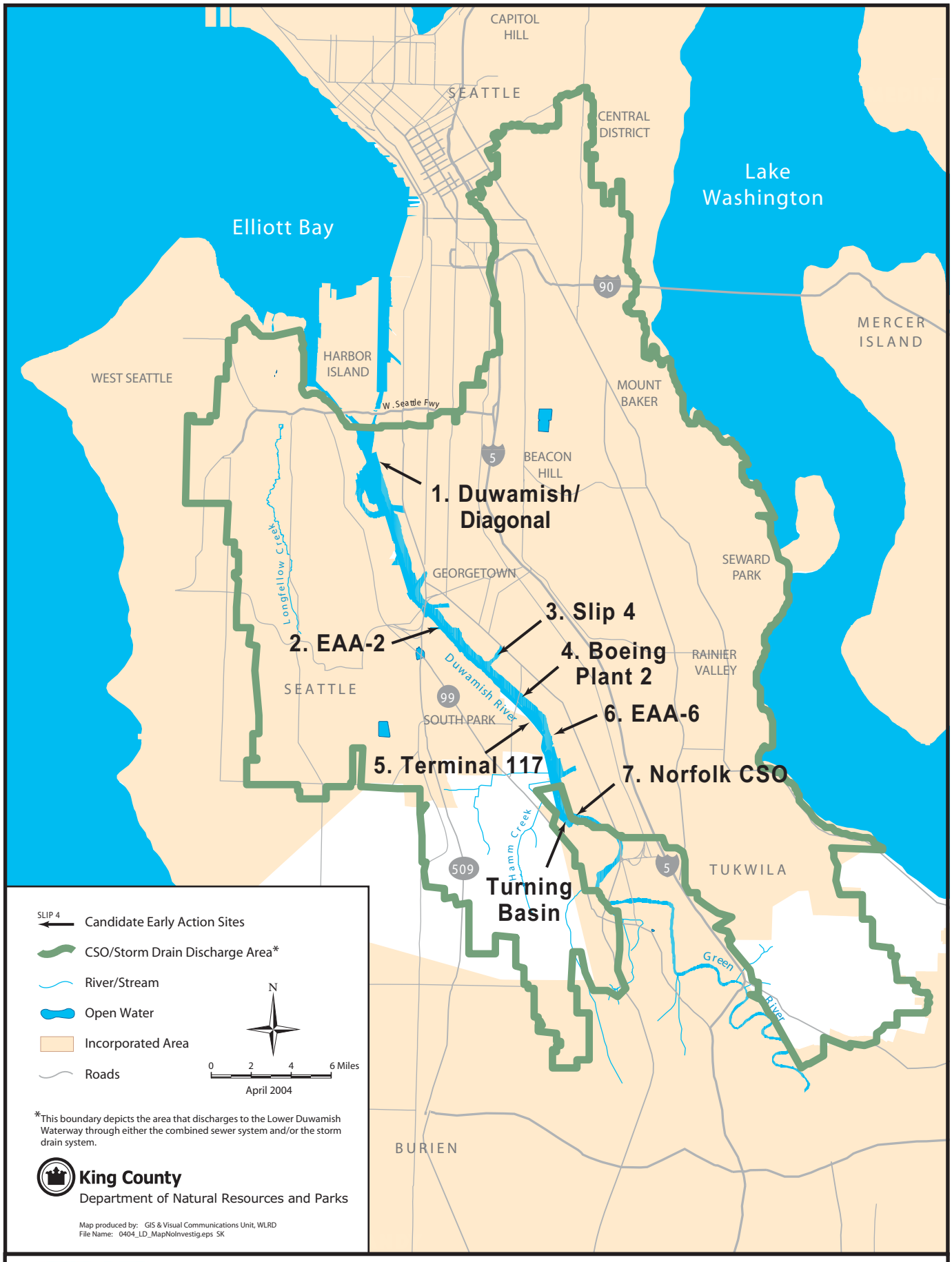

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Figure 1. Lower Duwamish Waterway Site

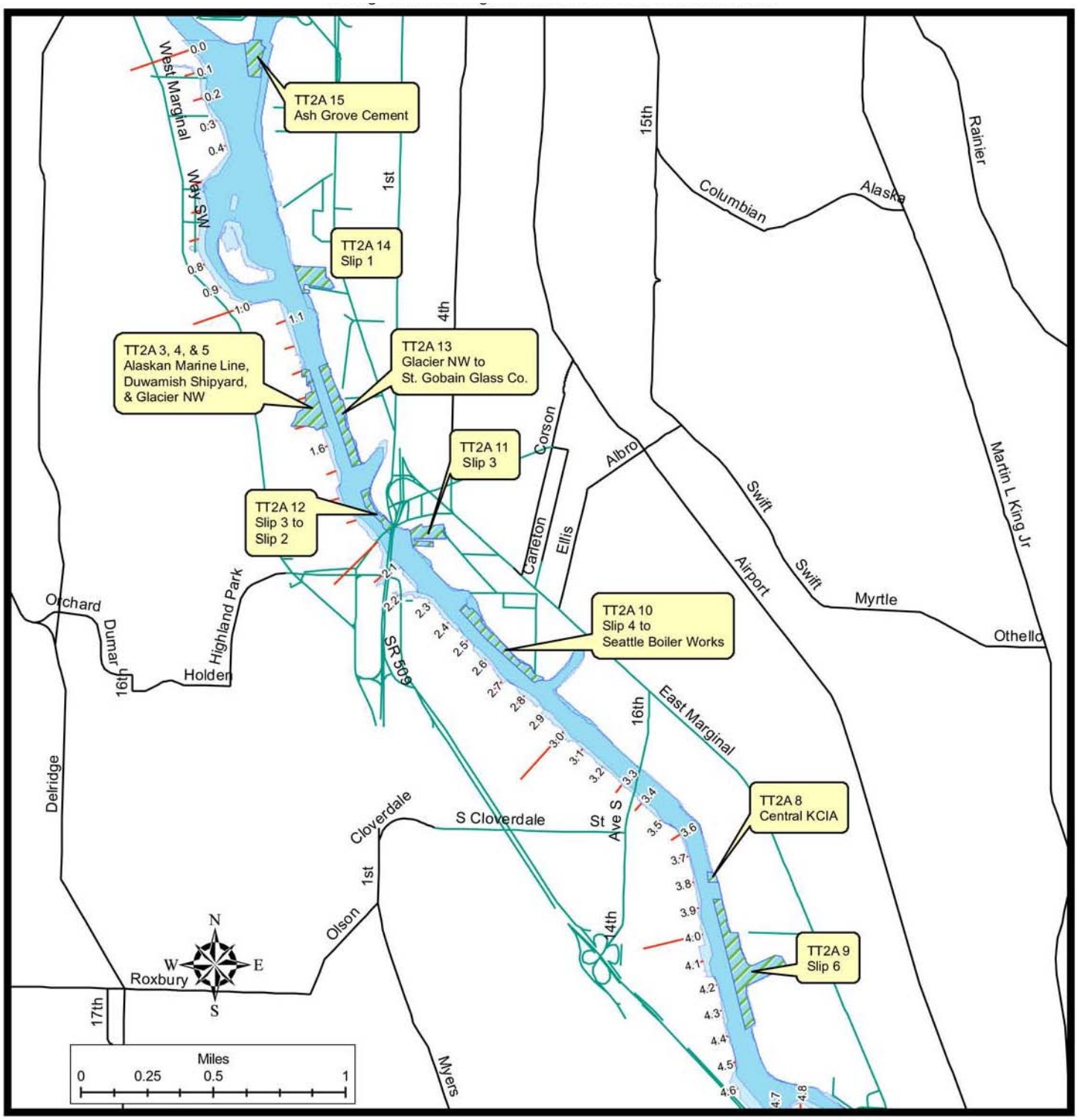

Figure 2. Tentative Tier 2 Areas

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Figure 3. Glacier Bay Source Control Area

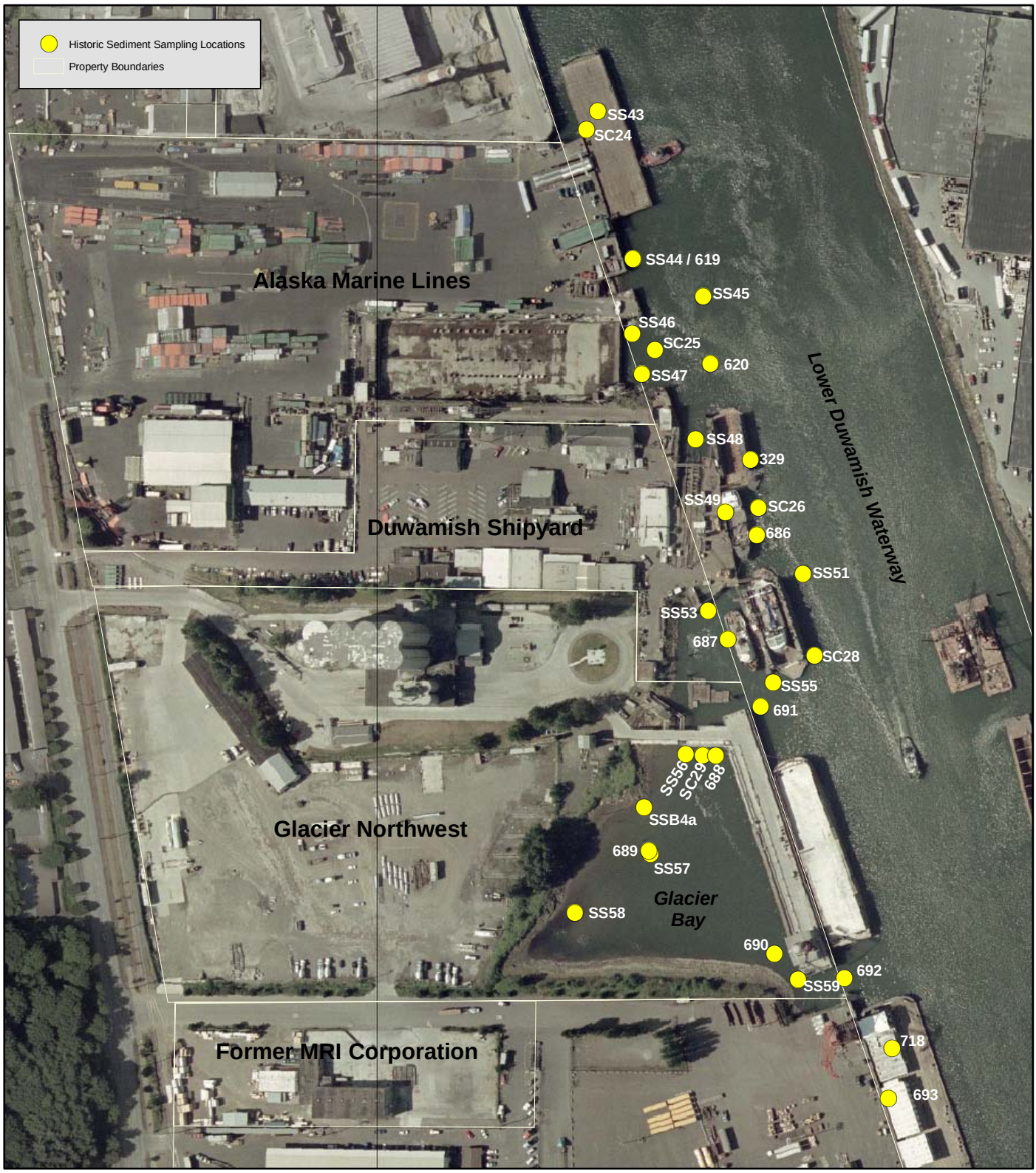

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Figure 4. Glacier Bay Sediment Sample Locations

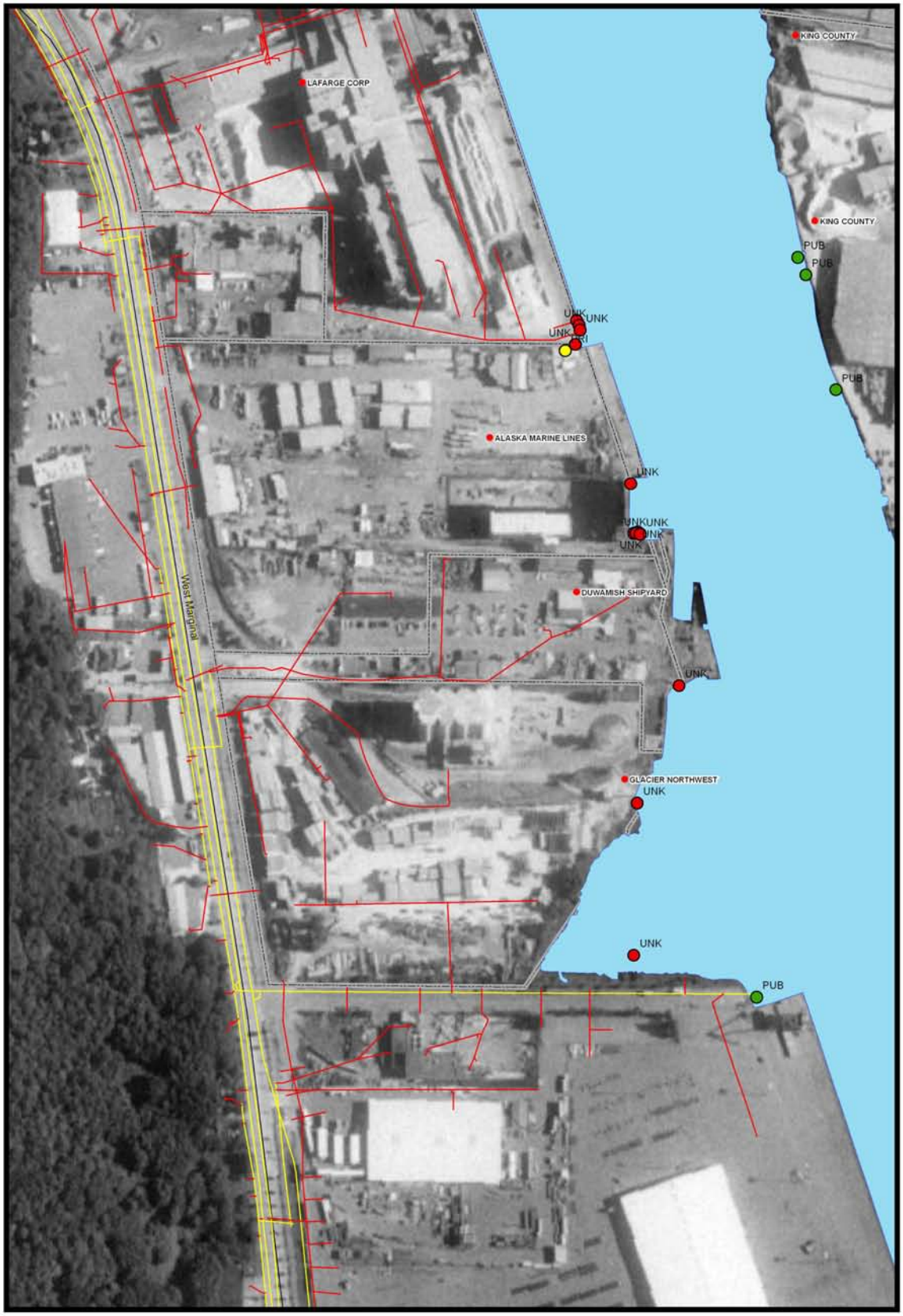

Figure 5. Storm Drain Lines at Glacier Bay Source Control Area

Source: Seattle Public Utilities

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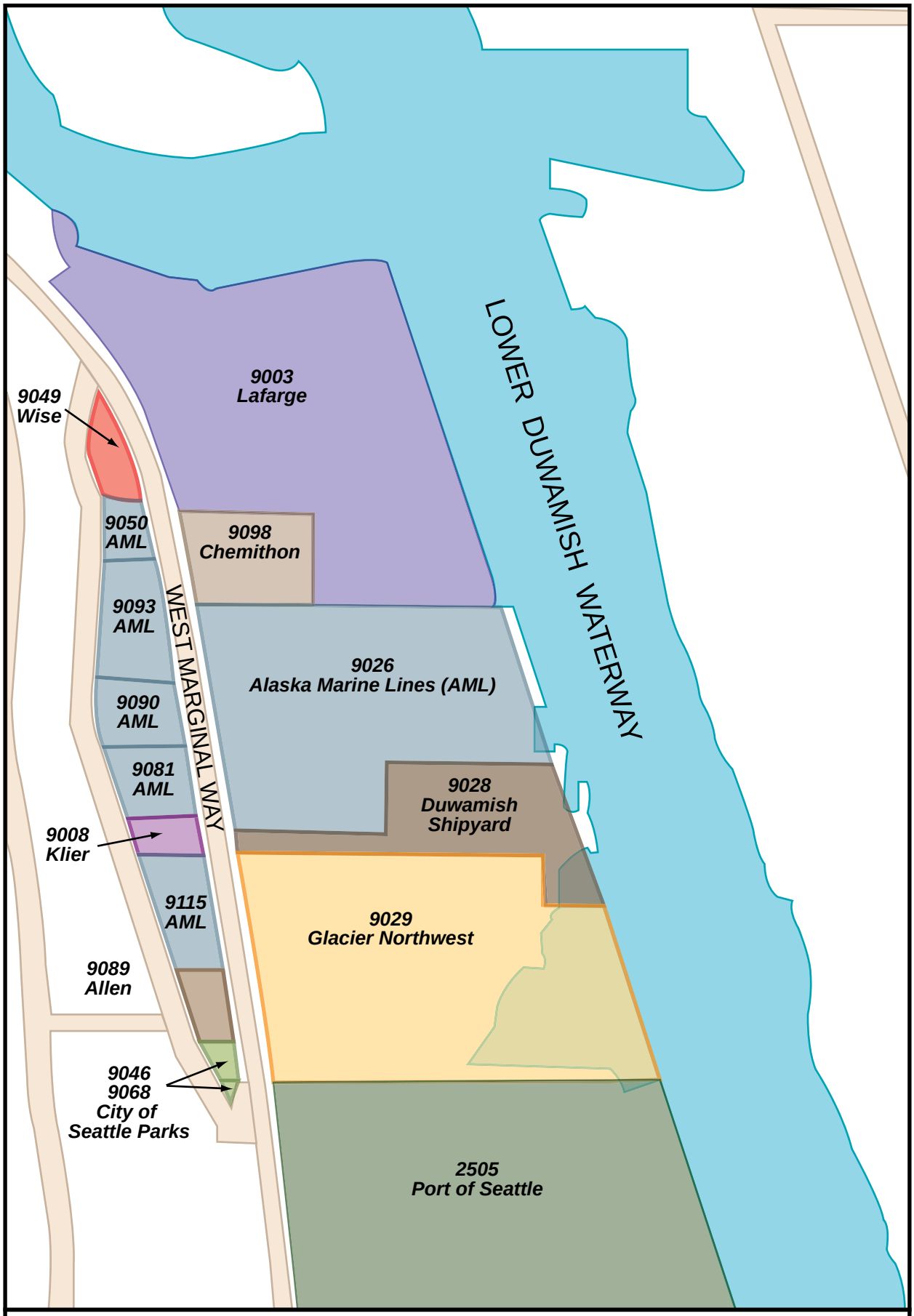

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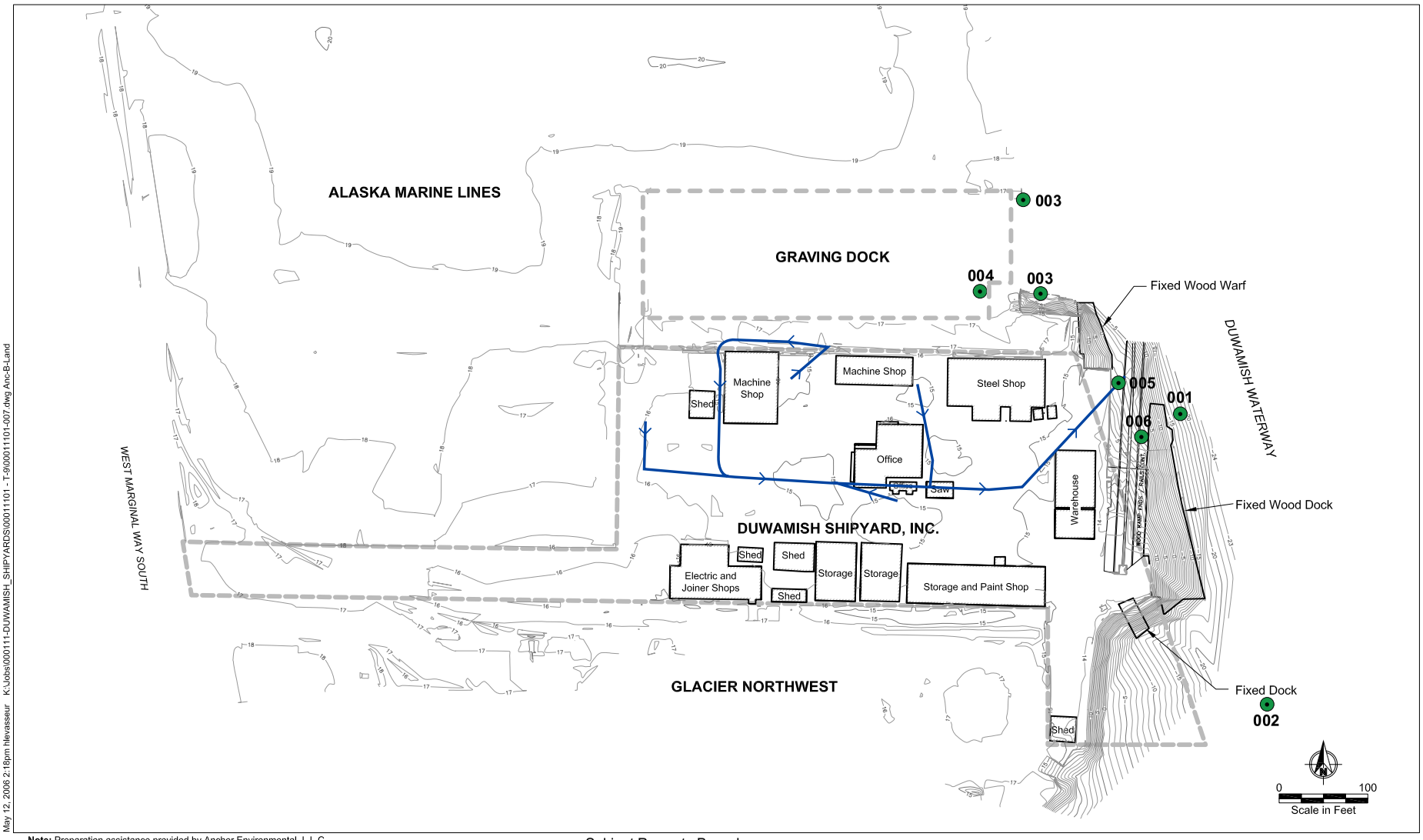
Figure 6. Parcel Ownership for Glacier Bay Source Control Area



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Note: Preparation assistance provided by Anchor Environmental, L.L.C.

DUWAMISH SHIPYARD INC.

Subject Property Boundary
10 Ground Elevation Contour in Feet (in MLLW)
001 NPDES Discharge Sampling Location and Outfall Number
Stormwater Drainage System and Flow Direction

Current Property Boundary
Duwamish Shipyard, Inc.
Seattle, Washington

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Figure 7. Duwamish Shipyard
Source: Anchor Environmental, LLC. 2006

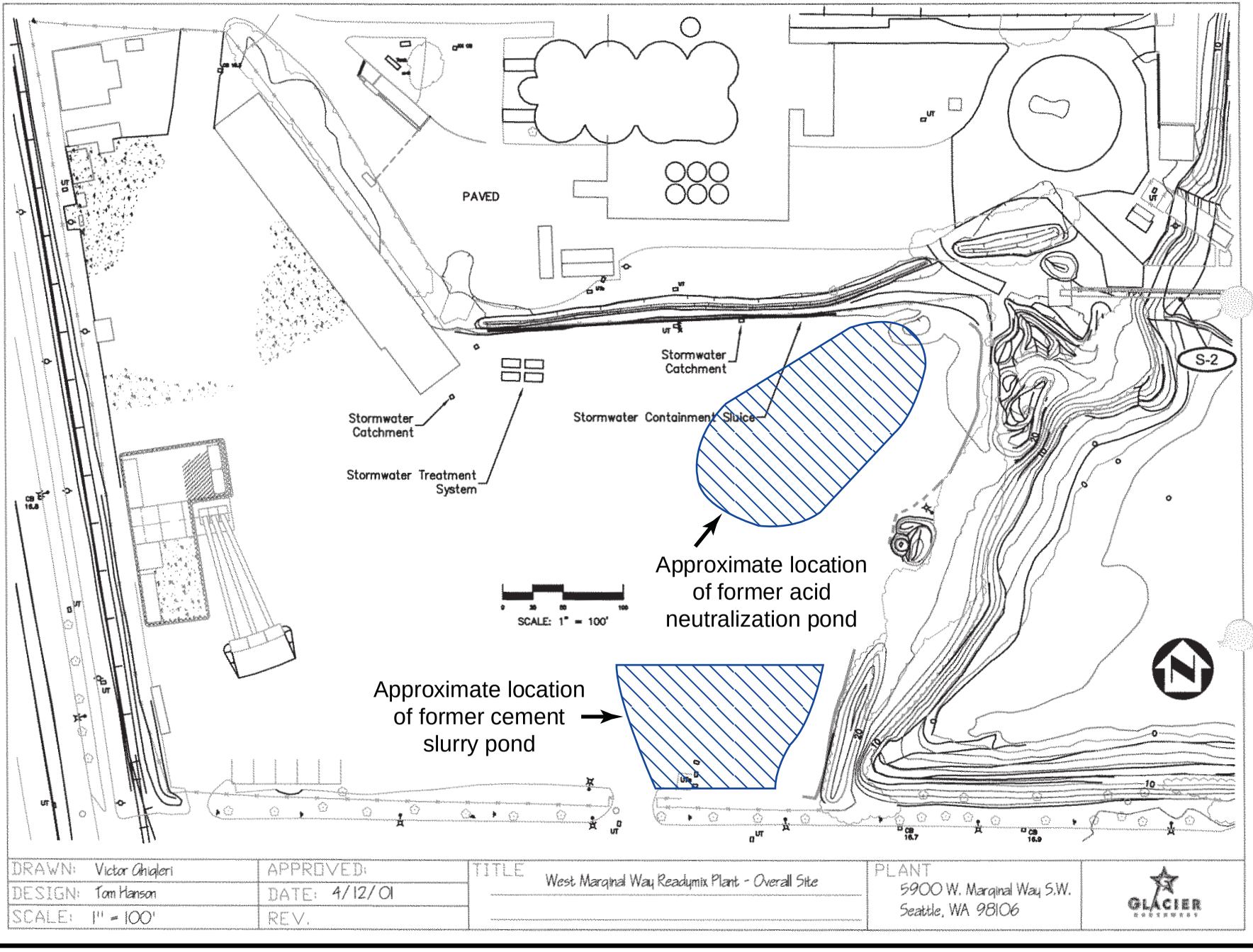

Figure 8. Glacier Northwest

Source: Glacier Northwest 2001, Parametrix, Inc. 1990

Stormwater Outfall

Not to Scale

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Figure 9. MRI Corporation

Source: Ecology & Environment, Inc. 1988, Harbor Engineering Co. 2004