

Five-Year Review Report

Commencement Bay Nearshore/Tideflats
Superfund Site
Tacoma, Washington

EPA Region 10

Prepared by:

Region 10 Environmental Cleanup Office

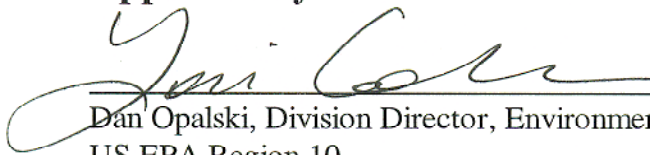
December 29, 2004

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Tacoma, Washington

EPA Region 10

Approved by:



Dan Opalski, Division Director, Environmental Cleanup Office
US EPA Region 10

12/29/04
Date

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Five-Year Review Summary Form

SITE IDENTIFICATION

Site name (from WasteLAN): Commencement Bay, Near Shore/Tide Flats

EPA ID (from WasteLAN): WAD980726368

Region: 10

State: WA

City/County: Tacoma, Pierce County

SITE STATUS

NPL status: Final Deleted Other (specify) _____

Remediation status (choose all that apply): Under Construction Operating Complete

Multiple OUs?* YES NO

Construction completion date: ___ / ___ / ___

Has site been put into reuse? YES NO

REVIEW STATUS

Lead agency: EPA State Tribe Other Federal Agency _____

Author name: Piper Peterson Lee and Nancy Harney

Author title: RPMs

Author affiliation: EPA

Review period:** 12 / 29 / 1999 to 12 / 29 / 2004

Date(s) of site inspection: ___ / ___ / ___ – ongoing at each waterway/Asarco area

Type of review:

- Post-SARA Pre-SARA NPL-Removal only
 Non-NPL Remedial Action Site NPL State/Tribe-lead
 Regional Discretion

Review number: 1 (first) 2 (second) 3 (third) Other (specify) _____

Triggering action:

- Actual RA Onsite Construction at OU # _____ Actual RA Start at OU# _____
 Construction Completion Previous Five-Year Review Report
 Other (specify) _____

Triggering action date (from WasteLAN): 12 / 26 / 1999

Due date (five years after triggering action date): 11 / 15 / 2009

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

Summarize issues.

1. Hylebos/Occidental. Additional investigations regarding the groundwater pathway and contaminated sediments
2. Sitcum. Port of Tacoma record a certified copy of the CD with the Registry of Deeds in Pierce County
3. St. Paul. Conduct an additional analysis of institutional controls (ICs) for the "deleted-from-the-NPL" portion of the site.
4. Thea Foss. EPA analyze additional data and make recommendations for further actions on the recontaminated portion of the Utilities' cap.
5. Thea Foss. City of Tacoma complete the design and implement the Bunker mitigation site on Hylebos Creek.
6. Thea Foss. Get approval from the U.S. Army Corps of Engineers for the Puyallup River Side Channel mitigation project to initiate this project.
7. Thea Foss/Utilities Work Area. Federal deauthorization of the navigational channel needed at the Head of the waterway.
8. Ruston/North Tacoma Study Area. Resample a subset of zone 1 and 2 properties to determine if there is recontamination.
9. Asarco Sediments. Implement remedy
10. Asarco Smelter. Repair portion of shoreline that collapsed after an earthquake into a mitigation area.
11. Asarco Smelter. Review of potential redevelopment plans to ensure they are protective of human health and the environment and the environmental cleanup remedy.

Recommendations and Follow-up Actions:

Summarize recommendations and follow-up actions.

1. Sitewide. Review monitoring at mitigation sites and describe the contribution of those sites towards the recovery of listed ESA species
2. Sitewide. Develop a work plan to conduct fish tissue sampling for CB/NT after sediment remedial actions are complete.
3. Sitewide. Implement ICs for all waterways and review status of ICs already in place
4. Sitewide. Implement Operations, Maintenance and Monitoring Plans for Hylebos, Middle and Thea Foss and Wheeler-Osgood Waterways to ensure effectiveness of RA and mitigation activities.
5. Sitewide. Include Tacoma Tar Pits (OU 03) in third Five-Year Review.
6. Hylebos/Occidental. Complete the characterization of the Occidental site, select and implement remedy.
7. St. Paul. Analyze the ICs to ensure they are consistent with EPA's September 2004 IC Strategy.
8. Sitcum. Work with Port of Tacoma to ensure adequate land use restrictions for Milwaukee Habitat and Clear Creek Habitat mitigation site and the CDF in Milwaukee Waterway.
9. Thea Foss. Analyze data and make recommendations for further actions on the recontaminated portion of the Utilities' cap.
10. Thea Foss. Track and ensure timely review of the Puyallup River Side Channel property transfer from the Corps of Engineers to the City of Tacoma.
11. Thea Foss/Utilities Work Area. Track deauthorization language on the Water Resources and Development Act Bill in Congress
12. Ruston/North Tacoma Study Area. Re-sample properties in zones 1 & 2.
13. Ruston/North Tacoma Study Area. EPA and Ecology meet to discuss areas outside of the Study Area with arsenic concentrations greater than 230 ppm.
14. Asarco Smelter and Sediments. Remedy implementation dependent on Asarco Trust fund monies.
15. Asarco Smelter. Rebuild shoreline armoring that collapsed into the adjacent mitigation site; dependent

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COMMENCEMENT BAY NEARSHORE/TIDEFLATS SUPERFUND SITE
TACOMA, WASHINGTON

1 INTRODUCTION

The Commencement Bay Nearshore/Tideflats Superfund site (CB/NT Site) is located in Tacoma, Washington at the southern end of the main basin of Puget Sound. This National Priorities List (NPL) site includes three main components: Source Control (Operable Unit 5) for Commencement Bay, remediation of the CB/NT Sediments (Operable Unit 1) and remediation of the Asarco Smelter Facility and surrounding impacted areas (Operable Units 2, 4 and 6), referred to as the “Asarco Area.” The Washington Department of Ecology (Ecology) is lead for source control actions. Cleanup of the CB/NT sediments is being conducted under EPA oversight. Cleanup of the Asarco Area is also conducted under EPA’s oversight.

Overall, the site is divided into six Operable Unit (OUs) –

- OU 01 Commencement Bay Nearshore/Tideflats Sediments,
- OU 02 Asarco Tacoma Smelter,
- OU 03 Tacoma Tar Pits,
- OU 04 Asarco Off-Property (referred to as the ERA sites),
- OU 05 Commencement Bay Nearshore/Tideflats Sources,
- OU 06 Asarco Sediments.

The CB/NT Sediments include 6 waterways, referred to as Problem Areas and are called – Hylebos, Sitcum, St. Paul, Middle, Thea Foss and Wheeler-Osgood Waterways – and 2 removal actions known as Olympic View and Occidental.

The first Five-Year Review was conducted in December 1999. That review is the trigger for conducting this second Five-Year Review. This is a statutory Five-Year Review

The purpose of a Five-Year Review is to determine whether the remedy at a site is protective of human health and the environment. In addition, Five-Year Review reports identify issues or deficiencies found during the review, if any, and recommendations to address them.

The Agency is preparing this Five-Year Review pursuant to CERCLA 121 and the NCP. CERCLA 121 states that:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such review.

The agency interpreted this requirement further in the NCP; 40 CFR 300.430(f)(4)(ii) which states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The focus of this Five-Year Review will be the Hylebos, Sitcum, St. Paul, Middle, and Thea Foss and Wheeler-Osgood Waterways problem area sediments, and two removal action areas known as Olympic View Resource Area and Occidental, as part of Operable Unit 01 (CB/NT Sediments) of the CB/NT Superfund Site. The Asarco Area operable units (OU 02, 04 and 06) will also be reviewed. The Five-Year Review for Operable Unit 03 – Tacoma Tar Pits was conducted in September 2003. It is considered a separate and unique upland site within the Commencement Bay area and is managed separately by EPA.

EPA conducted the document review, data analysis and technical assessment of the remedy.

2 SITE CHRONOLOGY

See individual write ups below in Section 4.0.

3 BACKGROUND

3.1 Site Location and Description

The CB/NT Superfund site is located in the City of Tacoma (City) and Town of Ruston (Ruston), Washington, at the southern end of the main basin of Puget Sound (Figure 1). The site encompasses an active commercial seaport and includes 10-12 square miles of shallow water, shoreline, and adjacent land, most of which is highly developed and industrialized. The upland boundaries of the site are defined according to the contours of localized drainage basins that flow into the marine waters. The marine boundary of the site is limited to the shoreline, intertidal

areas, bottom sediments, and water of depths less than 60 feet below mean lower low water (MLLW). The nearshore portion of the site is defined as the area along the Ruston shoreline from the mouth of the Thea Foss Waterway to Pt. Defiance. The tideflats portion of the site includes the Hylebos, Blair, Sitcum, St. Paul, Middle, Wheeler-Osgood, and Thea Foss Waterways; the Puyallup River upstream to the Interstate-5 bridge; and the adjacent land areas.

The CB/NT site is located within the City and Ruston. The land, water, and shoreline within the site boundary are owned by various parties, including the state of Washington, the Port of Tacoma, the City, Pierce County, the Puyallup Tribe of Indians, and numerous private entities. Much of the publicly owned land is leased to private enterprises. Within the site boundaries, land use is chiefly industrial and commercial. Ruston is primarily residential.

The Port of Tacoma operates many cargo handling and storage facilities along the Sitcum Waterway and owns and leases properties to large and small industrial, manufacturing, marina, and commercial tenants in the Hylebos and Thea Foss Waterways. Major private landowners include lumber, chemical, and petroleum companies. The Simpson Tacoma Kraft Company owns the property on both sides of the St. Paul Waterway and along the eastern shore of Middle Waterway. A majority of the property along the Hylebos Waterway is owned by private companies, and there are several privately-owned parcels along the Blair Waterway. The Thea Foss and Wheeler-Osgood Waterways have a mixture of privately-owned businesses with a large tract along the west side of the Thea Foss Waterway purchased by the City to facilitate a large urban renewal project. Other privately owned parcels are found predominantly at the landward end of the port and industrial area.

A large portion of the tideland and offshore areas of the CB/NT site is either owned or managed by the State of Washington through the Department of Natural Resources (DNR), or is designated as state-owned harbor areas. Most of the bottom sediments in the Thea Foss and Middle Waterways are state land. The Port of Tacoma owns tidelands and bottom sediments in several areas including Hylebos Waterway, the Head of Blair Waterway, and Sitcum Waterway. Bottom sediment in the St. Paul and Wheeler-Osgood waterways are privately owned. Private ownership of the shorelines and intertidal areas in many portions of the site generally corresponds with ownership of the adjacent upland property parcels.

Contaminants in the CB/NT area originate from both point and nonpoint sources. Early industrial surveys conducted by the Tacoma-Pierce County Health Department (TPCHD) and the Port of Tacoma indicated that there are more than 281 active industrial facilities in the CB/NT area. Approximately 34 of these facilities are National Pollutant Discharge Elimination System (NPDES)-permitted dischargers. Other sources to the CB/NT site include numerous storm drains, contaminated groundwater seeps, open channels, atmospheric deposition, direct dumping or filling, and industrial spills. TPCHD identified several hundred nonpoint sources that empty into Commencement Bay.

Commencement Bay, including the CB/NT site, supports important fishery resources. Salmonid species including steelhead and bull trout occupy the bay for part of their life cycle. Extensive

inshore marine fish resources include English sole, rock sole, flathead sole, c-o sole, sand sole, starry flounder, and speckled sand dab. Rock sole, c-o sole, and several species of rockfish are most abundant along the outer shoreline. Although the TPCHD has warned against regularly consuming fish, shellfish, and crabs caught within the study area, recreational harvesting of many of these species occurs, primarily within the Thea Foss Waterway and along the Ruston-Pt. Defiance Shoreline. Signs are posted around the waterway in 5 languages warning the public not to eat the fish and shellfish. Puget Sound Chinook salmon are now an Endangered Species Act (ESA) listed species.

3.2 Site History

At the time of urban and industrial development in the late 1800s, the south end of Commencement Bay was composed largely of tideflats formed by the Puyallup River delta. Dredge and fill activities have significantly altered the estuarine nature of the bay since the 1920s. Intertidal areas were covered and meandering streams and rivers were channelized. Numerous industrial and commercial operations have located in the filled areas of the bay, including shipbuilding, chemical manufacturing, ore smelting, oil refining, food preserving, and transportation facilities.

With industrialization, the release of hazardous substances and waste materials into the environment has resulted in alterations to the chemical quality of waters and sediments in many areas of the bay. Contaminants found in the area include arsenic, lead, zinc, cadmium, copper, mercury, and various organic compounds such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), and phthalates.

3.3 Site Discovery

3.3.1 Commencement Bay Nearshore/Tideflats

Commencement Bay was placed on a national interim list of 115 highest priority hazardous waste sites on October 23, 1981. Initially, the Commencement Bay site was divided into four areas: deepwater, nearshore, tideflats/industrial, and South Tacoma Channel (an upland site). The National Priorities List promulgated on September 8, 1983 designated the CB/NT area and the Commencement Bay South Tacoma Channel (CB/STC) as separate national Priorities List sites. The deepwater portion of the bay was eliminated from the list at that time because water quality studies indicated there was minimal contamination in the area.

Under an April 1983 agreement between EPA and Ecology, Ecology was designated as the lead agency for a remedial investigation/feasibility study on the nature and extent of contamination in the CB/NT site. The Commencement Bay Nearshore/Tideflats Remedial Investigation (August 1985) characterized the nature and extent of contamination at the site. The Commencement Bay Nearshore/Tideflats Feasibility Study (December 1988) described feasible alternatives for sediment remedial action at the site. The feasibility study included an integrated action plan to coordinate ongoing source control efforts and sediment remedial alternatives and a sediment

quality goals document to develop sediment quality objectives.

3.3.2 Asarco Area

Originally Asarco sediments were going to be included in the CB/NT ROD. However, Asarco further characterized the contaminated sediments along the Ruston-Pt. Defiance shoreline during a site-specific remedial investigation for the Asarco Tacoma smelter. Findings of this study were presented during public comment on the CB/NT feasibility study and proposed plan. As a result of Asarco's study, EPA separated the Asarco sediments from the CB/NT sediments.

An RI/FS was prepared by Asarco for the Asarco Smelter Facility in 1993 and for the Asarco Sediments and Groundwater site in 2000. EPA prepared an RI/FS for the Ruston/North Tacoma Study Area in 1997. Three RODs, one for each of these areas, were issued addressing contamination at the Asarco area sites.

4 REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR NEARSHORE/ TIDEFLATS

The primary objective of the remedial investigation (RI) was to define the nature and extent of sediment contamination. That investigation involved the compilation and evaluation of existing data and an extensive field sampling effort to collect additional data. At the conclusion of the remedial investigation, the database contained over 25,000 records, each consisting of 15-150 separate variables. There were descriptions of over 50 surveys, 500 sampling stations, and 2,000 samples of water, solids, and biota. Over 400 components of the Commencement Bay drainage system had been identified. Included were data on sediment and water column chemistry, bioassays, benthic invertebrates, fish pathology, and bioaccumulation. The distribution of sediment contaminants is described in detail in the remedial investigation report.

There was considerable variation in the types and concentrations of chemical contaminants in CB/NT sediments. Investigations of the nearshore waters of Commencement Bay have demonstrated the existence of sediment contamination by toxic pollutants, accumulation of some of these substances by biota, and possible pollution-associated abnormalities in indigenous biota. The highest concentrations of certain metals (i.e. arsenic, copper, lead and mercury) have been found in sediments in the waterways along the southwest shore, and near the Asarco smelter. Sediment contamination by persistent organic compounds (e.g. PCBs) was detected in the heavily industrialized waterways (e.g. Hylebos Waterway).

The purpose of the CB/NT feasibility study (FS) was to develop and evaluate the most appropriate remedial strategies for correcting the human health and environmental impacts associated with contaminated sediments in the CB/NT problem areas. The FS described cleanup objectives for the site and then presented a range of alternatives that offered viable means of achieving those objectives.

Source control was described as the most challenging and critical first step in the overall response strategy for the CB/NT site. Ecology's Commencement Bay Urban Bay Action Team (UBAT) was established in response to that challenge. To more effectively manage source control as a key element in the selected remedy, Operable Unit 05 (Source Control) was established in the spring of 1989. Public comment received on the CB/NT feasibility study indicated a very broad-based consensus that enhanced source control measures were important to overall project success.

4.1 Record of Decision for Nearshore/Tideflats

EPA issued the Commencement Bay Nearshore/Tideflats Record of Decision (ROD) in the September 1989. EPA selected a remedial action for eight of the nine sediment problem areas which were identified during the RI/FS. These problem areas are: 1) Mouth of Hylebos Waterway, 2) Head of Hylebos Waterway, 3) Sitcum Waterway, 4) St. Paul Waterway, 5) Middle Waterway, 6) Head of Thea Foss Waterway, 7) Mouth of Thea Foss Waterway, and 8) Wheeler-Osgood Waterway. The ninth problem area, off-shore of the Asarco smelter (OU 6), was addressed in a separate ROD signed in July 2000.

4.2 Cleanup Objectives

The cleanup objective for the remedial action, as described in Section 10 of the 1989 ROD, states that "the selected remedy is to achieve acceptable sediment quality in a reasonable time frame." "Acceptable sediment quality" is defined as "the absence of acute or chronic adverse effects on biological resources or significant human health risks." The ROD designated biological test requirements and associated sediment chemical concentrations referred to as sediment quality objectives (SQOs) to attain the cleanup objective for the CB/NT site. Sampling and test evaluation protocols for environmental effects, as well as the apparent effects threshold (AET) database, are to remain consistent with any adjustments adopted by the Puget Sound Estuary Program. The sediment quality objectives also apply to source control requirements. Monitoring of sources and sediments will be used to determine the effectiveness of source controls. Habitat function and enhancement of fisheries resources were also identified as part of the overall project cleanup objectives.

SQOs were developed based on AET generated from site data and data sets from various areas in Puget Sound. The AET data set was used in the FS to establish sediment cleanup goals. A list of AET used to define the sediment quality objectives (SQOs) for the CB/NT FS is provided in Table 5 of the ROD. These values represented the lowest AET for the three biological effects indicators (i.e., amphipod mortality, oyster larvae abnormality, and benthic infauna abundances).

A specific cleanup objective based on fish tissue data was not a requirement identified in the ROD. EPA plans to design and conduct a focused bay-wide fish tissue sampling effort at the conclusion of remedial actions to provide information to the Tacoma Pierce County Health Department in determining whether they will maintain the fish use advisories after EPA's remedial actions are completed.

In 1997, EPA issued an ESD to modify the PCB SQO for community health standards for the site where PCBs are present (primarily Hylebos and Thea Foss waterways). There are no additional changes to the SQOs to date. Exposure pathways and assessments, toxicity and other contaminant characteristics are still the same.

EPA and Ecology worked together to develop the SQOs as cleanup standards for contaminated sediments in Commencement Bay. After Ecology promulgated the SMS in 1991, EPA and Ecology again worked together to compare the SMS to the CB/NT SQOs to ensure that the SQOs for the CB/NT site were still protective of human health and the environment.

The SMS establishes an acceptable range of cleanup levels. Cleanup levels for a specific site using SMS are established as near as practicable to the no adverse effects level, taking into account net environmental effects, cost, and technical feasibility. EPA and Ecology agreed that, in general, the SQOs are within the range of cleanup levels established by the SMS.

4.3 Selected Remedy

The ROD selected a cleanup remedy that identified nine problem areas for sediment cleanup and allowed flexibility to utilize anyone, or a combination of, five key elements in any particular area which are:

Site use restrictions – Protect human health by limiting access to edible resources prior to and during implementation of source and sediment remedial activities; now commonly referred to as institutional controls. The ROD noted that institutional controls would consist primarily of public warnings to reduce potential exposure to site contamination, particularly through consumption of contaminated seafood.

Source controls – Implemented to prevent recontamination of sediments.

Natural recovery – Included as an optional (and preferred) remediation strategy for marginally contaminated sediments that are predicted to achieve acceptable sediment quality through burial and mixing with naturally accumulating clean sediments.

Sediment remedial action – Address sediments containing contamination that is expected to persist for unacceptable periods of time through confinement and treatment options. For areas that are not expected to recover within a 10-year time frame, the ROD specified that active remediation of problem sediments would be accomplished by utilizing a limited range of four confinement technologies. These technologies are in-place capping, confined aquatic disposal, nearshore disposal, and upland disposal.

Source and sediment monitoring – Refine cleanup volume estimates, characterize the effectiveness of source controls, and ensure that the remedy is effective. Long-term monitoring of the remediated areas, including disposal sites and habitat mitigation areas, is also a component of the remedy. Monitoring will be conducted to evaluate the

effectiveness of the remedy in achieving SQOs and in achieving the habitat functions that are called for in the mitigation plans.

Based on the cleanup objectives and five key elements, the intent of the ROD was for further remedial design sampling and analysis to determine specific cleanup plans for each of the unique waterway problem areas.

4.4 Source Control Strategy

The objectives under source control were to control major sources of contamination to the waterways prior to implementation of active remediation in the waterways and to monitor source control effectiveness both prior to and after completion of sediment remedial action.

In May 1992, Ecology and EPA issued a Source Control Strategy which outlined how Ecology's Urban Bay Action Team (UBAT) would prioritize, organize and conduct source control activities. The Source Control Strategy also described the administrative process Ecology would use to report on and document the progress of source control. Basically, Ecology conducted a site-wide investigation of sources and sorted them according to their likely potential for having contributed problem chemicals to the waterways. Because the ROD identified eight problem areas with unique lists of problem chemicals, Ecology's source control efforts were also focused on sources of the specific problem chemicals in sediments. For instance, PCBs were a high priority problem chemical in the Hylebos Waterway, but were not problem chemicals in sediments of the Wheeler-Osgood Waterway.

Ecology's general step-wise process is outlined below. The primary deliverables to EPA were the Source Control Status Reports, commonly known as Milestone Reports. Milestones are described below:

Milestone 1: Following investigation and evaluation of all potential sources of problem chemicals to a problem area, all confirmed ongoing sources were identified as one of the following types: potential (List 1), probable (List 2), or ongoing (List 3).

Milestone 2: Required essential administrative actions to be in place for "major sources" of problem chemicals in each problem area. Administrative actions included orders, decrees and permits. "Essential administrative action" meant that the action was needed to ensure the major sources would be controlled so that sediment recontamination would not be expected to occur (i.e., source is controlled). "Major sources" were defined by the CB/NT ROD as sources most directly aligned with current sediment impacts in a given problem area of a waterway; thus, "essential" varied from problem area to problem area.

Milestone 3: Required essential remedial actions for all major sources to be implemented. "Essential remedial actions" were largely physical or operational changes (construction, improved BMPs, removals, etc.) at major sources that represented elimination and/or reduction, to the extent practicable, of the contaminant sources most directly linked to

existing sediment impacts. Ultimately, these actions eliminated or reduced to the extent practicable, sources of problem chemicals that could potentially recontaminate sediments. Final and complete remedial action on all “non-essential” aspects of each major source was not required for this Milestone.

Milestone 4: Required administrative actions (e.g., orders, permits) to be in place for all confirmed ongoing sources in the problem area. “Confirmed ongoing sources” were identified on List 3 of the Milestone 1 Report, and also included any new sources that were identified in subsequent investigations or source control work.

Milestone 5: Required remedial actions (e.g., construction, removal) for all sources in the problem area to be implemented. Remedial actions at some sites are still underway.

After the all of the Milestone reports for a sediment problem area were issued, EPA then issued a Source Control Completion Report to document this final step of the source control process before beginning sediment remedial action. Source control completion in a problem area indicated that Ecology and EPA believed that source control measures were adequate for sediment remedial action to move forward in a problem area.

4.5 Explanation of Significant Differences

After the 1989 ROD, EPA issued the following Explanation of Significant Differences (ESDs) that expand on and clarify the general cleanup approach set forth in the CB/NT ROD:

June 1993 ESD – Identified the remedial action for the Sitcum waterway.

March 1997 ESD – Modified the cleanup standard for PCBs bay-wide.

August 2000 ESD – Determined the specific cleanup plans for the Thea Foss, Wheeler-Osgood, and Hylebos Waterway, included Endangered Species Act (ESA) as an Applicable or Relevant and Appropriate requirement (ARAR), selected the acceptable in-water and upland disposal options for dredged sediments from nearshore areas, provided remedial design performance criteria for capping, dredging, confined disposal, natural recovery and enhanced natural recovery and mitigation activities.

February 2002 ESD – Selected the remedy for Areas A and B in Middle Waterway (Figure 2).

March 2003 ESD – Selected the remedy for Area C in Middle Waterway (Figure 2).

September 2004 ESD – Identified a temporary storage area for dredged sediments, two new sources of capping material for the Thea Foss Waterway cleanup, and clarified several items that were defined after completion of the remedial design.

4.6 CERCLA Removal Actions During the Past Five Years

4.6.1 Olympic View Resource Area

A non-time-critical removal action was conducted in 2001 to address contaminated marine sediments at the Olympic View Resource Area (OVRA). The OVRA was not identified as a problem area in the CB/NT ROD, but it is located within the boundaries of the CB/NT Site. In 1997, the OVRA site was identified as one of five City restoration projects addressed in the City's Natural Resource Trustee Consent Decree (CD) to settle the City's liability for natural resource damages at the CB/NT site. As part of studies at OVRA, dioxin sediment contamination was found, and it was determined to be an imminent and substantial threat to human health and the environment.

Section 5.5 describes the cleanup action taken in this area.

4.6.2 Occidental Chemical

Two non-time critical removal actions were conducted by Occidental Chemical Corporation at its former chlor-alkali plant facility along the Hylebos Waterway, presently owned and operated by Pioneer Americas LLC. 1) The Area 5106 Removal Action included dredging, treatment and disposal of approximately 36,000 cubic yards (cy) of sludge-like sediment highly contaminated with chlorinated organic chemicals associated with perchloro-ethylene (PCE) and trichloro-ethylene (TCE) production waste. This removal action is not considered complete; additional work is needed to address PCE- and TCE-contaminated sediments in this area. 2) The Embankment Area Removal Action led to the draft design of a permeable cap to cover the intertidal and subtidal embankment to the toe of the slope at about -40 feet MLLW. EPA and Ecology have determined that better characterization of the area is needed prior to completing design and construction of the cap. More detailed information about the Occidental Site can be found in Section 5.1.4, the Hylebos Waterway portion of this Five-Year Review.

4.7 Sitewide Biological Assessment

After the last Five-Year Review, Puget Sound chinook salmon and bull trout were identified as Endangered Species Act (ESA) listed species.

On May 24, 1999, National Marine Fisheries Services (NMFS) formalized the listing of Puget Sound chinook salmon as threatened under ESA. On November 1, 1999, the United States Fish and Wildlife Service (USFWS) listed bull trout as a threatened species. Federal agencies are required to prepare an assessment of effects on listed species for any "major construction activity" they consider that is located in the vicinity of listed species or designated critical habitat. EPA's remedial actions in Commencement Bay, Tacoma, Washington, constitute such an agency action requiring an assessment. Remedial activities in the Sitcum and Mouth of St. Paul Waterways were completed before the Puget Sound chinook salmon were listed as threatened under ESA.

Chinook salmon are known to be present in the Puyallup River and rely, to some extent, on the nearshore and tidelflat habitats in Commencement Bay. Analysis of existing habitat conditions and project effects on chinook will apply to other listed species that may occur in Commencement Bay.

The remedial response actions described in the ROD are considered agency actions under ESA and are therefore required to substantively comply with the ESA. Although divided into six separate problem areas, and now two removal actions, EPA's proposed action is remediation of the entire CB/NT site as identified in the ROD. Therefore, EPA has maintained a Commencement Bay-wide perspective in formulating and evaluating remedial action plans and requirements for mitigation to ensure that ecological gains result from the cleanup actions. While specific actions within each individual waterways may vary due to site-specific conditions, the combined effect of each remediation will contribute to measurable improvement to aquatic habit functions in Commencement Bay.

The Biological Assessment (BA) evaluates the potential effects on threatened and endangered species from the selected remedial actions in Hylebos, Middle and Thea Foss and Wheeler-Osgood Waterways (See the Biological Assessment, Commencement Bay Nearshore/Tideflats Superfund Site, July 2000). Following this overall site-wide Biological Assessment, site-specific Biological Assessments for each waterway evaluated the impacts of the remedies on the listed species. These projects received Biological Opinions from the National Oceanic and Atmospheric Administration (NOAA) and/or the United States Fish and Wildlife Service (USFWS). Biological Assessments for Sitcum and St. Paul waterways were not conducted since these cleanup were completed before the ESA listing.

To comply with some the provisions of ESA, all in-water remediation work was restricted to established "fish windows" that are designated times between July 16 and February 14 when remedial action construction activities are allowed to occur, and other "conservation measures" were identified by the ESA agencies for the sediment remediation work.

4.8 Sitewide 404(b)(1) Analysis

The 2000 ESD selected disposal sites for the remaining cleanup actions in Hylebos, Thea Foss, Wheeler-Osgood, and Middle Waterways. Because the ESD selected two in-water disposal sites, EPA was required to conduct a site-wide evaluation of impacts associated with the filling of aquatic habitat. A Bay-wide 404 analysis was conducted to meet the substantive requirements of Section 404 of the Clean Water Act (CWA). The ESD also added a new ARAR, the Endangered Species Act as a result of the 1999 listing of chinook salmon and bull trout as threatened, ESA-protected species (see above).

EPA identified a comprehensive, bay-wide approach to mitigation that would fulfill EPA's responsibility in meeting the substantive requirements of these two ARARs. Specifically, nine performance criteria were identified in the ESD, CWA 404(b)(1) evaluation, and biological assessment documents, which required remedial design elements, remedial action

implementation and compensatory mitigation plans to contribute toward the conservation and recovery of ESA-listed species. Mitigation plans, due to unavoidable losses of aquatic habitat, have been approved for the two in-water disposal sites selected in the 2000 ESD. A description of the approved mitigation projects developed in fulfillment of these performance criteria are described in each of the waterway sections below.

4.9 Dredged Material and Disposal Sites

There are several disposal sites selected in the 1989 ROD and 1993, 2000 and 2002 ESDs for the disposal of contaminated sediments dredged from the various problem areas. The ROD included the options of using upland, nearshore and confined aquatic disposal locations. At Sitcum Waterway, the 1993 ESD selected the Milwaukee waterway as its disposal location and created a habitat area in front of the containment berm as part of its mitigation activities. The 2000 ESD, identified upland disposal, in-water disposal at the Puget Sound Dredged Disposal Analysis (PSDDA) site located in Commencement Bay (now referred to as the Dredged Materials Management Plan-- DMMP-- site) and two nearshore confined disposal facilities. Dredged sediments from the Hylebos and Middle waterway, as per the 2002 ESD, were placed in the Blair Slip 1 Nearshore Confined Disposal site (NCD) which is approximately 10 acres and has a disposal capacity of 650,000 cy. Dredged sediments from the Thea Foss and Wheeler-Osgood waterways are scheduled to be placed at the Head of the St. Paul Waterway in a confined disposal facility (CDF) which is 14 acres and will contain approximately 525,000 cy of contaminated sediments. Some sediments from the Hylebos and Thea Foss waterways were also disposed in the DMMP site and in upland facilities either in eastern Washington or in Pierce County, Washington. These three in-water disposal sites – the Milwaukee Fill, Blair Slip 1 and the St. Paul CDF will be continually monitored for any potential releases into the environment.

4.10 Partial Deletion of the Site

EPA's partial deletion pertains only to portions of OU 1 (CB/NT Sediments) and OU 5 (CB/NT Sources). Specifically, it pertains to the sediments contained in and upland properties draining only to the St. Paul Waterway or Blair Waterway, and to four properties which were transferred to the Puyallup Tribe of Indians under the Puyallup Land Settlement Act of 1989 ("Puyallup Land Settlement Properties"). The four Puyallup Land Settlement Properties are: the Taylor Way Property, the East-West Road Property, the Blair Waterway Property and the portion of the Blair Backup Property that drains only to the Blair Waterway. These areas were deleted in 1996.

A partial deletion of a site from the NPL does not affect or impede EPA's ability to conduct CERCLA response activities at areas not deleted and remaining on the NPL. In addition, deletion of a portion of a site from the NPL does not affect the liability of responsible parties or impede agency efforts to recover costs associated with response efforts. It does not impact the ability of Natural Resource Trustees to assess or recover for damages to natural resources at deleted portions of the site.

Further, removal of a site from the NPL does not affect or impede the continuance of long-term monitoring, operation and maintenance, or institutional controls at deleted portions of the site. Removal of portions of the site from the NPL does not preclude Ecology from subsequently conducting investigations or requiring response actions, including source control, under state law at the deleted portions of the site or areas remaining on the NPL.

5 REMEDIAL ACTIONS FOR COMMENCEMENT BAY NEARSHORE/TIDEFLATS WATERWAYS AND ASARCO OPERABLE UNITS

5.1 Hylebos Waterway

5.1.1 Background

The Hylebos Waterway is the northernmost waterway in the Commencement Bay tideflats area. The three-mile long waterway has been the site of several industries, such as manufacturing of chlorine and chlorinated chemicals, shipbuilding and repair, scrap metal recycling, lumber milling and log export, since the early 1900's. Sampling during the 1984 Remedial Investigation (RI) showed several contaminants of concern in Hylebos Waterway sediments, including arsenic, VOCs, PAHs, hexachlorobenzene, hexachlorobutadiene and PCBs. The 1989 ROD identified two contaminated sediment problem areas at the Mouth and Head of Hylebos Waterway that require Superfund cleanups.

EPA and a group of Hylebos Waterway PRPs known as the Hylebos Cleanup Committee (HCC), which consists of Asarco, Inc., Elf Atochem North America, Inc., General Metals of Tacoma, Inc., Kaiser Aluminum and Chemical Corporation, Occidental Chemical Corporation, and the Port of Tacoma, signed an Administrative Order on Consent (AOC) for pre-design studies in 1993. Under the AOC, the HCC has collected more than 500 physical, chemical, and biological samples in two sampling rounds to characterize the nature and extent of sediment contamination. The HCC developed a cleanup plan to address contaminated sediments, assessed the potential for recontamination from upland facility operations, and inventoried and evaluated potential disposal sites for dredged contaminated sediments. In 1999, the HCC completed the Pre-Remedial Design Evaluation Report (PRDE), which formed the basis for EPA's selected cleanup plan for the Hylebos Waterway (August 2000 ESD).

5.1.2 Source Control

Ecology identified 10 major sources to Hylebos Waterway sediment contamination:

Occidental Chemical Corporation (former chlor-alkali plant);

Elf Atochem 3009 Taylor Way (inactive log sort yard);

Elf Atochem 2901 Taylor Way(former manufacturer of chlorine-based chemicals);

Kaiser Aluminum and Chemical Company (aluminum plant);
General Metals of Tacoma (metal scrap yard);
Wasser Winters (inactive log sort yard);
Louisiana Pacific (operating log sort yard);
Tacoma Boat (former large shipyard);
B&L Landfill (drains to Hylebos Creek; and,
Blair Backup Property (inactive log sort yard).

Essential source control actions have been completed for all of these facilities as documented in Ecology's milestone reports for the Mouth and Head of Hylebos Waterway. Nineteen additional ongoing sources of contamination to Hylebos sediments were also identified and addressed through enforcement actions and/or voluntary cleanups under Washington state regulatory authorities (e.g., orders, decrees, permits). Ecology's Milestone 4 report (November 4, 1999) and Milestone 5 report (June 14, 2000) documents the completion of essential, site-specific, source control actions for Hylebos Waterway.

During the remedial design process, additional source control concerns were identified at two of these 10 major source areas. At the Elf Atochem 2901 Taylor Way property, now Arkema, at the Head of Hylebos waterway additional ground water source control actions were implemented to protect a 200 foot-long intertidal and subtidal cap at the Atofina Southeast shoreline area. These actions are ongoing by Ecology. EPA will monitor the subtidal cap which was installed in 2004, while Ecology continues its upland efforts to control the upland ground water arsenic and high pH plume. Although sediment re-contamination is not predicted to occur after the subtidal cap is constructed, additional upland source control actions will be necessary to ensure that surface water quality criteria within the biologically active zone are met over the long-term as well.

A second source of remaining contamination is at the former Occidental Chemical Corporation facility which continues to require source control actions (both upland and beneath the waterway) with sediment remedial action. EPA actions at the Occidental site, discussed below, are being actively coordinated with Ecology's RCRA program to address remaining soil, ground water, sediment and surface water contamination. This coordination is being formalized through an amendment to the Occidental Site AOC which will include Ecology as a signatory. Principal contaminants at the site are, 1) VOCs from PCE and TCE production waste, 2) high pH (8.5 - 13+) from caustic soda production, and 3) metals from slag and industrial debris landfilling.

5.1.3 Site Chronology

Key dates for Hylebos Waterway actions are as follows. Section 5.1.4 provides a description of the actions.

1997 Occidental Chemical Corporation signed an AOC for the Embankment Area non-time critical removal.

1999 Pre-Remedial Design Evaluation Report complete.

June 2000 Hylebos Waterway source control actions complete.

August 2000 ESD set cleanup plan and disposal site selection.

March 2002 Three UAOs issued to four parties:

1. General Metals of Tacoma and Arkema for Segments 1 & 2 (Head of Hylebos) sediments
2. Port of Tacoma and Occidental Chemical for Segments 3, 4, & 5 (Mouth of Hylebos) sediments
3. Occidental Chemical for Area 5106.

March 2003 Additional response actions required at Area 5106, non-time critical removal

July 2003 – February 2004

Intertidal excavation at the Head of Hylebos (Segments 1 and 2) completed
Dredging of the Mouth of Hylebos (Segments 3, 4, & 5) completed
Blair Slip 1 NCD constructed and filled with dredge material from the Mouth of Hylebos and Middle Waterways.

July 2004 - February 2005 Ongoing work to complete remaining dredging and capping actions, with the exception of the Occidental Site and Pier 25.

September 2004 General Metals and Arkema UAO converted into a CD.

**January 2005
(Planned)**

Amendment to 1997 Occidental AOC address further investigations, through remedial design and interim response actions at Occidental Site. Both EPA and Ecology will sign the amendment to coordinate RCRA and CERCLA response actions.

5.1.4 Remedial Action

Summary

EPA signed an ESD that finalized the cleanup plan for the Mouth and Head Hylebos Waterway problem areas (see Figures 3-5) in August 2000. These two problem areas were further divided

into five segments in the design phase. The cleanup plan for the Hylebos Waterway included dredging of an estimated 940,000 cy of contaminated sediments, capping 11 acres, monitoring 20 acres of marginally contaminated sediments as natural recovery areas. Consistent with the August 2000, ESD, all five of the CB/NT ROD key elements were incorporated into the design of the Hylebos Waterway Remedial Action. Response actions have also occurred pursuant to the Occidental Site non-time critical removal actions, and the remaining work folded into an amended AOC and associated SOW, as described below.

The design and implementation of the Hylebos Waterway sediments cleanup plan is being implemented in three sections as follows:

Head of Hylebos Segments 1 and 2,
Mouth of Hylebos Segments 3 and 4, and
Mouth of Hylebos Segment 5,

General Metals of Tacoma and Arkema are implementing cleanups at the Head of Hylebos (Segments 1 and 2). The Port of Tacoma and Occidental Chemical are implementing cleanups in the Mouth of Hylebos (Segments 3, 4 & 5).

In addition, Area 5106 and the embankment area at the Occidental Site (in Segment 5) are being implemented by Occidental Chemical under separate agreements.

In the Hylebos Waterway, essential source control actions were determined to be complete in June 2000, allowing EPA to initiate sediment remedial action.

Segments 1 and 2 (Head of Hylebos)

Intertidal cleanup actions were completed at the Head of Hylebos (Segments 1 and 2) in 2003. In order to avoid capping and long-term monitoring, four areas covering 1.5 acres were excavated to remove 7,400 cy of sediment exceeding the SQOs and then backfilled with clean sand and gravel. The General Metals graving slip, J&G property, Arkema intertidal shoreline and Dunlap Log Haul out area were excavated in the dry using upland excavation equipment.

One additional subtidal cap remains to be constructed at the Arkema shoreline after the dredging is completed. This cap is expected to cover approximately 200 feet of shoreline and be constructed by February 15, 2005.

The 2004 dredging season for in-water work started in July 16, 2004, and is on-going. At the completion of the 2004-2005 dredging season, all dredging in the Head of Hylebos Waterway is expected to be complete. Final dredge volumes and as-built information will be summarized in the next five-year review.

Segments 3, 4, and 5 (Mouth of Hylebos)

At the Mouth of Hylebos, intertidal cleanup actions were implemented at Sound Refining, Murray Pacific, and the Taylor Way properties. Excavation, bulkhead removal, regrading and backfilling has been completed at the Murray Pacific and Sound Refinery properties. Dredging and excavation of about 50,000 cy at the Taylor Way property was completed in December 2004.

In 2003, dredging was completed for Segment 5 of the Mouth of Hylebos (south of the 11th street bridge, see Figure 5). At the completion of the 2004-2005 dredging season, all dredging in Hylebos Waterway is expected to be complete with the exception of the Occidental Site.

To date, an estimated 626,935 cy of sediment have been dredged from the Mouth of Hylebos and approximately 246,000 cy of sediment has been dredged from the Head of Hylebos. Final dredge volumes and as-built information will be summarized in the next five-year review. At the Mouth of Hylebos, dredge material was disposed of in the Blair Slip 1 NCD facility and the DMMP open-water disposal site in Commencement Bay.

After the 2004-2005 field season, intertidal and subtidal cleanup actions remain to be completed in the Mouth of Hylebos, at the Occidental Site and adjacent Pier 25 shoreline. At the Occidental Site (which extends north along Pier 25 about 750 feet beyond the Pioneer facility property line) remedial action will be initiated following additional investigations. See section below on the Occidental Site.

Sedimentation rates in some areas are expected to naturally bury and sufficiently isolate some contaminated sediments within Segments 3 and 4. Based upon supplemental sediment sampling conducted during the remedial design process by the performing parties, some areas of Segments 3 and 4 have already naturally recovered.

Disposal of Dredged Material

The selected disposal sites for dredged material from the cleanup of the Hylebos Waterway were an upland regional landfill for dredge material from the Head of Hylebos, and a nearshore confined disposal facility (NCD) at Blair Slip 1 for dredge spoils from the Mouth of Hylebos. The DMMP open water disposal site in Commencement Bay was also used for less contaminated sediments from the Mouth of Hylebos.

The following table shows the origin and approximate amount of sediments dredged from the Mouth of the Hylebos Waterway (Segments 3, 4 & 5) as well as the disposal location:

Blair Slip 1 Nearshore Confined Disposal Facility	
Segment 3-4	196,750 cy
Segment 5	260,206 cy
Treated Area 5106 Sediment	35,000 cy
Mouth of Hylebos Subtotal	491,956 cy
DMMP (For Less Contaminated Sediment)	
Segment 5	134,979 cy
Estimated Total of Dredged Total Sediment from Mouth of Hylebos	626,935 cy

At the Head of Hylebos, dredged material is being transported by rail for disposal at the Roosevelt Regional Landfill in eastern Washington.

Construction activities to initiate closure and capping of the Blair Slip 1 NCD Facility have commenced and will continue through February 15, 2005. As part of the final construction, stone pilings will be placed in the containment berm to provide additional structural stability and protection against seismic activity, and ensure the NCD is suitable for subsequent upland development on the completed NCD. Final construction/development will occur over several years as the Port of Tacoma converts the NCD Facility to container storage and other Port operations.

Habitat Mitigation

Two mitigation projects, Clear Creek Phase 2 and Blair Slip 5, were approved by EPA to offset impacts from filling Blair Slip 1, which converted 14 acres of primarily subtidal aquatic habitat to uplands. The Clear Creek project restored two-acres of habitat along the Puyallup River to provide habitat for juvenile salmonids. This Phase 2 project expands the mitigation site previously developed by the Port of Tacoma as part of the Sitcum Waterway project. The second mitigation project, Blair Slip 5, located adjacent to the Blair Slip 1 NCD facility, is intended to convert 7 acres of subtidal habitat to protected, intertidal habitat more conducive to migrating juvenile salmonids. The two-acre Clear Creek restoration was completed in early 2004 and significantly improves the lower reach of Clear Creek for salmon migration and habitat for upland species. The second phase of the Slip 5 subtidal mitigation project will also be completed by February 15, 2005, providing low-bank foraging habitat for migrating fish species.

Institutional Controls

Institutional controls for the Hylebos Waterway remedial actions include sitewide fish use

advisories maintained by the TPCHD in designated areas, including Hylebos Waterway.

The second main institutional control required is site use restrictions for contaminants that remain in place (i.e., caps and NCD facility). The following remedial action elements are subject to institutional controls:

General Metals of Tacoma (MTCA covenant filed with title),

Arkema SE Shoreline (formerly Elf Atochem 2901 Taylor Way) - notice to successor in title and MTCA covenant required by consent decree,

It is expected that institutional controls will be required in two additional areas:

Pier 25 (remedial action still under design by Port of Tacoma),
Occidental (remedial action still under design).

Institutional control plans for the waterway are being developed during remedial action.

Occidental Site Removal Actions

The Area 5106 Removal Action (see Figure 6) was completed, as designed in March 2003, under authority of a UAO. Approximately 36,000 cubic yards (cy) of sludge-like sediment highly contaminated with chlorinated organic chemicals associated with PCE and TCE production waste at Area 5106 were hydraulically dredged, piped to an on-site treatment facility where the contaminated sediment was treated to reduce VOC mass, and disposed in the Blair Slip 1 aquatic confined disposal facility. The 1989 ROD did not include treatment as part of the selected remedy due to the nature of the sediments found throughout the site, however, treatment prior to disposal was needed for Area 5106 sediments because of the high VOC and SVOC concentrations. Post-dredge sediment sampling indicated severe and potentially deep VOC and SVOC contamination of underlying native sediment. EPA required additional response actions to characterize the extent of remaining sediment contamination within and around Area 5106 and work began in August 2003.

The Embankment Area Removal Action, performed under authority of an AOC, led to the draft design of a permeable cap to cover the intertidal and subtidal embankment to the toe of the slope at about -40 feet MLLW. In July 2003, before the design was finalized, additional information about contaminated sediment beneath portions of the subtidal slope and contaminated ground water discharges and discharges of groundwater with high pH to the waterway led Occidental, EPA's CERCLA program, and the Washington Department of Ecology's RCRA program to conclude that the permeable cap remedy would fail if implemented.. Occidental then proposed a new type of embankment cap for the hydraulic containment to EPA and Ecology in October 2003. With the concurrence of EPA and Ecology, Occidental subsequently began efforts to assess the feasibility of an impermeable embankment cap and under drain groundwater

containment system

In March 2004, EPA and Ecology agreed that a remedial investigations, feasibility study, and RD/RA were needed to address the remaining contaminated soil, ground water, and sediment at the site in an integrated manner. EPA, Ecology, and Occidental have continued upland and waterway field investigations throughout 2004.

In January 2005, an agreement is anticipated on a Scope of Work (SOW) to be incorporated into the amended AOC for the site discussed above to address the remaining field investigations, site characterization, remedy evaluation and selection and remedial design work. This amended AOC between EPA, Ecology, and Occidental Chemical Corporation will encompass remaining work under the CERCLA Embankment Area and Area 5106 removal actions and RCRA corrective action.

A schedule for implementation of the selected Occidental Site remedy will be established through a CD to be negotiated with Occidental and Pioneer Americas, the current owner of the former Occidental facility upon the completion of the remaining tasks in the SOW. Implementation of the Occidental site remedy is expected to be completed before the next five-year review.

5.1.5 OMMP Monitoring

Long-term monitoring and maintenance is required for all of the remedial action components to ensure the overall effectiveness of the remedy. In most cases, the Hylebos Waterway remedial action elements have only been recently completed or are still in progress, so that the required monitoring has not yet been initiated.

For the Hylebos Waterway, O&M monitoring will be required for the following key remedy elements:

Dredged areas – to confirm that recontamination is not occurring;

Intertidal and subtidal caps – to confirm that contaminants remain isolated and recontamination is not occurring;

Blair Slip 1 NCD facility – ground water monitoring to confirm that contaminants remain within the disposal facility; and,

Mitigation sites (Blair Slip 5 and Clear Creek Phase 2) – to confirm that the desired habitat function(s) are being achieved.

Individual monitoring plans exist for the Head and Mouth of Hylebos that address the various

remedy elements. Specific monitoring intervals are identified in the O&M plans with additional monitoring as necessary depending on prior results. The next five-year review will provide a more detailed summary of monitoring requirements and results from the intervening years.

One monitoring plan for the General Metals cap has been implemented, calling for physical integrity monitoring. To date, EPA has reviewed data for years 0-5. The cap continues to function as expected, as evidenced by lead line and diver surveys that demonstrate the cap thickness has remained as designed. In 2001, General Metals conducted minor repair to the cap after a docked ship damaged several pier pilings located within the cap footprint. No significant damage was done to the cap. However, new pilings were put in and additional cap material was placed in around the new pilings.

5.2 Sitcum Waterway

5.2.1 Background

The Sitcum Waterway is located between the Blair Waterway to the northeast and former Milwaukee Waterway, and Milwaukee Habitat Area, to the southwest (Figure 1). Sitcum Waterway is a deep navigational waterway, created by dredging and filling native mudflats since 1910. The Port of Tacoma owns the submerged land and bottom sediment in the waterway and the land adjacent to the waterway. The Port operates Terminal 7 as a container handling and bulk unloading facility.

The Sitcum Waterway Problem Area comprises a 55-acre area of contaminated marine sediments in the main navigational channel and berth areas. Sediments were contaminated with metals (arsenic, cadmium, copper, lead, nickel, and zinc) and PAHs above the SQOs identified in the CB/NT ROD. Primary contaminant sources included historical releases of metal ores handled at Terminal 7, and releases from a stormwater outfall (SI-172) that discharges runoff from an industrial and commercial area covering approximately 170 acres. The Milwaukee Waterway is the mitigation site for Sitcum.

5.2.2 Source Control

The major sources of contaminants to the waterway were addressed by the cessation of black ore off-loading at Terminal 7 and implementation of source control efforts (including storm drain sediment clean out) associated with the storm drain SI-172.

5.2.3 Site Chronology

Key Dates:

1991 EPA/Port of Tacoma AOC for RD/RA.

1993 ESD selects remedial action for Sitcum.

- 1993** EPA/Port of Tacoma enter into CD.
- 1995** Construction complete for all projects except Clear Creek.
- 1998** Construction complete for Clear Creek.

5.2.4 Remedial Action

Subsequent to EPA's issuance of the 1989 CB/NT ROD, the remedial action for addressing contaminated sediments in the Sitcum Waterway Problem Area was approved in a 1993 Explanation of Significant Differences (ESD). Based on these documents and the EPA-approved Remedial Design, the Sitcum Waterway Remediation Project comprised the following:

Dredging approximately 428,000 cy of contaminated sediments from Sitcum Waterway for disposal in the Milwaukee Waterway nearshore confined disposal facility,¹

Dredging approximately 2.1 million cy of sediment from the Blair Waterway for construction of, and disposal in, the Milwaukee Waterway² nearshore confined disposal facility. Of the 2.1 million cy, 1,225,400 cy were designated as "clean" (appropriate for in-water disposal under DMMP) and targeted for construction of the Milwaukee Waterway nearshore fill berm. The remainder of the Blair Waterway sediments were targeted for disposal in the Milwaukee nearshore confined disposal facility,

Construction of a nearshore confined disposal facility utilizing approximately 72 percent of the Milwaukee Waterway,

To compensate for the fill of the Milwaukee Waterway, construction of habitat mitigation at two locations: 1) the Milwaukee Habitat Area located in front of the nearshore fill closure berm in the Mouth of the Milwaukee Waterway, consisting of approximately 20 acres of intertidal habitat; and 2) an "additional mitigation area" consisting of

¹The bulk of this volume, approximately 396,000 yards, was to be removed from the "Phase 1 Area," or bottom sediments from Sitcum Waterway, the extent of which was limited by rip rap and Pier 7 along the northern shoreline. The "Phase 2 Area," or areas of sediment over existing rip rap and slopes under Pier 7, was to be removed to the extent technically feasible. The ESD estimated approximately 32,300 yards would be removed in the Phase 2 Area. After construction, Phase 2 was to be evaluated for potential future action. In the EPA-approved memorandum from the Port, dated October 1, 1995, it was determined that no further action would be required in the Phase 2 Area, and that the area beneath Pier 7 would continue to be evaluated for monitored natural recovery as specified in the OMMP. The area beneath Pier 7 is now known as Area B, while the original Phase 1 Area is now known as Area A. Area B is a 4.5 acre monitored natural recovery area.

approximately 9.5 acres of restored, off-site, refuge habitat for salmon and other fish from the Puyallup River. Subsequent to the ESD, the Clear Creek Habitat Improvement Project³ was selected as the “additional mitigation area.”

Final dredging and fill volumes were adjusted slightly during construction. EPA approved the Construction Completion Report for the dredging of Sitcum and Blair Waterways, for the Milwaukee nearshore confined disposal facility, and for the Milwaukee Habitat Mitigation Area on July 25, 1995. EPA approved the Construction Completion Report for the Clear Creek Habitat Area on December 17, 1998.

5.2.5 OMMP Monitoring

The long-term monitoring efforts associated with the Sitcum Waterway Remediation Project are documented in the following reports:

The Operations, Maintenance, and Monitoring Plan (OMMP) for the Sitcum Waterway Remediation Project (1994, updated 1995);

Additional Response Action Plan, Terminal 7 Phase 2 Subarea (ARA) (ARA; 1995);

Clear Creek Habitat Improvement Project OMMP (1995); and,

Work Plan for Long-term Sediment Quality Monitoring in the Sitcum Waterway (Work Plan; 1996).

Results are summarized below for each of the four broad categories of long-term monitoring efforts.

5.2.5.1 Sediments within the Berth and Channel Areas of Sitcum Waterway

Surface sediment monitoring occurred in 1998 and 2003 to enable a periodic review of the general condition of waterway sediments in Sitcum Waterway. Monitoring occurred in Area A and Area B, as follows: 1) Area A is defined as the channel and side slopes bayward of the existing waterway pier structures and the area under the Sea-Land Pier and the exposed side slope at the head of the waterway between Sea-Land and the Terminal 7 piers; and, 2) Area B is defined as the under-pier area located below Terminal 7 of the waterway. See Figure 7.

³Attachment A to the CD (1993) detailed a conceptual design for the “Clear Creek” Habitat Improvement Project proposed for the “additional mitigation” required in the ESD. The Clear Creek site is located near the mouth of Clear Creek, a left bank tributary of the Puyallup River near River Mile 2.9. Project components included development of a pond/wetland habitat complex, excavation of a refuge bay, excavation of a tidal mudflat, improvement of upland habitat, and modification of the flood gate to facilitate passage of juvenile and adult salmonids and other fish.

The 1998 monitoring results showed that chemical concentrations in Area A remained well below the SQOs (except for mercury⁴). Also, natural recovery in Area B appeared to be taking place more rapidly than expected with only a few stations showing slight exceedances of SQOs.

The 2003 monitoring results were reported in the Sediment Quality Monitoring Results for Sitcum Waterway Area A and Area B, which was approved by EPA in July 2004.

For Area A, all sediment chemistry results for samples collected in 2003 were below the SQOs, with the exception of bis(2-ethylhexyl)phthalate at one location⁵. In addition, data collected in 2000 to support the Port's Sitcum Waterway Navigational Dredging Project did not exceed the SQOs. The Port completed dredging the Sitcum Waterway channel and berth areas in November 2003 as part of that project. This dredging deepened the waterway to -51 ft MLLW, which is well into native material.

For Area B, a monitored natural recovery area, the 2003 results show that the SQOs have been attained. Thus, as specified in EPA's framework for this "Additional Response Area," natural recovery has occurred and long-term monitoring in Area B is complete.

At this time, all long-term monitoring efforts required in the OMMP (as updated and revised), the Additional Response Action, and the Work Plan for the sediments in the Sitcum Waterway Problem Area have been completed. The Port of Tacoma has recommended that no additional sediment monitoring efforts be proposed at this time. In December 2004, EPA approved the Port's recommendation with the understanding that per the CD (Section VII), EPA retains the opportunity to request future studies in support of five-year reviews.

No institutional controls were required in the Sitcum Waterway CD for this portion of the Sitcum

⁴The October 1998 monitoring report noted exceedances of SQOs for mercury in the head of the waterway at two locations. Mercury was not detected above SQOs either prior to, or immediately after cleanup. Based on a discussion between the Port and EPA, the Port conducted a voluntary review of potential mercury sources to the Sitcum Waterway in coordination with the City. A report was transmitted to EPA via a letter dated February 4, 2000 presenting the findings from the review. Based on the findings, the Port recommended that the results from the long-term sediment monitoring event already designed, approved and scheduled for year 2003 be used to re-evaluate the condition of the Sitcum sediments. In August 2000, EPA determined that the Port would not be required to conduct further investigation or cleanup action in conjunction with the mercury exceedances. EPA deferred any consideration of further investigation or cleanup action to the Washington State Department of Ecology under the Model Toxics Control Act (MTCA) or the Clean Water Act. Subsequent sediment sampling in 2003 showed mercury concentrations to be below the SQOs.

⁵ The OMMP was designed to assess the general condition of the waterway, and the OMMP does not require action for a single exceedance of a single chemical.

Waterway Remediation Project because there are no contaminants left in-place requiring restrictions on use of the waterway or concerns about future human health or aquatic organism exposure.

5.2.5.2 Groundwater Sampling associated with the Confined Disposal Facility

At the confined disposal facility, baseline groundwater data were collected between March 1988 and November 1996. Wells were sampled in the closure berm, in the areas north and south of the fill in the peninsula, and up gradient of the fill. For all wells, groundwater was analyzed for conventional parameters, metals, SVOCs and VOCs.

For post-construction long-term monitoring, the baseline groundwater metals data are being used for statistical comparisons with groundwater data collected in the first round (2003) of Stage 1 monitoring. The Stage 1 monitoring focuses on metals (arsenic, copper, lead, and zinc) because the results of leaching tests on sediments from Sitcum Waterway indicated that metals are the most mobile chemicals leached from sediments.

Based on the Stage 1 groundwater data collected in 2003, no increases above baseline were found (in fact, most metals concentrations were undetected or were reported at values very close to the method detection reporting limit). Thus, results indicate that constituents are not being leached from the fill material and being horizontally transported outside the fill area in groundwater. This confirms the efficacy of the original remedy.

The next groundwater monitoring effort will occur in March 2008 (see Port of Tacoma letter to EPA dated August 2003). The monitoring event will follow the details provided in the Port's letter to EPA dated October 2003.

The Sitcum ESD or 1993 Sitcum Waterway CD did not specify any institutional controls for the confined disposal facility. Section 9 of the CD required that the Port record a certified copy of the CD with the Registry of Deeds, Pierce County, WA, but did not require the Port to provide a copy of such notification to EPA. EPA has requested documentation from the Port on this issue. The disposal facility is currently being used as a container storage facility, which was the planned for and anticipated land use for the site. An additional analysis of the institutional controls will be conducted before the next five-year review to ensure long-term protectiveness of the remedy.

5.2.5.3 Milwaukee Habitat Area

The Milwaukee Habitat Area is a mitigation project that compensates for the fill of the Milwaukee Waterway. The goals for the mitigation action are to:

Provide habitat characteristics that yield an increase in habitat function relative to existing habitats (provide high quality habitat);

Provide habitat available to juvenile salmonids throughout the tidal cycle;

Provide a range of habitat types to compensate for habitat losses for species of concern and indirectly benefit other species with similar or overlapping habitat requirements; and,

Provide a salt marsh.

These goals and functional objectives for the mitigation action are reflected in the performance standards defined in the OMMP.

Over the past five years, long-term monitoring at the Milwaukee Habitat Area occurred in 2000, 2002, and 2004. Throughout this period, the various elements of long-term monitoring included physical monitoring, sediment monitoring, and habitat attributes. The habitat attributes monitored included: juvenile salmonid utilization study; epibenthic plankton, algae, avifauna, and benthic infauna in the sediments; and, plant assemblage and coverage and avifauna in the upland habitat.

Consistent with the OMMP (as revised and updated), the 2000 and 2002 data indicate that all performance standards at the habitat area have been achieved for physical and habitat attributes. In 2003, one performance standard was eliminated (with concurrence from Natural Resource Trustees) because a small patch of prickly-weed would not grow even after replanting numerous times.

The 2004 monitoring data were submitted to EPA on November 1, 2004. EPA approved the final report in December 2004. All performance standards were achieved, except for one (the intertidal acreage has decreased by 0.56 acres from the acreage measured in the as-built survey). However, the total intertidal and shallow subtidal acreage at the site has increased 0.5 acre from the acreage reported in the as-built survey due to the continued growth of the Puyallup River delta. As such, the Port proposed, and EPA agreed, that the overall objectives of the mitigation site have been met, and additional monitoring of this performance standard is unnecessary with the understanding that the CERCLA allows for periodic five-year reviews.

In addition to physical and habitat monitoring efforts, sediments were collected from the habitat area in 2004 to assess the general condition of sediments (no performance standards were established). Consistent with the 1996 and 1998 sediment data, all of the surface sediment chemical concentrations reported for 2004 were below the SQOs.

In summary, results show that the habitat is successful, plant assemblages are meeting standards, and there is documented juvenile salmonid use of the site for feeding. No further sampling beyond 2004 is contemplated in the OMMP for the Milwaukee Habitat Area, and EPA does not intend to require further sampling at this time.

The Sitcum ESD or 1993 Sitcum Waterway CD did not specify any institutional controls for the Milwaukee Habitat Area. Section 9 of the CD required that the Port record a certified copy of the CD with the Registry of Deeds, Pierce County, WA, but did not require the Port to provide a

copy of such notification to EPA. EPA has requested documentation from the Port on whether such documentation was recorded for the Milwaukee Habitat Area. An additional analysis of the institutional controls will be conducted, before the next five-year review, to ensure long-term protectiveness of the remedy.

5.2.5.4 Clear Creek Habitat Improvement Project

The Clear Creek Habitat Improvement Project is a 9.5-acre mitigation project that compensates for the fill of the Milwaukee Waterway. The goals for the Clear Creek Habitat Project set out in the Sitcum Waterway CD are to:

- Provide refuge habitat for juvenile salmonids from the Puyallup River system; and,
- Provide 9.5 acres of restored habitat of which a minimum of 6 acres is regularly wetted.

The specific objectives of the project are as follows:

- Improve fish passage at the culvert at the mouth of Clear Creek;
- Increase the acreage of wetland habitats;
- Restore the influence of regular tidal flooding;
- Increase refuge and feeding habitats for salmon;
- Restore the connection of isolated or irregularly connected habitats to the Puyallup River system; and,
- Increase habitats for waterfowl.

The Clear Creek OMMP required monitoring in 1999 (Year 1 after construction), 2001 (Year 3), and 2003 (Year 5). In 2001 and 2003, the long-term monitoring of the Clear Creek Habitat Project focused on five physical and biological activities: water level monitoring, juvenile salmonid observation, vegetation monitoring, photo points, and waterfowl use. The OMMP specified that the 2001 data would be compared to the performance standards as early warning triggers, and the 2003 data would be compared to the performance standards to determine overall project compliance with the objectives of the OMMP.

The 2003 monitoring results show that all performance standards have been achieved. It is noted that in 2004, one performance standard was eliminated because activities by muskrats and beavers curtailed the growth of cattails in a specified area.

Based on the OMMP, the next physical monitoring (water level and photographic documentation) for the Clear Creek Habitat Improvement Project occurs in 2009. There is no performance standard associated with this Year 10 monitoring, however EPA will evaluate whether the project continues to meet overall project objectives.

The Sitcum ESD or 1993 Sitcum Waterway CD did not specify any institutional controls for the Clear Creek Habitat Area. Section 9 of the CD required that the Port record a certified copy of the CD with the Registry of Deeds, Pierce County, WA, but did not require the Port to provide a copy of such notification to EPA. EPA has requested documentation from the Port on whether such documentation was recorded for the Clear Creek Habitat Area. An additional analysis of the institutional controls will be conducted to ensure long-term protectiveness of the remedy.

The remedy for the Sitcum Waterway Problem Area has proven to be effective. Removal of contaminated sediments from Sitcum Waterway, construction of the Milwaukee Waterway nearshore confined disposal facility, construction of the Milwaukee Habitat Area, and construction of the Clear Creek Habitat Improvement Project, have also proven to be effective. Monitoring since the remedial action has shown that sediments have not become recontaminated, and that natural recovery has been reached in sediments within Area B of the Sitcum Waterway. Continued groundwater monitoring of the Milwaukee nearshore confined disposal facility has demonstrated that the fill is functioning as designed, and that effects from contaminant leaching have not been observed. The Milwaukee and Clear Creek mitigation sites are successful.

In conclusion, the remedial action initiated for the Sitcum Waterway Problem Area has been successfully completed.

5.3 St. Paul Waterway

5.3.1 Background

The St. Paul Waterway is located between the Puyallup River to the north and the Middle Waterway to the south. The St. Paul Waterway Problem Area comprises a 17-acre area of contaminated marine sediments adjacent to the Simpson Tacoma Kraft Mill (former owners include Champion International and St. Regis). Due to releases from the pulp and paper mill, sediments were contaminated with VOCs, SVOCs, PAHs, and organic debris.

5.3.2 Source Control

A source control completion report was approved in 1990. Key completed actions included relocation of the secondary treatment outfall, in-plant process modifications, stormwater control, woody debris control, and revision of the NPDES permit.

As noted above, the predominant sources of contamination to this waterway were operations conducted at the kraft mill. Because the sources of contamination were easily identified and

relatively straightforward to control, source control at this waterway actually pre-dates the 1992 Source Control Strategy (see Background). Even so, Ecology's source control investigations and actions all met the substantive requirements of the Source Control Strategy, concluding with a source control completion report approved by EPA in 1990. Key completed source control actions included relocation of the secondary treatment outfall, in-plant process modifications, industrial stormwater control, woody debris control, and revision of the NPDES permit.

5.3.3 Site Chronology

Key Dates:

1987 Ecology, DNR, Simpson Tacoma Kraft, Champion International sign CD with State.

1988 St. Paul cleanup and habitat restoration project completed.

1990 Source control completion report.

1991 EPA approval of completion report for project; federal CD in place.

1996 St. Paul Waterway problem area deleted from NPL.

2004 Long-term monitoring completed.

5.3.4 Remedial Action

Remedial action at the site was designed to provide: 1) permanent isolation from the environment of toxic chemical contamination found in marine sediments, 2) protection of sediments from recontamination after cleanup, and 3) restoration of intertidal and shallow subtidal habitat. After analyzing the options available for cleanup, capping of contaminated sediments "in place" in the shallow water offshore of the mill was selected as the remedy. The cleanup action was integrated with natural resource restoration to produce new intertidal and shallow subtidal habitat in Commencement Bay.

The St. Paul Waterway Cleanup and Habitat Restoration Project was completed in 1988 by two PRPs under a CD with the Washington State Department of Ecology and DNR. The 17-acre area was contaminated with 4-methylphenol and other chemicals; the area was capped with 4 to 20 feet of clean sediment from the Puyallup River. More than 6 acres of new intertidal habitat were constructed over the portion of the cap along the shoreline. Clean, subtidal habitat was provided over the remaining 11 acres. Additional remedial action activities, such as source control efforts and habitat improvement actions, included: site preparation (e.g., piling removal); relocation of the mill's wastewater treatment plant outfall; dredging for the new outfall alignment; disposal of dredged material from the outfall project; removal of the former outfall and placement of the new outfall; dredging and disposal of sediments from the chip barge area; and habitat enhancement.

In January 1991, EPA approved the Commencement Bay Nearshore/Tideflats Superfund

Completion Report for St. Paul Waterway Sediment Remedial Action. The cleanup work, and long-term monitoring provisions, were agreed to in a 1991 CD among EPA, Simpson, Champion, and the Washington State DNR. The St. Paul Waterway Problem Area was partially deleted from the NPL on October 20, 1996.

The federal CD specified the applicable performance standards for the remedial action, as generally described below:

The physical performance standard requires a minimum of three feet of clean sediment be maintained over Areas A and B of the sediment cap; and,

The biological performance standard consists of not finding an adverse effect for benthic infaunal abundance. An interim chemical standard was used until 1994, when the biological performance standard (“biological indicators approach”) went into effect.

5.3.5 OMMP Monitoring

Consistent with the requirements of the long-term monitoring plan, the physical, chemical, and biological characteristics of the project in the St. Paul Waterway Problem Area have been monitored for 15 years (1989 - 2004).

Over the first ten-year period (1989 - 1999), specific monitoring elements included bathymetric surveys (conducted annually), visual inspections, aerial photographs, surface and subsurface sediment chemistry sampling, water seep sampling, methane gas vent sediment sampling, benthic and epibenthic community sampling, and macrophyte (algae) surveys. Results indicated that physical, chemical, and biological performance standards were achieved, and that the sediment cap is functioning as intended⁶. Chemical monitoring yielded relatively few detections and biological monitoring showed that abundance and diversity at the site was similar to background stations indicating a community similar to a typical healthy mudflat in Puget Sound. The project provides habitat for diverse biological communities, as well as algae. Shorebirds and salmon use the site for feeding and rearing.

In 1999, EPA approved an updated and revised Post-Ten Year Contingency Monitoring and Adaptive Management Plan for the St. Paul Waterway Area project. Over the past five years (2000 - 2004), the monitoring elements included bathymetric surveys (intertidal transects and a one-time final survey covering all of areas A and B) and visual inspections.

For the most recent five-year period, the overall changes in elevation between 2000 and 2004

⁶Bathymetric surveys indicated some redistribution of cap material at the site. In general, the northern area of the project (near the river) was more depositional, and the southern area was somewhat erosional. In 1997, although the cap thickness standard had not been violated, coarser material was placed in a small area of the cap near Transect 5.

across all stations other than the 2004 nourishment area averaged only 0.2 ft; the net change on these stations over the past five years was approximately -0.1 ft (which is close to the level of accuracy for the transect monitoring method, indicating that very little change has occurred at these stations).

In February 2004, a small-scale preventive beach nourishment project was implemented near Transect 4 as an adaptive management action (no trigger levels or performance standards were exceeded) in response to naturally differential movement of sediment at middle intertidal levels of the restored habitat. Approximately 2,600 cy of 75% sandy gravel mixed with 25% 3- to 6-inch diameter cobble was placed across the nourishment foot print.

As of October 2004, all required long-term monitoring efforts were completed, and reports have been approved by EPA. The only long-term monitoring requirement remaining is the following: “Should any major storm (with winds from the north or southeast at 30 miles-per-hour or greater, which persists for more than four hours) or earthquake of significance occur, an intertidal transects survey coupled with a visual inspection will be conducted as soon as possible after the event.” The monitoring plan describes the contingency planning process, which includes early notice, contingency planning, and contingency response procedures, for such occurrences.

With regards to institutional controls, Simpson Tacoma Kraft filed a Notice of Consent Decree with Pierce County, Washington, in 1999 regarding Assessor’s Tax Parcel 930716603. A copy of this record is in EPA records. However, consistent with EPA’s September 2004 “Strategy to Ensure Institutional Control Implementation at Superfund Sites,” an additional analysis of the institutional controls at this deleted-from-the-NPL portion of the site will be conducted to ensure long-term protectiveness of the remedy.

The remedy for the St. Paul Waterway Problem Area has proven to be effective. Fifteen years of long-term physical, chemical and biological monitoring for the St. Paul cap and habitat restoration area have shown the cap to be functioning well at isolating contaminants and there has been no indication of recontamination. The project continues to provide habitat for a diverse population of marine organisms, and results indicate ongoing recruitment, biological diversity, and a self-sustaining habitat.

In conclusion, the remedial actions initiated for the St. Paul Waterway Problem Area of the CB/NT site has been successfully completed and the remedy implemented remains protective of human health and the environment. As described above, an additional analysis of the institutional controls for the deleted portion of St. Paul will be conducted to ensure long-term protectiveness.

5.4 Middle Waterway

5.4.1 Background

The Middle Waterway is located in Commencement Bay and is bounded by the Thea Foss

Waterway on the southwest and the St. Paul Waterway on the northeast. The waterway is approximately 3,500 feet long and 300 feet wide. The total area of Middle Waterway is approximately 49 acres. The head of the waterway consists of one of the few remaining natural intertidal mudflats in Commencement Bay.

The industrial transformation of this area began in the late 1880's. Historical industries on the Middle Waterway include metal foundries and machine works; shipbuilding, maintenance, and repair; wood and coal tar products; metal scrap yards; industrial laboratories; and other uses (e.g. trucking firms, stormwater discharge). Current land uses include tugboat and marine transport base operations, ship repair activities, warehousing and storage, log rafting and haul out. Contaminated sediments in Middle Waterway have high concentrations of mercury, copper and PAHs.

5.4.2 Source Control

Ecology identified only one major source of problem chemicals to Middle Waterway, Marine Industries Northwest (MINI) at the mouth of the waterway. In addition to Ecology's source control investigations around the waterway and controls implemented at MINI, the City developed a City-wide stormwater management program which includes regular business and industrial/hazardous waste inspections in the industrialized stormwater drainage basin for municipal outfall #200 discharging at the head of the waterway. No significant sources of problem chemicals have been identified in the stormwater discharge. On December 11, 2000, the Source Control Completion Report was issued, documenting that all Milestone criteria were met. Ecology has recently issued a waste discharge permit to MINI for stormwater hydroblast treatment and wastewater discharge. In January 2005, Ecology will be reissuing an NPDES permit which will require sediment quality monitoring in coordination with the long-term sediment monitoring program for Middle Waterway.

5.4.3 Site Chronology

The Middle Waterway Action Committee (MWAC) was established to represent a group of Middle Waterway PRPs (Foss Maritime Company, Marine Industries Northwest, Inc., and Pioneer Industries). In April 1997, EPA and MWAC entered into an AOC for the Pre-Remedial Design and Remedial Design. Under the AOC, MWAC agreed to conduct additional sampling to determine the full nature and extent of contamination, evaluate data and remedial options, recommend a remedy to EPA and design the remedy selected by EPA. During the site investigation activities, Middle Waterway was divided into Areas A (the mouth of the waterway), Area B (the mid-portion of the waterway) and Area C (the Head of the waterway). See Figure 2. Each of these areas were subsequently divided into sub-areas known as Sediment Management Units or SMUs.

As previously discussed, a series of ESDs were developed to identify cleanup specifics not detailed in the 1989 ROD. In February 2002, EPA issued an ESD for Middle Waterway that identified the specific cleanup actions to be performed throughout Middle Waterway. These

actions included dredging, disposal in Blair Slip 1, capping, enhanced natural recovery (ENR), natural recovery and monitoring. At the head of the waterway, in what is known as SMU 51a, the selected remedy in the 2002 ESD included leaving subsurface sediment contamination in place, monitoring, and ENR to address the surface sediment contamination.

The State of Washington (both Ecology and DNR) expressed a preference for removal of contaminated subsurface sediments in this area. EPA also received support for active remediation in this area from the Commencement Bay community (e.g., Citizens for a Healthy Bay). The State proposed to undertake removal of the subsurface contaminated sediment in SMU 51a and was willing to fund the additional cleanup. Since the enhanced action did not conflict with, nor was it inconsistent with the EPA-selected remedy, EPA agreed to incorporate the additional cleanup as an enhancement to the selected remedy. In March 2003, EPA issued an ESD that specified a more extensive remedial action for SMU51a in Area C. The enhanced remedy consisted of the removal of the contaminated subsurface sediments from SMU 51a with upland disposal of the removed material.

In August, 2003, EPA entered into two separate CDs for the cleanup of Middle Waterway. MWAC entered into a CD for implementation of the remedial action for Areas A and B. EPA, DNR, the City, and other parties, entered into a Remedial Design/Remedial Action CD to address the cleanup of Area C. After EPA approval of MWAC's design documents, cleanup activities began in Areas A and B during the summer of 2003 and were completed in February 2004. The cleanup work in Area C was conducted by DNR during the summer and fall of 2004. In August

2004, MWAC proposed to do some additional dredging, enhanced natural recovery (ENR), and pile removal and replacement to address unanticipated post-remediation issues. This work is expected to be completed by February 2005.

Key Dates:

April 1997	AOC with Middle Waterway PRPs.
May 1998	Round 1A Sampling Event.
September 1999	Round 1B Sampling Event.
August 2000	ESD for selection of potential disposal sites.
February 2002	ESD identified selected remedies specifically for Middle Waterway.
March 2003	Two separate CDs signed by EPA and PRPs, one with MWAC for Areas A and B, and one with DNR and other parties for Area C .
March 2003	Explanation of Significant Differences for enhanced remedy in Area C.
April 2003	EPA approval of Final Design for Areas A and B.

June 2003	DNR removes abandoned barges along west shoreline.
July 2003	In-water Construction Begins for Areas A and B
February 2004	Dredging, disposal, capping, ENR completed for Areas A and B.
April 2004	EPA approval of Final Design for Area C.
July 2004	In-water construction begins for Area C.
August 2004	MWAC identifies additional cleanup actions that need to be taken in Areas A and B; completes Year 0 sampling for OMMP.
September 2004	DNR completes dredging, disposal, and ENR in Area C; MWAC begins dredging near former Scow Shed.
February 2005	Planned completion of MWAC work.
April 2005	Planned completion of DNR's in-water planting in Area C.

5.4.4 Remedial Actions

Areas A and B

Construction activities in Areas A and B occurred between mid-July 2003 and mid-February 2004. Activities included both the required cleanup work as well as the related support work: mobilization and site preparation; demolition; replacement bulkhead construction, utility relocation and replacement; dredging and disposal; backfilling, capping and ENR; and planting and habitat enhancement activities.

Demolition

Many structures had to be demolished or relocated in 2003-2004 to provide safe access to the sediments with chemical concentrations above the SQOs. In addition, structures were removed as part of the habitat improvement element of the project. Structures that required demolition or relocation included the Cook's Marine pier and marine railway; the float and tip of the pier at Foss Maritime; a dilapidated pier; the Scow Shed; and the existing wharf at Marine Industries Northwest (MINI). A total of approximately 71,000 square feet of over-water coverage was removed as part of the remedial action.

Dredging and Disposal

Approximately 109,500 cy of sediment and debris were dredged in Areas A and B of Middle Waterway as part of the remedial action. Confirmation sampling occurred after dredging had been completed to confirm removal of material with chemical concentrations exceeding the SQOs. Based on test results, additional dredging was required in some areas. Dredging continued until SQOs were achieved, or until MWAC and EPA concluded that an alternative

action was more appropriate. Dredged material was loaded onto a split-hull barge and transported to the Blair Slip 1 disposal site. Some debris was disposed at a construction debris landfill.

Backfill, Capping and Enhanced Natural Recovery (ENR)

Backfilling, thick-layer capping and ENR techniques were all used in Areas A and B. Backfilling was used to eliminate habitat loss or conversion through the placement of clean material to return dredged areas close to their original grade. Surface backfilling consisted of cap material known as “habitat mix” which is a mixture of small cobble/gravel and fine grained sediment beneficial for aquatic organisms and salmonid feeding areas.

The cleanup objective of the thick-layer capping is to isolate problem sediments from the water column and the biologically active zone of the sediments. Thick-layer capping was required in areas where sediments with chemical concentrations exceeding the SQOs could not be completely removed because existing structures could not be relocated or because of slope stability issues. A 45 centimeter (cm) clean silty sand cap was placed over approximately 2.15 acres of the waterway.

Two cleanup remedies involved ENR: (1) ENR with surficial cap; and (2) dredging and ENR. The cleanup objective for the ENR-and-surficial-cap area was to improve habitat conditions and address minor chemical exceedances. The area received a thin layer of sand material with a top layer of surficial cap material (habitat mix). This mix provided both a habitat benefit as well as allowing the clean material to remain in place. The cleanup objective for the dredging-and-ENR areas was to remove a majority of the contamination with dredging and augment the natural sedimentation rate in areas with residuals by introducing a layer of clean material. Approximately 6.5 acres in Areas A and B were treated with one of the two ENR actions. It should also be noted that cleanup of approximately 0.5 acres in Middle Waterway is being addressed through natural recovery.

Habitat Considerations

Habitat restoration was one of the five key cleanup elements in the CB/NT ROD. Fish habitat enhancement elements were incorporated into the overall remedial design for Middle Waterway.

Specifically, the remedial design enhanced the existing habitat by minimizing the conversion of intertidal habitat to subtidal habitat through:

- Backfilling slopes with material beneficial to salmon;
- Shoreline planting and placement of large woody debris;
- Using capping material that enhanced habitat function (e.g. suitable substrate and habitat for aquatic organisms in the environment);
- Removing chemicals above the SQOs;

Removing over-water structures;
Permanently removing creosote-treated piling; and,
Implementing conservation measures during construction.

5.4.5 Additional Cleanup Activities

In August 2004, MWAC notified EPA that additional cleanup activities were necessary in Areas A and B. These included:

Fender pile replacement

As part of the remedial design, and in accordance with resource agencies' wishes, MWAC used untreated timber fender piles to replace creosote pilings that were removed. These fender piles were expected to last 5 to 10 years based on normal use. In approximately 6 months, the piles were observed to be heavily honeycombed with shipworm bores and have been determined to be sufficiently weakened to make them incapable of functioning as designed to protect the bulkhead from vessel impact during normal docking operations. This rapid and complete infestation was not expected by the resource agencies. Therefore, MWAC has decided to replace the untreated timber piles with steel piles with corrosion resistant coating. The fender pile replacement work was completed in the fall of 2004.

Former Scow Shed Area dredging and disposal

Since the remediation work, slope sloughing occurred exposing an extensive formerly buried timber bulkhead. Part of the bulkhead has since collapsed into the newly dredged basin. It is believed that some of the sediment that was supported on the slope contained residual contamination that sloughed into the waterway and resulted in sediments within the basin that exceed the SQOs. Approximately 1500 cy of contaminated material was removed from this area in the fall of 2004. This area was resampled and meets SQOs.

Installation of a passive cathodic protection system on the Foss float piles

As required by the resource agencies, new 12-inch diameter pipe piles were installed to replace the creosote-treated piles at the Foss mooring float which were removed as part of the remediation work. No galvanizing or cathodic protection was included in the design of these piles due to the increased wall thickness; however, some scaling had already been observed on the new piles and there was concern of premature corrosive failure. Therefore, installation of a passive cathodic protection system was completed in the fall of 2004.

Placement of Enhanced Natural Recovery Material

During the remedial action, two dredge areas were dredged several times to remove contaminated sediments; however, confirmation sampling results showed minor exceedances of

mercury. At the time, a decision was made to change the remedy in these two areas from a dredge only to dredge with natural recovery. To ensure a more rapid recovery to the SQO, MWAC plans to place additional ENR material over these areas by mid-February 2005.

5.4.6 OMMP Monitoring

The OMMP calls for monitoring to be performed in years 0, 3 and 5 following the completion of the remedial action. Results from the Year 0 monitoring completed to date indicate that areas treated with ENR material (e.g., sand) last spring meet cleanup objectives. MWAC will perform more monitoring in conjunction with the placement of the additional ENR material later in 2005.

Area C

The remedial action in Area C involved the removal of contaminated subsurface sediments in SMU 51a and backfilling with habitat-suitable substrate to restore the mudflat environment. Sediment removal in SMU 51a was completed “in the dry” using land-based excavation equipment during periods when the tideflat was exposed at low tide. This was accomplished by excavating a discrete cell that could be completed before the incoming tide, removing the contaminated material, and then backfilling the cell to approximate the pre-existing mudflat grade. Debris and piles were also removed. Approximately 3200 cy of contaminated sediments were dredged and disposed at an upland landfill. Samples were collected post-excavation in each cell prior to backfilling. Analytical results are still pending and are expected to be available in January 2005.

ENR material was placed in SMU 51b to promote enhanced natural recovery of near-surface sediments. This represents approximately 2.2 acres at the head of the waterway. Samples were collected in October 2004 and results are still pending. The final OMMP for Area C has not yet been approved by EPA. However, long-term monitoring will be implemented to monitor attainment of the SQOs in Area C.

All required remedial actions in Middle Waterway have been completed in the past year and a half. These remedies are functioning as intended and are therefore protective. No remaining issues have been identified.

5.5 Olympic View Resource Area

5.5.1 Background

The Olympic View Resource Area (OVRA) is offshore of the peninsula between the Thea Foss and Middle Waterways. The OVRA site was not identified as a problem area in the CB/NT ROD, but sediment contamination was identified in 1998. Pursuant to an EPA AOC, the City performed a non-time-critical removal action to address approximately 3 acres of contaminated marine sediments at OVRA. EPA’s Action Memorandum was signed in July 2001.

The primary contaminant of concern found in sediments at the OVRA site was polychlorinated dibenzo-p-dioxins and dibenzofurans (hereinafter referred to as dioxins). Sediments contaminated with certain metals (arsenic, copper, mercury, and zinc), PCBs, and PAHs were more localized and did not exhibit the broader distribution shown for dioxin-contaminated sediments. The CB/NT SQOs were used as cleanup standards for OVRA, as well as a site-specific sediment quality criterion of 20 parts per trillion (ppt) Toxicity Equivalent Quotient (TEQ) dioxins.⁷ TEQ is the expression of toxicity based on the overall toxicity of specific congeners of a multiple congener containing compound.

5.5.2 Source Control

Past releases by the former Puget Sound Plywood Company are considered to be the primary source of the most significant contaminants found on the site. The plant operation historically discharged stormwater and process wastewater directly in Commencement Bay. Disposal of other solid and contaminated wastes from the facility is believed to have occurred in the intertidal and subtidal layer within the OVRA. Investigation by Ecology has resulted in a determination that there is no ongoing source of contamination to the site from the upland property adjacent to the OVRA.

5.5.3 Site Chronology

Key Dates:

July 2001 Action Memorandum to implement non-time-critical removal.

July 2001 EPA/City AOC for removal action.

October 2002 Construction complete.

August 2003 Long-term Monitoring and Reporting Plan approved.

5.5.4 Remedial Action

The primary removal action objective for the OVRA was to:

Significantly reduce the potential risk to human health and/or marine ecological receptors resulting from potential exposure to contaminants present in sediments in the project area by removing and disposing of the contaminated sediment at an acceptable disposal site,

⁷As set forth in the Action Memorandum for OVRA, the sediment quality criterion of 20 ppt TEQ dioxins will ensure that the average remaining concentration at the OVRA will not exceed the site-specific background concentration of 7.4 ppt TEQ dioxins. This SQO and the background approach used to derive it are not necessarily applicable to other Superfund sites or problem areas identified in the CB/NT ROD.

and/or capping contaminated sediments in place in the project area.

The elements of the removal action for the OVRA were:

- Removal of contaminated sediments with disposal at an off-site upland facility, followed by capping or backfilling of remaining sediments (intertidal; Areas A through D);
- Capping of contaminated sediments (subtidal; Area E);
- Achievement of a site-wide dioxin concentration less than background;
- Removal of pilings;
- Sediment resampling of one station during design;
- Implementation of institutional controls; and,
- Perform long-term monitoring.

The City developed a cleanup plan and design documents. The cleanup project occurred in 2002. Approximately 600 wooden piles and 11,438 tons of contaminated sediment and debris were removed from the nearshore area and disposed of in an off-site upland landfill. Approximately one acre of marine sediments were capped with clean material. EPA approved the Removal Action Completion Report in March 2003, agreeing that the objectives of the removal action were achieved, including:

- Removal or long-term isolation of chemical materials from the environment and,
- Elimination or significant reduction of potential human health and environmental risks.

5.5.5 OMMP Monitoring

In 2003, EPA approved the Final Long-term Monitoring and Reporting Plan (LMRP) for the OVRA. The goals of the long-term monitoring program for the OVRA are to ensure that the selected cleanup action continues to be protective of human health and the environment. The specific objectives of the LMRP are to ensure that:

- The sediment cap continues to isolate toxic concentrations of previously identified chemicals of concern (COCs) in underlying sediments from marine biota and other biological receptors; and,

- The sediment cap is not recontaminated with COCs from underlying sediments.

The LMRP describes the physical integrity monitoring (elevation surveys and visual inspections) and sediment chemical monitoring, and the associated performance standards, that apply to the site. The LMRP also details the process for contingency planning and response in the event that performance standards are not met.

In 2003 (Year 1), the first long-term monitoring effort was completed, and EPA approved the final report in 2004. Physical integrity monitoring (i.e., conventional and bathymetric transect surveys results and visual inspections) showed that erosion is not occurring to an extent that

would compromise the ability of the cap to physically isolate contaminated sediments from environmental receptors. Sediment quality monitoring (i.e., surface chemistry results) showed that contaminants are not moving upward to the top of the cap via diffusion or other transport mechanisms. None of the performance standards for physical or chemical monitoring results were exceeded.

In 2003, some of the early warning values for physical integrity monitoring were exceeded at Transect 1, which crosses the capped Area B. In response, EPA required the City to resurvey Transect 1 in April 2004 (rather than waiting until 2005, when the next survey was scheduled). EPA also required the City to establish a new transect (Transect 0) approximately 50 ft from Transect 1, which would provide baseline data that could be used in 2005 to provide more comprehensive coverage of the area of the cap where the erosion was observed. These actions were implemented, as described below.

In 2004 (Year 2), visual inspections of the sediment cap were completed in April and August, a new transect near capped Area B was surveyed in April (Transect 0; baseline data collected for future comparisons), and Transect 1 near capped Area B was resurveyed in April. The 2004 results were submitted on October 28, 2004, and approved as final by EPA in December 2004. No performance standards were exceeded. Results for Transect 1 showed that one of four stations exceeded the early warning trigger, but that single station did not exceed the performance standard for Area B. Using the final as-built as a baseline, it is noted that the majority of the loss occurred in Year 1 (loss of -0.9 ft) as compared to Year 2 (loss of an additional -0.1 ft).

In summary, Year 1 and Year 2 monitoring results have confirmed the continued success of the removal action at the OVRA.

With regards to institutional controls, the objective of the OVRA site institutional controls is to prohibit activities that would disturb the capped areas of the site. These controls were developed based on reasonably expected future uses of the site for non-commercial purposes. The City will continue to maintain site access and related institutional controls. These controls, which are detailed in Section 8 of the LMRP, include:

- Designation as a City Natural Resource Damage Assessment Settlement site;

- Withdrawal order from DNR to protect the area from further commercial use and potential development or commercial leasing;

- Execution of a 30-year lease with DNR by the City to maintain access and control over the capped areas;

- Creation of a U.S. Coast Guard Regulated Navigation Area; and,

- Development of signage postings in the upland portion of the site to limit disturbance by the general public, and establishing off-shore buoys per Coast Guard requirements to prohibit moorage or anchorage.

Revisions and updates include the following:

DNR Environmental Reserve - In 2000, OVRA was established as an environmental reserve by DNR under RCW 79.68.060. In 2003, the Commissioner of Public Lands rescinded that order, and then invoked a new order in May 2004 that withdraws the OVRA project area from leasing under RCW 79.90.460. This withdrawal is intended to protect this area from further commercial use and potential development or commercial leasing. A copy of this document is provided in Appendix E of the Year 2 Annual Monitoring Report for the OVRA.

Public Access, Signage, and Marker Buoys - Signs were placed at OVRA in January 2004. The signs describe the cleanup action, show a map of the capped areas, and provide contact information.

5.6 Thea Foss and Wheeler-Osgood Waterway

5.6.1 Background

The Thea Foss Waterway is the westernmost waterway in Commencement Bay, and is adjacent to the downtown core of the city of Tacoma. This waterway extends north to south and makes up about 1.5 miles of downtown shoreline (110 acres) for the City. The Wheeler-Osgood Waterway is approximately 0.3 miles long, runs east to west, entering the Thea Foss Waterway approximately halfway down the east shoreline just south of the 11th Avenue Bridge and north of J.M. Martinac Shipbuilding. See Figure 8. The land use along the waterways was primarily industrial dating from the early 1890's until the 1980's.

In the past 25 years, the City and other entities have worked to enhance public access and create green spaces along the Thea Foss Waterway. A significant urban renewal project is underway along the waterway. Marinas have been upgraded and new development has occurred, such as the Tacoma Glass Museum, a renovated Albers Mill, and Thea's Landing condominiums. There remain active, commercial businesses along the waterway, such as, marinas, J.M. Martinac, Johnny's Restaurant and Johnny's Seafood, and Colonial Fruit and Produce. The majority of the submerged lands of the Thea Foss Waterway are state-owned aquatic lands, managed by DNR. The Wheeler-Osgood Waterway is privately owned.

Contaminants found at elevated levels in the Thea Foss and Wheeler-Osgood Waterways include zinc, lead, mercury, cadmium, copper, nickel, PAHs, 2-methylphenol, 4-methylphenol, bis[2-ethylhexyl] phthalate (BEP), butyl benzene phthalate, and PCBs. In addition to these contaminants, non-aqueous phase liquid (NAPL) seeps have been found at the head of the Thea Foss Waterway.

5.6.2 Source Control

Overall, the ROD identified three separate problem areas for this waterway, and Milestone Reports were issued over the time-period between 1992 and 2003, with separate Source Control Completion Reports for each problem area (May 28, 1997, for Mouth of Foss; June 16, 2000, for Wheeler-Osgood; and June 30, 2003, for Head of Foss). Overall, Ecology identified the following “major” sources to these problem areas:

- Municipal storm drain 254 (Wheeler-Osgood);
- “D” Street Petroleum (Mouth of Foss);
- Tacoma Coal Gasification (Head of Foss);
- J. M. Martinac (Head of Foss); and,
- Municipal storm drains 237A, 237B, 230, 235, and 245/248 (Head of Foss).

As the result of sediment investigation and upland source investigations, the relative priorities of problem chemicals identified and prioritized in the 1989 ROD shifted, particularly at the Head of Thea Foss. For instance, ongoing sources of metals were discovered to be small in comparison to historic discharges and depositions of metals. This, combined with assessments of waterway dynamics and source loading, made metals less of a source control priority than PAHs and phthalates for preventing and reducing recontamination potential.

As noted in the Background section (Section 3.0), the ROD identified a two-phase approach for site cleanup: once sources are regulated, sediment cleanup can begin. For the Head of Foss, historical sources adjacent to the waterway have been eliminated, ongoing sources are administratively controlled, and the nearly 6,000 acres of municipal stormwater discharge is being managed by the City to reduce its recontamination potential.

The City has implemented significant enhancements for its stormwater program to prevent recontamination. This includes: enhanced monitoring of stormwater in major drains, inspections, and public education.

In 1998, the City began monitoring stormwater solids in the major drains and in 2001 began a comprehensive sampling program for whole water effluent and accumulated solids. This program was approved under an AOC Addendum and also included in the CD as part of the long-term monitoring of the site. Whole water is analyzed for selected semi-volatiles (PAHs and phthalates), selected metals (lead, mercury and zinc), hardness, pH and total suspended solids (TSS) and sediment samples are analyzed for the same constituents, plus total solids, TOC, Pesticides/PCBs, NWTPH-Dx and grain size. The City samples 10 storms per year per drain as well as dry and wet-weather base flows. Stormwater solids from in-line sediment traps are deployed annually from August through March or April, depending on seasonal rainfall. Annual reports, including and evaluation of the data relative to continuing source control efforts are

prepared for EPA and the Washington State Ecology. Results from the monitoring of sediments and effluent discharges are used first as indicators of source control effectiveness from drain-to-drain and then as guidance to the City about where and how to focus additional investigations and control work.

In 2002-2003, at the Tacoma Coal Gasification site, Ecology implemented a cleanup for the coal tar and creosote sources on the uplands at the Head of the Thea Foss Waterway to remove the source of NAPL from the west bank at the Head of the Thea Foss Waterway. The resultant removal of contaminated bank and debris in February 2003, included some intertidal, and nearshore subtidal material as well. Ecology coordinated the design and implementation of this source control action with the remedy designed for adjacent sediments in the head of the waterway.

In 2001-2004, the City worked with Ecology to identify and address several sources of heavy PAHs to stormwater in drains 245 and 248 along the east side of the waterway. This removal and cleanup project, also known as the “D” Street Pipeline, is being carried out under the State’s Model Toxics Control Act (MTCA). Sources of PAHs infiltrating City stormwater include leaking underground storage tanks with various contents and an abandoned railway fuel line dating back to 1910. As Ecology manages the cleanup of sources, the City has also performed capital improvements to the public stormwater lines to prevent infiltration and control the load of PAHs reaching sediments. The City monitors in-line PAH conditions closely and maintains sorbents to capture any PAH infiltration that may occur.

In the course of developing the remedial design for waterway sediments under the AOC, the City identified marinas as a source of contamination to waterway sediment for PAHs and phthalates. The predicted impacts of marinas to sediment were cause for concern because marinas are an important part of the existing waterway as well as critical to the City’s plans for downtown redevelopment. The City and the Foss Waterway Development Authority (FWDA) began working with the DNR, Ecology, and marina owners, operators and clients on ways to manage and minimize the predicted impacts of marinas on sediments. It will be extremely difficult to estimate or quantify the effect that source control for marinas will have on minimizing or preventing sediment recontamination, as a comprehensive study of their contribution to sediment contamination has not been performed. However, Ecology believes increased awareness of contaminant issues in the DNR leases, coupled with ongoing education programs, and a full-time presence to provide assistance/enforcement are key to successfully preventing pollution from marinas.

5.6.3 Site Chronology

Key Dates:

March 1994 City of Tacoma signed an AOC for pre-remedial and remedial design activities on the Thea Foss and Wheeler-Osgood Waterways cleanup

- August 2000** ESD identified the selected remedy for the Thea Foss, Wheeler-Osgood and Hylebos Waterways.
- June 2002** Special Notice Letters were sent to 71 PRPs
- November 2002 - February 2003** City conducted six cleanup actions under a UAO
- May 2003** CDs for the City and Utilities were entered into federal court. EPA agreed to two separate CDs for the City and the parties known as the “Utilities.” Cleanup of the entire waterway would be completed but it was divided into two work zones at 73+10, just north of the SR-509 bridge.
- June 2003** City hired Manson Construction Company (MCC) as its RA contractor. Commenced work on RA related infrastructure at Simpson Timber Company.
- July 2003** Utilities’ remedial design completed.
- September 2003** EPA approved RA Work Plans and start of remedial action activities.
- March 2004** Biological Opinion from NOAA that no adverse effects would occur from this project.
- November 2003** EPA approved final RD.
- February 2004** Utilities’ in-water remedial action activities completed.
- September 2004** ESD identified a temporary storage area for material dredged from the St. Paul CDF, in-water alternatives for capping material, clarification of mitigation projects, volume of dredge material, final design for SR-509 seep in Utility work area, project costs and project institutional controls.
- November 2004** City and Utilities draft institutional control plans submitted to EPA.

5.6.4 Remedy Selection

For the Thea Foss and Wheeler-Osgood waterways, there have been two Explanation of Significant Differences (ESDs) identifying the selected remedy for this site. The cleanup elements in these plans for this site are identified below.

August 2000 ESD

In August 2000, EPA issued an ESD selecting the cleanup remedies and disposal options for the Thea Foss and Wheeler-Osgood and Hylebos Waterways.

This ESD called for specific dredging, capping and enhanced natural recovery and natural recovery activities along the Thea Foss and Wheeler-Osgood Waterways. These areas were broadly referred to as Superfund Sediment Management Areas (SSMA). SSMA's were then further refined into segments (e.g., SSMA1 1e2). The cleanup addressed the highest levels of contamination in the head of the waterway. Contaminant levels taper off towards the mouth. It was determined that no action was necessary at the mouth, which is the northernmost end of the waterway.

The ESD identified a cleanup remedy based on maintaining the current navigational depth in the channel, except in the head of the waterway, by (1) dredging to clean where possible and backfilling with clean material if necessary for maintaining bottom elevations, (2) using caps when contamination extends well beyond the navigation depth, or along banks where dredging would compromise upland structures or would over-steepen the bank, (3) identifying no action areas, and (4) identifying enhanced natural recovery, and natural recovery areas where it is expected that sediments will meet the SQOs within 10 years, which are mostly in the mouth of the waterway. Cap performance standards are identified in the ESD.

At the Head of the Thea Foss Waterway additional remedy provisions and objectives were identified in order to control the NAPL found there:

Placement of a composite multilayered cap of sand, sorbent material and geotextile membrane over areas that have active NAPL seeps (that also meets the performance standards); and

Placement of a sheet pile wall across the waterway north of the State Route 509 bridge to provide stabilization for the cap in the Utilities Work Area.

Also, two in-water confined disposal facilities (CDF) at the Head of the St. Paul Waterway and Blair Slip 1, an upland facility for the DMMP site were identified as disposal locations for dredged sediments.

Finally, the ESD required the City "to take all appropriate and practicable steps to avoid short and long-term unacceptable adverse impacts to the Commencement Bay aquatic environment" during the remedial design, construction and site maintenance to continue to avoid and minimize adverse impact to aquatic habitat. EPA identified affirmative conservation measures for the Thea Foss, Wheeler-Osgood and Hylebos waterways which focus on developing broad landscape attributes and ecosystem processes to promote juvenile salmon utilization of existing and potential Puyallup River delta and Commencement Bay habitats. It is EPA's intent that remediation, including required compensatory mitigation, of the CB/NT site cumulatively contribute toward the recovery of ESA listed species.

September 2004 ESD

In September 2004, EPA finalized another ESD providing additional clarification to the selected

remedy in the August 2000 ESD and to identify new components of the cleanup identified during the remedial design process. The actions covered by the September 2004 ESD include:

Identifying that the Puyallup River delta area can be used as a temporary storage area for 264,000 cy of suitable sediments dredged from the confined disposal facility (CDF) in the Head of the St. Paul Waterway, while the Mouth of the Thea Foss cleanup progresses. Of the 246,000 cy dredged and placed on the delta, no less than one-third of that amount will remain on the delta to benefit juvenile salmonids and create additional aquatic habitat while, up to two-thirds of that amount, 146,000 cy, will be beneficially reused as (a) capping material in the Thea Foss Waterway; (b) to create habitat mitigation sites or (c) for capping the CDF. Placing these sediments on the Puyallup River delta is different from disposing them at the Dredged Material Management Program open water site (DMMP) in Commencement Bay as proposed in the August 2000 ESD;

Identifying two new sources of capping material: (a) from the Puyallup River delta and (b) from the mouth of the Puyallup River, that can be dredged for beneficial reuse as part of the Thea Foss and Wheeler-Osgood Waterways cleanup and used as capping material in the Thea Foss Waterway or for the CDF, or as material to create or augment habitat mitigation areas;

Identifying that the final volume of dredged contaminated sediments from the Thea Foss and Wheeler-Osgood Waterways and the final capacity of the St. Paul confined disposal facility (CDF) will be lower than the volume identified in the August 2000 ESD;

Identifying habitat mitigation projects and the total number of acres created as a result of these projects which meet the performance criteria identified in the August 2000 ESD;

Providing clarification of the selected remedy and federal deauthorization of the navigation channel in the Thea Foss Waterway;

Identifying the basic institutional control measures that will be employed to ensure that the containment remedy in the Thea Foss Waterway will be maintained and remain protective to aquatic species in the waterways and ensure the habitat mitigation areas are preserved in perpetuity;

Identifying the final cleanup remedy for the NAPL seep area near SR-509 in the Head of the Thea Foss Waterway; and,

Identifying the project costs for the remedial actions performed by the City and three companies known as “the Utilities,” Puget Sound Energy, PacifiCorp and Advance Ross Sub-company.

5.6.5 Remedial Action

2002 Remedial Activities

The City commenced its cleanup activities in November 2002 under a UAO to address six areas along the Thea Foss and Wheeler-Osgood Waterways. The areas cleaned up were Johnny's Seafood, Martinac Shipbuilding, St. Paul/Middle Waterway Peninsula Timber Piling Removal, Thea's Park, Totem Marine Services and the shoreline of the Wheeler-Osgood Waterway. An overview of the design and any necessary design modifications to the 2000 ESD are identified in the Remedial Action Construction Report (June 2003).

2002-2004 Utilities' Remedial Design and Remedial Action

After the CD was signed by the Utilities, these parties started working on a remedial design to address all the problems and contaminants identified in the Head of the Thea Foss Waterway. Ultimately, the Utilities design included a minimum of dredging and upland disposal, placing cap material throughout the work area, a scour protection system in front of the twin 96-inch outfalls, an impermeable cap over the SR-509 seep, a transition sheet pile wall and habitat enhancement areas along the east side of the waterway. An informal Biological Opinion consultation was received from NOAA on September 26, 2003, that stated that the project would have no adverse impacts. The Utilities started remedial action activities on September 19, 2003, and completed the cleanup on February 27, 2004.

Final Inspection and Verification Reports were submitted and approved by EPA. Project Verification/Operations, Maintenance and Monitoring Plan (OMMP) Year-0 Sampling was conducted April 7-9, 2004, to collect baseline information and determined that the final dredge and cap elevations met the SQOs.

Sample results indicate that although there are some chemicals of concern present, these concentrations are not above SQOs. See "Results of Year 0 Operation, Maintenance and Monitoring Plan Sampling" (Dalton, Olmsted & Fuglevand, Inc., August 27, 2004).

2004 - Ongoing City of Tacoma Remedial Action

The City hired its remedial action contractor Manson Construction Company in July 2004. After finalizing the Remedial Action Work Plans and other associated RA documents, the City began construction of a new log haul-out facility in the Middle Waterway for the Simpson Timber Company in order to remove the existing log-haul out facility in the Head of the St. Paul Waterway. The Head of the St. Paul Waterway would eventually become the disposal site for contaminated sediments dredged from the Thea Foss and Wheeler-Osgood Waterways. Additionally, a fuel facility was moved to the mouth of the St. Paul Waterway.

After the City received approval of its Remedial Design in November 2003, it commenced dredging the head of the St. Paul Waterway to deepen it to -60 feet MLLW in order to accommodate 525,000 cy of contaminated sediments. Sediments removed during dredging were placed at the DMMP site in Commencement Bay and on the Puyallup River delta to enhance the

leading edge creating additional aquatic habitat for migrating juvenile salmonids.

Other remedial action activities during the 2003-2004 remediation season were:

Construction of a habitat corridor on the western side of the St. Paul and Middle Waterways peninsula that would provide for a fish friendly passage to the Middle Waterways Tideflats habitat site to be constructed at the head of Middle Waterway;

Dredging and capping activities were also conducted on the west bank and shoreline in front of the Glass Museum in the Thea Foss Waterway. Sediments dredged from this location were placed in the CDF with a thin layer of clean material on it during the fish closure period between February and August 2004; and,

Beginning construction of two new marinas at Albers Mill and City View to use for temporary moorage for boats needing to be moved from existing marinas during cleanup.

Design modifications during the construction season included changing the design of the cap in front of Albers Mill on the west bank from a standard cap to using a grout mat (i.e., geotextile fabric with pumped in concrete between two layers of fabric) in order to address concerns about potential future NAPL release in this area.

Schedule modifications during the construction season included not starting construction of the Puyallup River Side Channel habitat mitigation site due to issues of access, ownership and liability between the City and U.S. Army Corps of Engineers and not dredging 75,000 cy from the Thea Foss Waterway by February 2004.

Mitigation Sites

In order to comply with Section 404 of the CWA the City is required to mitigate for approximately 13 acres of habitat that is impacted by the St. Paul CDF and other impacts from remedial activities in the Thea Foss waterway. The mitigation sites for this project are on the St. Paul berm, the Middle Waterway Corridor, the Middle Waterway Tideflats, the Puyallup River Side Channel, several pocket beaches throughout the Thea Foss Waterway and the still being developed Bunker mitigation site on Hylebos Creek.

Recontamination Issues

In mid-August 2004, the City and Utilities sampled the northeastern portion of the Utilities cap prior to the City dredging materials adjacent to the transitional sheet pile wall north of the Utilities work area. After dredging activities were completed, post-dredge sampling was conducted in at the same areas. Sample results from both 0-2 cm and the 0-10 cm intervals indicate that the concentrations of contaminants of concern were significantly higher post-dredge and exceeded the SQOs compliance point in the 0-10 cm samples (see Memorandum entitled, "Data from Utilities' Capped Area," October 29, 2004).

Concerned by these results, the City, also collected samples from their adjacent cleanup areas along the western shoreline. Results from these samples indicate that the contaminant levels are higher than in February 2004, just after cap placement, but are not as high as the concentrations found on the Utilities cap ("Supplemental Surface Sediment Sample Results, City, November 29, 2004") and only exceed SQOs for a few contaminants. Additional sampling by both parties occurred in November 2004; sample results are expected in January 2005. Preliminary results presented by the Utilities suggest that contaminants are located in a silt layer deposited on the cap and are not migrating through the cap from contaminated sediments below.

Possible routes of recontamination are from (1) early season storm events discharging from adjacent storm drains, (2) drifting sediments from dredging activities from the City's adjacent work area, or (3) "bottom-up" recontamination due to a cap failure in the Utilities work area. Further evaluation of this area will continue and EPA will determine what, if any, additional actions are required.

Best management practices are being reviewed for any future dredging activities in the City's work area so that recontamination from on-going dredging activities is minimized.

6 ASARCO

6.1 Location of the Asarco Area Site

The Asarco Area Site (the Site) consists of the former Asarco copper and lead smelter facility ("Smelter Facility" or "facility") and the surrounding area (described below). The Smelter Facility is located along the Commencement Bay shoreline within the municipal boundaries of Ruston and Tacoma, Washington. The upland portion of the Smelter Facility is approximately 100 acres in size, and encompasses a 60- acre smelter and a 40- acres slag Breakwater Peninsula. Approximately 30 acres of offshore intertidal and subtidal lands are also under Asarco ownership. Additional offshore areas are owned by the State of Washington and are managed by DNR (see Figure 9).

The surrounding area, known as the Ruston/North Tacoma Study Area includes approximately 950 acres and comprises an arc of approximately one mile radius around the Asarco smelter facility (excluding Commencement Bay) encompassing the town of Ruston and the northern portion of the city of Tacoma. Land use is primarily residential and includes schools, playgrounds, and parks. The southern portion of Point Defiance Park and Zoo, which extends along a wooded peninsula to the northwest of the smelter, is located within the Study Area and includes access to the Vashon Island Ferry. Commercial development consisting of retail shops and small businesses is mainly located along Pearl Street.

The Site includes an estimated population of approximately 5000 people, and about 1,820 housing units. Contamination at the site is the result of airborne emissions from smelting operations and consists primarily of arsenic and lead in surface soils. Smelter slag has also been used by residents in various applications.

6.2 History of the Asarco Smelter

The smelter began operations in 1890 as a lead smelter. Asarco purchased the smelter in 1905 and converted it to a copper smelter in 1912. The smelter specialized in processing ores with high arsenic concentrations and recovered arsenic trioxide and metallic arsenic as byproducts. Operation of the Asarco smelter for over 95 years resulted in contamination, primarily arsenic and lead, of the smelter site, off-shore sediments and the surrounding residential area. In recovering copper from ores and concentrates, the smelting process produced slag, a hard, glassy material containing elevated concentrations of arsenic, lead, and other metals. Copper smelting operations ceased in 1985, and the arsenic production plant was closed in 1986.

Much of the smelter facility was constructed on slag fill. The slag fill was used to modify and extend the pre-existing shoreline by approximately 500 feet into Commencement Bay. The slag beneath the Breakwater Peninsula is up to 125 feet thick.

6.3 Background of EPA's Cleanup Actions

In the 1980's, EPA identified the Asarco Smelter, Ruston/North Tacoma and Off-shore Sediments as Operable Units (OU 02, 04 and 06 respectively) in the Commencement Bay Nearshore/Tideflats interim and final NPL listing.

EPA is the lead regulatory agency for the Site. Ecology has supported EPA at the Site throughout the CERCLA process. Asarco is the only identified responsible party.

In the late 1980's, 11 publicly available sites were identified which consisted primarily of school yards, parks and vacant lots. These sites were known as the Expedited Response Action (ERA) sites. Asarco removed contaminated soil, and placed clean soil if necessary, at these locations.

In 1987, pursuant to an AOC, Asarco began an RI/FS for the Asarco Smelter site. The Asarco Off-shore Sediments were being investigated under the CB/NT RI/FS and EPA began a fund-lead RI/FS for the Ruston/North Tacoma Study Area in the late 1980's. As part of the Smelter facility RI/FS, site stabilization was also addressed. The ore flues to the Asarco Stack were demolished in 1987. In 1990, EPA signed a ROD for the demolition of the remainder of the structures on the site. In January 1993, the Asarco Stack, which was 562 feet tall, was imploded and temporarily buried on-site.

During the public comment period for the CB/NT proposed plan, Asarco provided comments indicating that the Asarco Off-shore Sediments was different from the tidelflat waterways in the southern end of the Commencement Bay basin, and the Asarco Off-Shore Sediments should be evaluated separately. EPA agreed and did not include this site in the final 1989 CB/NT ROD.

Initially the Smelter facility ROD was to include groundwater cleanup. However, while preparing the ROD, EPA determined that it did not have enough information on the impacts of groundwater to the off-shore sediments. It was, therefore, determined to omit groundwater from

that ROD and include it in the additional off-shore sediment studies.

6.4 Source Control

The primary source of contamination in the adjacent residential area came from the operation of the Smelter. This facility closed in 1985 and the final smelter work activities on the facility was completed by 1986. As a result, there are no further concerns about smelter emissions recontaminating these areas. Careful dust control during remedial activities on the facility minimize the potential for further contamination from blowing dust .

The Smelter Facility ROD included the capture of shallow groundwater in selected areas, construction of a low-permeability cap over the Facility, excavation of the most highly contaminated source materials (selected slag material and contaminated soils) and consolidation of these materials into an on-site containment facility (OCF). Once completed, these facility cleanup elements will remove a significant source of contamination that would otherwise impact groundwater quality, and significantly reduced the flow of contaminated groundwater to Commencement Bay by minimizing recharge of the shallow aquifer system (e.g., surface water controls and the low-permeability cap will reduce infiltration). These actions will serve as source control for the off-shore sediments. However, until the smelter remedy is completed, some surface and groundwater will continue to reach the Bay.

6.5 Site Chronology

Key Dates:

Asarco Smelter

September 1986	AOC for RI/FS and Phase I site stabilization signed.
1988	Phase I site-stabilization (demolition) activities completed.
December 1990	Interim ROD for Phase II site-stabilization (demolition) and surface water controls issued.
May 1992	Demolition CD signed by Asarco and EPA.
January 1995	Final RI/FS report for OU 02 (including groundwater) submitted and approved.
March 1995	ROD signed.
February 1996	CD for RD/RA signed.
April 1996	RD initiated.

Ruston/North Tacoma Study Area

- 1989** AOC for Expedited Response Actions in Ruston/North Tacoma signed.
- June 1993** ROD for Ruston/North Tacoma Study Area issued.
- August 1993** UAO for Ruston/North Tacoma Study Area issued.

Asarco Sediments

- 1994** AOC for Groundwater, Surface Water, Soil and Marine Sediments monitoring and sampling signed.
- 1996** Phase 1/Phase 2 Expanded RI/FS Sediment Activities completed.
- 1997** Placement of pilot cap in a small portion of the offshore contaminated sediments area.
- 1999** Asarco Sediment/Groundwater Task Force concludes their evaluation of potential groundwater impacts to Commencement Bay waters and sediments.
- 2000** Year 2 Pilot Cap Monitoring Report completed.
- 2000** Refinement of the Proposed Remedy Report completed.
- January 2000** Proposed Plan issued (January).
- July 2000** ROD signed.
- 2002** UAO issued to Asarco to implement 2000 ROD.
- 2003** National Settlement-CD with US and Asarco entered in Arizona.
- September 2004** RD Completed.

6.6 History of Enforcement Actions Against Asarco

Pursuant to an AOC dated September 1986, Asarco agreed to perform immediate site stabilization activities at the Asarco Tacoma Smelter and to conduct a Remedial Investigation and Feasibility Study (“RI/FS”) of the Asarco Smelter and the surrounding area to determine the nature and extent of contamination and to evaluate alternatives for remediation of the Asarco Tacoma Smelter and surrounding areas. The requirements of that AOC have been satisfied.

Pursuant to an AOC for Ground Water, Surface Water, Soil and Marine Sediments Monitoring and Sampling, Docket No. 10-94-0221, as amended, Asarco agreed to conduct certain monitoring and sampling both on the Asarco Tacoma Smelter and the off-shore sediments to further evaluate contamination of the groundwater and marine sediments. The requirements of that AOC, other than payment of oversight costs, have been satisfied.

Pursuant to a CD entered in United States v. Asarco Incorporated, Civil No. C91-5528 B, Western District of Washington, on May 19, 1992, Asarco agreed to conduct interim remedial actions at the Asarco Tacoma Smelter including the demolition of most of the remaining structures. The requirements of that CD have been satisfied.

Pursuant to a CD entered in the United States v. Asarco Incorporated, Civil No. C91-5528 B, Western District of Washington, on February 16, 1996, Asarco agreed to conduct remedial actions at the Asarco Tacoma Smelter, originally planned to be completed by December 2003.

In 1999, Asarco approached EPA requested a schedule extension for the Asarco Smelter and Ruston/North Tacoma CDs and deferral of oversight costs on all of its agreements with EPA due to financial constraints. EPA agreed to extend the Smelter schedule and defer oversight costs if Asarco agreed to a) increasing the amount of residential yards it would remediate each year under the Ruston North Tacoma CD; and b) amending the Smelter CD to add lump sum penalties if Asarco missed milestone cleanup dates for both the Smelter and Sediments remedial actions. Upon reaching agreement on these terms, EPA and Asarco modified the Smelter and Ruston CDs, and the Sediments AOC. As modified by Amendment One to the CD, entered on November 2, 2000, and the Modification Agreement, dated November 1999, the requirements for the Smelter CD, not including long-term monitoring, are to be completed by November 1, 2005.

Pursuant to United States v. Asarco, Inc and Southern Peru Holding Corporation, in January 2003, Asarco parent company Grupo Mexico signed a CD with the United States deferring enforcement of their national liabilities in exchange for setting up a \$100 million trust fund (the Trust) to be used for Asarco's environmental liabilities. Under the Trust, EPA will not move to enforce outstanding actions against Asarco for a three year period. The Trust will be paid out over 8 years (\$12.5 million per year plus interest). For three years, until 2006, this money is to be used for Asarco's liability nation-wide. Therefore, site activities at the Asarco Smelter have slowed due to lack of funding although yard cleanups continue at a rate of 100 per year.

6.7 Remedial Action for Asarco Smelter

The selected remedy in the ROD is summarized below:

Excavation of soil and granular slag from five source areas. Soil that fail the Toxic Characteristic Leaching Procedure (TCLP) will be excavated from stack hill, the cooling ponds, arsenic kitchen, the former copper refinery, and fine ore bins building, and disposed of onsite;

Construct a RCRA C onsite containment facility (OCF) on the property for disposal of contaminated material from the source areas. The facility will be designed to hold approximately 240,000 cy of material;

Construct surface and groundwater diversion and controls to protect the OCF from water

infiltration;

Grade and prepare site for capping using residential material from the Study Area as sub-base;

Incorporate plans for future development into the cap design;

Armor the shoreline around the plant site to prevent further erosion of the shore; and,

Mitigate for shore line monitoring activities where they adversely impact intertidal lands.

6.7.1 Asarco Smelter Biological Assessment for Shoreline Armoring

EPA's remedial action for shoreline armoring of the Asarco Smelter constituted a "major construction activity" in the vicinity of a listed species or designated critical habitat under ESA. Therefore, a Biological Assessment was required to evaluate the potential effects on threatened and endangered species from shoreline armoring and receive Biological Opinions from NOAA and USFWS.

To comply with some of the provisions of ESA, all in-water remediation work was restricted to established "fish windows" that are designated times when remedial action construction activities are allowed to occur. Dredging activities during shoreline armoring were required to be done inside silt curtains to ensure that young salmon were not impacted. Divers were used to chase fish out of the curtained area prior to work commencing.

6.7.2 Shoreline 404(b)(1) Analysis

Section 404 of the CWA is an ARAR for the Site. This requires that mitigation must occur for any remedial action(s) that cannot be avoided or minimized. To meet the requirements, the shoreline was sloped upward to form beaches rather than just being armored. A five-acre habitat beach was constructed to mitigate for areas where covering intertidal area could not be avoided.

6.7.3 Asarco Smelter Remedy Implementation

As of October 2004, the following progress has been made on the Smelter remediation:

The OCF has been constructed and all of the source area material from the site has been placed in it. The fine ore bins building has been demolished and most of the wood from the building has been disposed of offsite. All of the buildings on the site have been demolished, and the shoreline armoring is completed. However, in the 2001 Nisqually earthquake, caused a portion of the breakwater forming the habitat beach in the mitigation site to collapse.

The Stack Hill has been remediated to residential standards and is ready for redevelopment. The completion of the OCF cap is expected to take place in 2005, site capping in 2006, and

completion of the remedial action in 2007.

In 2004, 25,000 cubic yards of smelter waste from the Everett Smelter located in Everett Washington, a smelter operated by Asarco at the turn of the last century, was barged to the site and disposed in the OCF. The material was placed after all of the site source area material had been placed in the OCF.

6.8 Remedial Action for Ruston/North Tacoma Study Area

The Record of Decision (ROD) for the Ruston/North Tacoma site was signed on June 16, 1993. Action levels identified for soil removal of residential soil were 230 parts per million (ppm) for arsenic and 500 ppm for lead. The arsenic action level of 230 ppm was based on reducing the additional potential skin cancer risk to no more than 5 in 10,000, within EPA's acceptable risk range (5×10^{-4}) for cancer causing chemicals. The 500 ppm action level for lead was based upon a national goal of reducing levels in children's blood to no greater than 10 up/dl, as well as EPA guidance that recommended establishing soil lead cleanup levels of 500 to 1,000 ppm.

Under Ecology's Model Toxics Control Act (MTCA) Method A, the soil cleanup levels for residential areas were 20 ppm for arsenic and 250 ppm for lead. MTCA requires that some form of action be taken to address contamination above these levels. In evaluating the available remedial actions to address contamination at this site, Ecology considered the nature and extent of site contamination, the nature of human health risks, the exposure pathways, and the potential impacts and costs associated with physical remediation activities in the community. Ecology concluded that the EPA action level of 230 ppm for soil arsenic represented the best balancing of factors for a level at which engineering actions (e.g., soil removal) for remediation should begin at this site. Institutional controls, mostly consisting of educational measures, were deemed by Ecology to be suitable for protection of human health and the environment at those locations within the Study Area where soil arsenic concentrations were between the MTCA cleanup level of 20 ppm and 230 ppm. For lead, Ecology set the soil lead cleanup level under MTCA at 500 ppm for this site.

The March 1995 ROD for the Asarco smelter facility called for the use of the R/NT soils as part of the sub-base for the smelter site cap. The remedy also identified that slag driveways within the Study Area (as well as other areas where small, ingestible, pieces of slag were used) would be excavated and replaced with gravel.

The community had an extensive role in the remedy selection process for the site.

6.8.1 Property Cleanup

The remedial design for the site was started in the fall 1993. Sampling began in October 1993, and cleanup activities were initiated in the spring 1994. The Study Area was divided into four zones, based on known soil arsenic concentrations, in an effort to focus sampling and cleanup activities in the most contaminated areas first. Sampling of all properties

in zones 1 - 3, the preliminary remediation area, is required in the ROD and was completed in 2003. Remedial action in zones 1 - 3 was completed in 2004. Sampling in zone 4 is voluntary, and residents must request sampling of their property. Sampling and remediation of zone 4 is underway. Currently 1400 properties have been remediated in zones 1 to 4, including various public use areas.

6.8.2 Institutional Controls

A community protection measures program (institutional controls) was developed for the Study Area and is being implemented by a program coordinator from the Tacoma Pierce County Health Department, the coordinator for the Asarco Information Center, and a work group consisting of representatives from government agencies, a local interest group, local officials, and Asarco personnel. The program is referred to as "PACE" - the Program for Area Cleanup Education and meets on a quarterly basis. The objective of the PACE program is to provide owners and residents in the Study Area with educational materials and guidance on the management of soils in the area. The PACE program is being implemented in accordance with its requirements. Asarco also provides a soil repository program to allow local residents to dispose of residential soils for free if they are removing dirt from their yards. The program is not used often.

6.8.3 O&M for the Study Area

The PACE program monitors the progress of the Study Area remediation. Periodic updates are provided to community residents. Fact sheets are sent out which continue to advise people on the proper protection measures for areas with soil below the threshold for physical remediation but above 20 ppm arsenic. In addition to education, the program maintains a property data base with sampling results for yards, and has a garbage can collection program for dirt excavated by property owners. The PACE program operates at an annual cost of approximately \$50,000.

6.8.4 Future Studies

Ecology has begun an investigation of smelter contamination outside of the study area. Ecology is mapping areas in King and Pierce County, Washington, with soil arsenic concentrations above 20 ppm with the intent to remediate properties with arsenic concentrations below the 230 ppm trigger for physical remediation in the study area. The area above 20 ppm is estimated at 400 square miles. Currently Ecology calls for soil removal where arsenic concentrations exceed 100 ppm for child use areas. Where properties outside the study area are found above 230 ppm arsenic, EPA and Ecology will make a determination regarding which agency will address the contamination, and what cleanup standards will be used to address these properties.

6.9 Remedial Action for Asarco Sediments

The selected remedy for the Asarco Sediments/Groundwater Operable Unit 06 includes the two major elements, groundwater and sediments.

EPA determined in a Groundwater Task Force, comprised of Asarco, EPA and other regulatory agencies, that additional groundwater remedial actions, over and above those already being implemented under the Smelter facility ROD, were not necessary.

The Selected Remedy for marine sediments included the following elements:

Dredge contaminated sediment in the Yacht Basin and place the dredged sediment beneath a low-permeability soil cap to be constructed on the upland portion of the Facility (i.e., OU 02). The sediments will be contained under the low-permeability cap at an elevation such that groundwater will not come in contact with the sediment;

Monitor the dredged area in the Yacht Basin to verify that it does not become recontaminated;

Cap contaminated sediments in selected offshore areas;

Monitor the sediment caps to confirm that they remain in place, continue to isolate the underlying contaminated sediment, become recolonized with healthy biological communities, and do not become recontaminated;

Use institutional controls to prevent activities that could damage the sediment caps;

Monitor the areas outside the capped and dredged areas to confirm that these areas meet RAOs;

Continue to monitor groundwater to evaluate the long-term effects that the Facility cleanup will have on future groundwater quality; and,

Implement institutional controls to restrict future use of Smelter facility groundwater.

Although there is an approved RD, there is no schedule for the RA to proceed. Money from the Asarco Trust is currently being used for sites with human health risks, and therefore the sediment remedy which is remediating ecological risks has been determined to be less of a priority for the limited funds available.

7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The first Five-Year Review was completed in December 1999. It concluded that the Sitcum and St. Paul Waterways had been successfully completed and that remedial activities for the remaining waterways had not yet been initiated. The report recommended that these remaining waterways be evaluated during the next five-year review. The OVRA and Occidental removal action sites had not been identified as problems at during the first Five-Year Review.

8 FIVE YEAR REVIEW PROCESS

The Five-Year Review team was comprised of the Remedial Project Managers responsible for each of the waterway cleanups and the Asarco area. The CB/NT site is primarily industrial and the interested parties are comprised of local businesses, attorneys and an active citizens groups known as Citizens For A Healthy Bay. In June 2004, EPA issued a Fact Sheet which introduced the Five-Year Review, invited suggestions, and solicited information related to the review. No comments were received from the public. The Five-Year Review consisted of a review of relevant documents including decision documents (ROD), ESDs, remedial design and remedial action reports, environmental laws and regulations, monitoring reports, and enforcement documents. Citizens For A Healthy Bay reviewed the draft Five-Year Review Report and provided comments to EPA.

Regular site visits occur for monitoring and maintenance purposes. Reports of these visits were reviewed to complete this report.

No interviews were conducted.

9 TECHNICAL ASSESSMENT

9.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

9.1.1 Hylebos Waterway

Yes. Although the remedial actions in Hylebos are still ongoing, portions of each of the five CB/NT ROD key elements have been implemented and are performing as expected. Dredging at the Mouth of Hylebos have generally met the SQOs in Segments 3, 4 and 5. Intertidal excavations in 2003 were constructed to specification. Existing monitoring reports for the General Metals cap support that the cap is functioning as intended by isolating the contaminated sediments and thereby reducing exposure to the benthic community. The new cap surface provides a clean surface on which the benthic community can reestablish itself. Natural recovery areas appear to be following the predicted sedimentation trends based upon data from the Mouth of Hylebos (Segment 3 and 4). Source control actions have been implemented, with only the Occidental and Arkema properties known to require additional work at this time. Finally, the institutional controls are being implemented as work occurs and plans are in place to reevaluate the need for the fish advisories after the sediment SQOs have been achieved.

As discussed above, additional investigations and characterization are required at the Occidental Site to identify the nature and extent of sediment contamination beneath the waterway and its relationship to contaminated groundwater discharging to the waterway.

9.1.2 Sitcum Waterway

The remedial action is complete, and performance standards have been met: sediments in the Sitcum Waterway remain below SQOs; natural recovery of sediments within the natural

recovery area of Sitcum Waterway is complete; performance standards within the two mitigation areas have been met; and the Milwaukee nearshore confined disposal facility continues to operate and function as designed (no documented exceedances of chemical concentrations in groundwater).

9.1.3 St. Paul Waterway

The remedial action and long-term monitoring efforts are completed, and performance standards have been met. Institutional controls are being implemented. Future long-term monitoring efforts associated with the sediment cap will occur if there is a significant earthquake or wind storm.

9.1.4 Middle Waterway

All the required remedial activities have been completed in Middle Waterway except the in-water plantings for area C which will be done in the spring of 2005. No problems occurred during the construction nor have any problems been identified that could lead to the remedy not being protective. Preliminary indications are that performance standards in Middle Waterway are being met. All exposure pathways have been addressed. Long-term monitoring is planned as part of the OMMP and will be implemented to determine the effectiveness of the remedies and source control in the future. Institutional control are in the process of being implemented for areas with thick capping. These include revisions to NOAA navigational charts and deed restrictions. Effectiveness of these ICs will be evaluated in the next five-year review.

9.1.5 Olympic View Resource Area

The remedial action is complete, the first two years of long-term monitoring are complete, and all results show that performance standards continue to be met.

9.1.6 Thea Foss and Wheeler-Osgood Waterways

Utilities Work Area. Overall, six months after implementation of the remedy, the cap and transition sheet pile wall are working as intended. There is a recontamination issue on the northeast area of the cap, and data has been collected to determine if this is related to cap failure, which is not considered likely, or due to external circumstances which may require additional dredging best management practices or stormwater discharge controls.

City Work Area. The City is still in the process of completing its remedial action activities. The work conducted in 2003-2004 met the cleanup standards. However, it appears that some portion of this capped area may have been recontaminated by fall 2004 dredging actions in the southern most portion of the City's work areas. Further sampling and analysis is being conducted. Results are expected in January 2005.

9.1.7 Asarco Smelter

The site remediation is still ongoing, and is expected to continue for the next several years. Completion of the OCF will occur in 2005 if funding is received from the Asarco Trust. Final site capping should take place by 2007. The remedy has not been fully constructed and is not yet functional.

9.1.8 Ruston/North Tacoma Study Area

The site remediation is still ongoing, and is expected to continue for the next several years. As the sites now being remediated are further away from the stack, sampling is indicating contamination in parts of yards rather than the entire yard as was found in zones 1 and 2. Remediation is occurring without incident. The portions of the remedy completed to date are functioning as intended by the decision documents.

9.1.9 Asarco Sediments

The sediments remedy has not been implemented and so is not working as intended.

9.1.10 Institutional Controls

During the next five-year review, EPA will conduct a more comprehensive assessment of all institutional controls related to site use restrictions where containment remedy elements are being used and to evaluate all of the applicable site use restrictions and their effectiveness.

9.1.11 Operations & Maintenance Costs

In each of the waterways and at the Asarco Area, the PRPs are conducting O&M activities and those costs are not available.

9.2 Question B: Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Still Valid?

9.2.1 Commencement Bay Waterways, Asarco Sediments and Asarco Smelter Facility

For all the waterways in Commencement Bay and the Asarco Area, site conditions and land use have not significantly changed since the ROD. The western shore of the Thea Foss Waterway has more public access via an Esplanade and other public works projects such as condominiums and the Tacoma Glass Museum. The site continues to be mainly used for industrial purposes and Port related activities.

The cleanup levels and cleanup objectives for this project are still valid even when land use has changed. Site cleanups have incorporated the Endangered Species Act (ESA) requirements since the Puget Sound chinook salmon were listed in 1999 as threatened.

The Commencement Bay Nearshore/Tideflats SQOs have not changed since the ROD, with the exception of the PCB SQO in the 1997 ESD. Ecology's Sediment Management Standards (SMS) were promulgated after the CB/NT ROD, however an analysis of the CB/NT ROD SQO's vis-a-vis the SMS cleanup numbers indicated the SQOs were still protective of human health and the environment.

9.2.2 Occidental

At the Occidental Site, comments provided to EPA in 2000 suggest that low concentrations of highly toxic compounds such as furans/dioxins were in the sludge which has since been removed and might have been mobilized by chlorinated solvents. Therefore, EPA is concerned that furans/dioxins may still be on site. The Scope of Work incorporated into the amended AOC for the Occidental Site requires Occidental to test for the presence of these compounds in sediment and ground water which is most heavily contaminated with chlorinated solvents. The results of these and other additional characterization investigations will be accounted for in the evaluation and selection of remedies and subsequent remedial design for the Occidental Site.

9.2.3 Ruston North Tacoma Study Area

In their comments on the first Five-Year Review, Ecology informed EPA that it has changed its interpretation of MTCA since the signing of the Ruston/North Tacoma ROD, and that the cleanup decision no longer complies with the cleanup requirements for residential soils under MTCA.

Specifically, Ecology states that:

“Under WAC 173-340-740(1)(a), some form of “treatment, removal, or containment remedy” must be employed for residential soils containing hazardous substances in excess of soils cleanup levels (e.g., 20 ppm arsenic). We believe this applies to each exposure unit, that is, each residential property. Under WAC 173-340-440(2), institutional controls cannot be used as a substitute for cleanup actions that are otherwise technically possible. In short, we do not believe that reliance on institutional controls to reduce exposure to and risk from arsenic in surface residential soils at levels between 20 ppm and 230 ppm counts as a form of “treatment, removal, or containment” under the applicable regulation.”

Under the National Contingency Plan, EPA is required to consider newly promulgated or modified requirements after the ROD has been signed to evaluate whether the remedy is still protective of human health and the environment (55 Federal Register 8757 (March 8, 1990)). Although Ecology's change in interpretation is not a promulgated change to MTCA, EPA considered Ecology's revised position. EPA believes that the 230 ppm action level for this site is still within EPA's acceptable risk range for carcinogens given consideration of exposure, technical, and uncertainty factors, and still protective of human health.

9.3 Question C: Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

9.3.1 Hylebos Waterway

The remedy has been focused on meeting SQOs. At the Occidental site, pore water contamination from discharging contaminated groundwater needs to be addressed, and will be completed by Occidental as described in Section 5.1.4.

9.3.2 Sitcum Waterway

No information has come to light that could call into question the protectiveness of the remedy.

9.3.3 St. Paul Waterway

No information has come to light that could call into question the protectiveness of the remedy.

9.3.4 Middle Waterway

The remedial activities in Middle Waterway have recently been completed. There was no other information that came to light during the construction that would call into question the protectiveness of the remedy.

9.3.5 Olympic View Resource Area

No information has come to light that could call into question the protectiveness of the remedy.

9.3.6 Thea Foss and Wheeler-Osgood Waterways

Recontamination of the northeastern area of the Utilities cap and in the southwestern end of the City's caps has been identified. Samples have been taken from these areas to help determine the source of the contamination. Three potential sources of the recontamination have been identified. The next steps will depend on the source or sources of the recontamination.

If some or all of the recontamination is due to dredging practices, additional best management practices and closer oversight will be required for all on-going and future dredging in this waterway. EPA will likely require most of such additional best management practices to ensure that recontamination through this pathway does not become an issue.

If some or all of the recontamination is associated with storm water discharge from the major storm drains in the area, additional external measures will be assessed and applied so that the remedy remains protective. The City is required to evaluate these measures under the terms of the CD.

If some or all of the recontamination is associated with contamination coming up through the cap, then the protectiveness of the capping remedy will be reevaluated.

9.3.7 Asarco Smelter and Groundwater

Based on current information, no information calls into question the protectiveness of the remedy.

9.3.8 Ruston/North Tacoma Study Area

There are no new ecological risks that have come to light since remedy implementation, no natural disasters have impacted the remedy. Based on current information, no information has come to light which calls into question the protectiveness of the remedy.

9.3.9 Asarco Sediments

No information has come to light that could call into question the protectiveness of the remedy. Prior to remedy implementation, the rationale for the remedy will be reviewed to ensure that the remedy as designed is still protective.

10 ISSUES

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
<p>Hylebos/Occidental – Additional investigations and a subsequent review of information about the groundwater pathway and contaminated sediments is necessary due to the severity of contamination at the Occidental Site. Occidental related source material and contaminated ground water remain beneath Hylebos Waterway and in adjacent upland areas at the Occidental Site. Considerable characterization work remains to develop a remedial design which meets EPA and Ecology requirements.</p>	<p>Y</p>	<p>Y</p>

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Sitcum – The Sitcum CD required the Port of Tacoma to record a certified copy of the CD with the Registry of Deeds, Pierce County, WA. The CD did not require that a copy be provided to EPA, and it appears that EPA has no such records in our files. This issue does not affect current protectiveness, but EPA wants to ensure that adequate land use restrictions exist to ensure that the Milwaukee Habitat and Clear Creek mitigation sites remain mitigation sites in perpetuity, and that the protectiveness of the nearshore confined disposal facility is maintained.	N	Y
St. Paul – An additional analysis of the institutional controls for the deleted-from-the-NPL portion of the site needs to be conducted	N	Y
Thea Foss – Recontamination of Utilities and City’s caps	Y	Y
Thea Foss – The Bunker mitigation site design has not yet been completed.	N	N
Thea Foss –Puyallup River Side Channel mitigation project requires approval from the U.S. Army Corps of Engineers, Secretary of the Army, to breach the Corps levee on the Puyallup River. Approval from the Army will take an unspecified amount of time and may cause delays.	N	N
Thea Foss (Utilities Work Area) – Federal deauthorization of the navigational channel of the Head of the waterway is required before the remedial action construction report is approved.	N	N
Ruston/North Tacoma – A subset of zone 1 and 2 properties should be resampled to determine whether recontamination has occurred since remediation.	Y	Y

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Ruston/North Tacoma – How to address properties outside of the Study Area (not addressed by the current ROD) with arsenic concentrations above 230 ppm	Y	Y
Asarco Sediments – Remedy implementation is dependent on funds being received from the Asarco Trust	Y	Y
Asarco Smelter – Part of the shoreline collapsed during the Nisqually earthquake in 2001, this section comprises a portion of the mitigation site 2001. This section will have to be rebuilt repair and is dependent on Trust Fund monies	N	N
Asarco Smelter – Once the property is remediated it will be available for redevelopment. Careful consideration must be given to the type of development that occurs to ensure that the cap is protected	N	Y

11 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affect Protectiveness? (Y/N)	
				Current	Future
Sitewide –Review the results of monitoring at the mitigation sites and based on that data describe the contribution of those sites towards the recovery of ESA species.	EPA	EPA	January 2009	N	N
Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment Remedial Actions are complete. Provide results to Washington DOH to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved.	EPA	EPA	December 2005	N	Y
Sitewide – Implementation of Institutional Controls for all waterways and review status of institutional controls already in place.	Waterway PRPs	EPA	March 2007	N	Y
Sitewide – Implementation of OMMPs for Hylebos, Middle and Thea Foss and Wheeler-Osgood Waterways to ensure effectiveness of remedial actions and mitigation activities.	Waterway PRPs	EPA	On-going	N	Y
Sitewide – In the 3 rd Five-Year Review (due November 15, 2009), include CB/NT Operable Unit 3 Tacoma Tar Pits as part of this review.	EPA	EPA	November 15, 2009	N	N
Hylebos/Occidental – a) Complete the characterization of the Occidental site, b) select and implement the remedy	Occidental	EPA & Ecology	a. Dec. 2005 b. Aug 2007	Y	Y

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affect Protectiveness? (Y/N)	
St. Paul – EPA conduct an additional analysis of the institutional controls to ensure they are consistent with EPA’s September 2004 “Strategy to Ensure Institutional Control Implementation at Superfund Sites”	EPA	EPA	December 2005	N	Y
Sitcum – EPA will work with the Port of Tacoma to ensure that adequate land use restrictions are in place for the Milwaukee Habitat and Clear Creek Habitat mitigation sites (ensuring that sites are maintained as mitigation sites in perpetuity) and the confined disposal facility in the former Milwaukee Waterway (ensuring that protectiveness is maintained in the future).	Port of Tacoma	EPA	June 2005	N	Y
Thea Foss – Analyze data to be received in January 2005 and make recommendations for further actions on the recontaminated portion of the Utilities cap.	City of Tacoma and Utilities	EPA	June 2005	Y	Y
Thea Foss – Complete Bunker mitigation site design and implement mitigation actions.	City of Tacoma	EPA	a. June 2005 b. December 2005	N	N
Thea Foss – Track and ensure timely U.S. Army Corps of Engineer review of the Puyallup River Side Channel property transfer transaction to ensure that this mitigation site can be built.	City of Tacoma & Corps of Engineers	EPA	May 2005	N	N
Thea Foss (Utilities Work Area) – Track the deauthorization language on the Water Resources and Development Act (WRDA) in Congress to ensure that the language deauthorizing the Head of the waterway is passed	Utilities	EPA	March 2006	N	N

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affect Protectiveness? (Y/N)	
Ruston/North Tacoma Study Area – The potential for recontamination has not been addressed. A subset of zone 1 and 2 properties should be resampled to determine whether recontamination has occurred since remediation.	Asarco	EPA	January 2006	N	Y
Ruston/North Tacoma Study Area – EPA and Ecology will meet to discuss properties outside of the study area with arsenic concentrations greater than 230 ppm	EPA and Ecology	EPA	June 2005	Y	Y
Asarco Smelter and Sediments – Remedy implementation is dependent on the availability of Trust Fund monies and financial status of Asarco	EPA R10 and Asarco	EPA HQ	Unknown	Y	Y
Asarco Smelter – Rebuild the shoreline armoring that comprises a portion of the mitigation site which collapsed during the Nisqually earthquake in 2001; repair is dependent on Trust Fund monies	EPA R10 and Asarco	EPA HQ	Unknown	Y	Y
Asarco Smelter – Monitor redevelopment plans to ensure that future development is protective of environmental cleanup remedy	Asarco	EPA	On-going	Y	Y

12 PROTECTIVENESS STATEMENTS

12.1 Hylebos Waterway

Remedial actions at Hylebos Waterway are under construction. The remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The following actions have been completed and are protective:

Intertidal cleanup at the Head of Hylebos;

General Metals intertidal cap;

Dredging in Segment 5 (Mouth of Hylebos) except at the Occidental Site.

The remaining remedial action components are ongoing as of this Five-Year Review:

Intertidal Cleanup at Mouth of Hylebos (Pier 25);

Occidental Site RI/FS and RD/RA;

Segment 3/4 Dredging (Mouth of Hylebos);

Segment 1 and 2 Dredging (Head of Hylebos);

Clear Creek Phase 2 Mitigation Project;

Slip 5 Mitigation Project; and,

Blair Slip 1 Confined Disposal Facility construction.

12.2 Sitcum Waterway

Because the remedial action is complete and protective, the site is protective of human health and the environment.

12.3 St. Paul Waterway

Because the remedial action is complete and protective, the site is protective of human health and the environment.

12.4 Middle Waterway

The remedial action is currently protective of human health and the environment because all of the required remedial actions have been completed. However, in order for the remedy to be protective in the long-term, the SQOs need to be met in all ENR and natural recovery areas.

12.5 Olympic View Resource Area

Because the remedial action is complete and protective, the site is protective of human health and the environment.

12.6 Thea Foss and Wheeler-Osgood Waterways

Remedial actions at the Thea Foss and Wheeler-Osgood Waterways are under construction. The remedy is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through temporary soil capping and dust control during remediation activities.

12.7 Asarco Smelter

Remedial actions at the Asarco Smelter are expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

12.8 Ruston North Tacoma Study Area

For the properties that have been remediated the remedial actions are protective of human health and the environment. For un-remediated properties the remedial action is not protective because the properties have not been remediated. The properties need to be remediated to ensure protectiveness.

12.9 Asarco Sediments

The remedy for the Asarco Sediments is not protective because no part of the remedy has been implemented. The remedy will need to be implemented to ensure protectiveness.