PREASSESSMENT SCREEN
OF
NATURAL RESOURCE DAMAGES IN THE COMMENCEMENT BAY ENVIRONMENT

DUE TO ACTIVITIES TAKING PLACE IN AND ABOUT

THE COMMENCEMENT BAY/NEARSHORE TIDEFLATS (CB/NT)

SUPERFUND SITE

Performed by

The Puyallup Tribe of Indians
The National Oceanic and Atmospheric Administration
of the United States Department of Commerce
The State of Washington Department of Ecology
The United States Department of the Interior
and the
Muckleshoot Tribe of Indians
for
The Natural Resource Trustees

October 29, 1991

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

The purpose of a Preassessment Screen is to enable the Natural Resources Trustees (Trustees) to make an informed decision with regard to whether the past or ongoing discharges or releases of hazardous substances warrant the Trustees' preparation of a full-scale Natural Resource Damage Assessment (NRDA). In short, the Preassessment Screen is "a rapid review of readily available information. . . [with which to] ensure that there is a reasonable probability of making a successful claim" and, therefore, whether to proceed with the damage assessment itself. 43 C.F.R. Section 11.23(b).

The decision to proceed past the preassessment phase to a full assessment is based upon the following criteria:

1. A discharge or release of a hazardous substance has occurred;

2. Natural resources for which the agency or agencies can assert trusteeship have been, or are likely to be, adversely impacted;

3. The nature, quantity and concentration of substances released have the potential to cause injury to such natural resources;

4. Data sufficient for preparation of the assessment are either readily available or likely to be obtained at reasonable cost; and

5. Superfund remedial response activities at or about the facility from which the release occurred will not remedy past or ongoing injury to natural resources.

II. DISCHARGE OR RELEASE OF HAZARDOUS SUBSTANCES

A. Site History, Relevant Operations, and Duration and Quantity of Release.

Industrial, commercial and urban development of the Commencement Bay environment (Figure 1) began in the late 1800s. Dredge and fill activities began in the 1920s and significantly altered the estuarine nature of the bay. Intertidal areas and

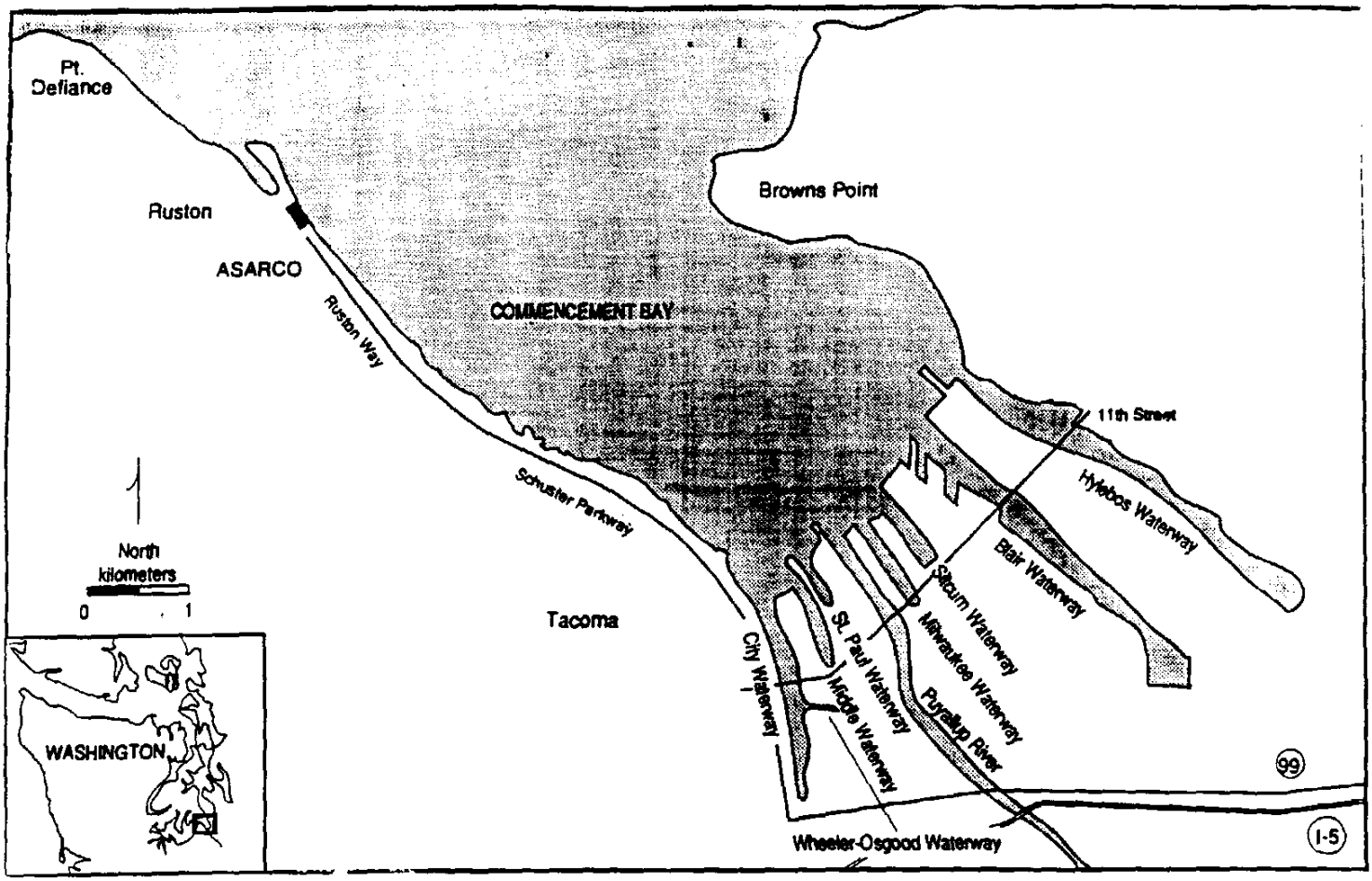

Figure 1. The Commencement Bay Nearshore/Tideflats Study Areas: The Commencement Bay Nearshore/Tideflats environment consists of about 12 square miles of waterways, shoreline and upland area at Tacoma, Washington. The Nearshore Area includes eight waterways that are potentially contaminated within the site: Hylebos Waterway, Blair Waterway, Sitcum Waterway, Milwaukee Waterway, St. Paul Waterway, Middle Waterway, City Waterway, (including Wheeler-Osgood Waterway), as well as the Ruston-Pt. Defiance Shoreline. The latter is administered by EPA as a separate operable unit of the Nearshore/Tideflats site known as the ASARCO marine sediments unit. The Superfund site extends to the 60 foot depth contour (as measured at mean lower low water). Natural resource damages may have also occurred in the deeper waters of Commencement Bay. The Puyallup River, Wapato Creek and Hylebos Creek all drain into Commencement Bay.

tideflats of the Puyallup River were filled in and meandering streams were channelized. Historical, industrial and commercial operations located on filled areas of the bay include: pulp and lumber mills, shipbuilding, shipping, marinas, chlorine and chemical production, concrete production, aluminum smelting, foundries, oil refining, food processing, automotive repair services, railroad operations, landfills and other storage, transportation, and chemical manufacturing companies (Tetra Tech, 1985).

Currently, more than 281 industries are active in the Commencement Bay environment. From these and past activities, an indeterminate amount of hazardous substances and waste materials have been released into the terrestrial, freshwater, groundwater, and marine environments surrounding Commencement Bay. Pollutants include trace metals, semi-volatile organic compounds, PCBs, chlorinated pesticides, and several tentatively identified compounds (TICs) (Tetra Tech, 1985).

Attributing areas of high contaminant concentrations to specific operations is difficult because of the environment's long history of industrial activity; however, the Commencement Bay/Nearshore Tideflats (CB/NT) Remedial Investigation (RI), performed by Tetra Tech (1985), associated certain contaminant classes with certain types of industrial operations. For example, high concentrations of metals and chlorinated aromatic hydrocarbons in the Hylebos Waterway have been attributed in part to chemical and metal processing facilities, and high concentrations of phenols and aromatics in the St. Paul Waterway have been attributed to wood products operations (Tetra Tech, 1985).

B. Names of Hazardous Substances.

The hazardous substances released into the Commencement Bay environment include, but are not limited to, the following (Tetra Tech, 1985), as set out in at 40 C.F.R. Chapter 1 Part 302.4:

Antimony and Compounds of Antimony
Arsenic and Compounds of Arsenic
Cadmium and Compounds of Cadmium
Copper and Compounds of Copper
Lead and Compounds of Lead
Mercury and Compounds of Mercury
Nickel and Compounds of Nickel
Zinc and Compounds of Zinc
Phenol
Pentachlorophenol

Hexachlorobenzene
1,2 Dichlorobenzene
1,3 Dichlorobenzene
1,4 Dichlorobenzene
1,2,4 Trichlorobenzene
Hexachlorobutadiene
*Trichlorobutadiene
*Tetrachlorobutadiene
*Pentachlorobutadiene
Hexachloroethane
Dimethylphthalate
Dioctylphthalate
Di-n-butylphthalate
Bis(2-ethylhexyl)phthalate
Di-n-octylphthalate
Polychlorinated Biphenyls (PCBs)
Methyl Phenol (4 Methylphenol)
2,4 Dimethylphenol
Naphthalene
Acenaphthylene
Acenaphthene
Fluorene
Phenanthrene
7Anthracene
*2-methylnaphthalene
Fluoranthene
Pyrene
Benz(a)antharene
Chrysene
Benzofluoranthene
Benzo(a)pyrene
Indeno(1,2,3 - c,d)pyrene
Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene
*Benzyl Alcohol
Benzoic Acid
*Dibenzofuran (only furan listed in 40 C.F.R. § 302.4)
Nitrosodiphenylamine
Tetrachloroethane
p,p'-DDE
p,p'-DDD
p,p'-DDT

* Not listed in 40 C.F.R. § 302.4

C. Additional Hazardous Substances Potentially Discharged From the Site.

2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD)
Other TICs.

D. Potentially Responsible Parties (PRPs).

At this time over one hundred fifty persons and corporations have been named as PRPs for releases to the Commencement Bay environment. Although identification and notification of PRPs is ongoing, a current list of PRPs is included as Attachment A (U.S. EPA Region X, 1991).

E. Damages Excluded from Liability Under CERCLA or the CWA.

Under 42 U.S.C. § 9607(f)(1), certain natural resource damages may be excluded from liability under CERCLA. Natural resource damage assessments should not be conducted where the potential injuries being assessed are within the scope of one or more of the statutory exemptions from liability. At this time, the Trustees are aware that a significant number of permitted and unpermitted releases into the Commencement Bay environment have caused and have the potential to cause injury and damage to natural resources. Furthermore, at this time the Trustees are unable to conclude that damage to natural resources from such releases are excluded from liability under either CERCLA or the CWA.

III. NATURAL RESOURCES FOR WHICH THE PUYALLUP TRIBE, U.S. DEPARTMENT OF INTERIOR (DOI), THE U.S. DEPARTMENT OF COMMERCE, THE STATE OF WASHINGTON DEPARTMENT OF ECOLOGY (ECOLOGY), OR THE MUCKLESHOOT TRIBE MAY ASSERT TRUSTEESHIP UNDER CERCLA AND WHICH HAVE OR MAY HAVE BEEN AFFECTED BY THE DISCHARGE OR RELEASE.

A. Preliminary Identification of Pathways.

Contamination emanating from a variety of sources has migrated through a complex web of pathways to affect adversely the ecological system of the Commencement Bay environment. Numerous drains, seeps, open channels and other point and non-point discharge sources have been identified in the Commencement Bay environment (Tetra Tech, 1985). The most prevalent sources are direct discharge outfalls, storm drains, and runoff from industrial facilities. Additional sources include groundwater, landfill leachate, and spills from petroleum storage facilities (Tetra Tech, 1985).

Discharges from these sources initially enter the environment through surface water, groundwater, the air, and, through retention in sediments. Ultimately these discharges enter the food chain. Contaminated water moves through the most common pathway — surface water — either through storm drains or directly as runoff into the various waterways and their tributaries. In some cases, groundwater acts as an intermediate pathway between such pollution sources as leaking pipelines, landfills, or waste ponds and the surface waters of the Commencement Bay environment. Less commonly, contaminants from ore smelting or sandblasting facilities travel through the air and are ultimately deposited on the surface waters. Contaminants that travel through each of these pathways eventually are retained in the sediments of the Commencement Bay environment.

The sediments of the Commencement Bay environment also serve as a source for contaminants entering the ecological system. Benthic infauna consume organic materials deposited on and in the sediments. These infauna are consumed by higher trophic level organisms, including fish and crab. In turn, these organisms are consumed by mammals, birds, and humans. These animals at the top of the food chain contain the highest concentration of contaminants because they consume large quantities of organisms with lower concentrations. Previous studies, including the RI for the CB/NT Superfund site (Tetra Tech, 1985), have confirmed the detrimental impact of contaminants on benthic communities within the Commencement Bay environment. Bioaccumulation studies in the RI measured elevated concentrations of copper, lead, mercury, dioxins, and PCBs in edible tissues of English Sole, cancrid crabs, and shrimp. Further evidence that the food chain acts as a pathway is the presence of elevated concentrations of organic contaminants and heavy metals in waterfowl known to feed in the Commencement Bay environment (Henney, et al., 1990; Institute of Wildlife and Environmental Toxicology (IWET), 1990).

B. Estimates of Exposed Areas and Waters.

Releases of hazardous substances have contaminated or potentially contaminated a significant portion of the Commencement Bay environment. The Commencement Bay environment, which consists of approximately 12 square miles of waterways, shoreline, upland area, and associated drainages, includes eight potentially contaminated waterways: Hylebos Waterway, Blair Waterway, Sitcum Waterway, Milwaukee Waterway, St. Paul Waterway, Middle Waterway, City Waterway (including Wheeler-Osgood Waterway), as well as the Ruston-Pt. Defiance Shoreline. Figure 1. The latter is administered by EPA as a separate operable unit of the Nearshore/Tideflats site known as the ASARCO

marine sediments unit. This site extends to the 60-foot depth contour (as measured at mean lower low water). The Puyallup River, Wapato Creek, and Hylebos Creek, all of which drain into Commencement Bay, are potentially contaminated (Tetra Tech, 1985).

IV. THERE ARE SUFFICIENT QUANTITIES AND CONCENTRATIONS OF HEAVY METALS TO POTENTIALLY INJURE NATURAL RESOURCES.

A. Estimates of Concentrations.

Elevated concentrations of contaminants have been measured in all waterways of Commencement Bay and along the Ruston-Pt. Defiance shoreline. Four metals and six organic contaminants have been measured in sediments of Commencement Bay at concentrations greater than 1,000 times concentrations in reference sediments. Concentrations 100 to 1,000 times reference conditions were measured for 28 contaminants or contaminant groups (Tetra Tech, 1985).

Maximum concentrations of several contaminants greatly exceed their corresponding Apparent Effects Thresholds (AET), the concentration of a particular chemical in sediments above which statistically significant effects are always observed (Table 1). The AET were empirically derived from matched field data for sediment chemistry and various biological indicators, including amphipod mortality or oyster larvae abnormality during bioassays, and depressions in the abundances of indigenous benthic infauna. The AET values originally developed during the Commencement Bay RI have been updated to incorporate data from other studies in Puget Sound (PTI, 1989). Subsequently, the State of Washington adopted final Sediment Management Standards for the Puget Sound based primarily on the AET studies from Commencement Bay. Washington Administrative Code (WAC) 173-204.

Impacts to benthic macroinvertebrate assemblages are evident to varying degrees in much of the Commencement Bay environment (Tetra Tech, 1985). These impacts were determined by comparing the abundances of major taxa (Polychaeta, Mollusca, and Crustacea) and total abundance between sampling stations in Commencement Bay with abundances from stations in uncontaminated reference areas. The benthic communities in many of the waterway stations of Commencement Bay displayed generally low diversity (i.e., relatively few species) and a high abundance of opportunistic species, a condition indicative of environmental stress. This stress may be attributed to contamination by toxic substances present in Commencement Bay. Significant depressions in major taxonomic groups generally corresponded to an 80 percent or greater depression as compared to reference conditions.

Significant depressions in two or more major taxonomic groups of benthic macroinvertebrates have been documented at sampling stations in Hylebos Waterway, St. Paul Waterway, City Waterway, Wheeler-Osgood Waterway, and the Ruston-Pt. Defiance Shoreline.

The extent of the contamination's impact on benthic communities has been conservatively estimated. Based on data collected in the mid-1980s, benthic impacts are estimated to have occurred over an area of 2.5 million square meters (NOAA, 1988). Benthic impacts may, in turn, affect the total biological productivity of Commencement Bay because the benthic community is at the base of the ecological food chain for many different organisms that feed on the bottom.

As part of the RI, two bioassays were used to evaluate the relative toxicity of Commencement Bay sediments (Tetra Tech, 1985). An amphipod mortality bioassay was used to measure direct lethal response, and an oyster larvae abnormality bioassay was used to measure abnormal embryonic development in oysters. Sediments toxic to amphipods were found in all study areas of the site, except for the Milwaukee Waterway. Oyster larvae abnormality was measured in three waterways and along the Ruston-Pt. Defiance shoreline.

Bioaccumulation studies were conducted to determine if contaminants observed in the sediments or surface waters accumulated in resident organisms (Tetra Tech, 1985). Several organic contaminants and metals have been found at elevated concentrations in edible tissue of English sole, cancrid crabs and shrimp. Copper, mercury, and polychlorinated biphenyls (PCB) have been measured in significantly elevated concentrations in muscle tissue of English sole, as compared to reference conditions; lead, mercury, and PCB concentrations were elevated in crab muscle tissue (Table 2).

Histopathological studies have revealed significant abnormalities within Commencement Bay organisms (Tetra Tech, 1985). Histopathological analyses have been conducted on the livers of over 1,000 English sole from the site. The incidence of preneoplastic nodules, megalocytic hepatosis, and nuclear pleomorphisms was significantly higher in Commencement Bay than at Carr Inlet, a relatively uncontaminated reference area (Tetra Tech, 1985). In addition, significantly elevated levels of organ abnormalities in shrimp and crabs have been observed in Commencement Bay. Based on these studies, notices have been posted by the Tacoma-Pierce County Health Department (TPCHD) and a press release was issued in 1982 advising people to not eat bottomfish and crab from Commencement Bay waterways (Tetra Tech, 1985).

Additional studies document the extent to which hazardous substances released into the Commencement Bay environment have also contaminated animals at the top of the ecological food chain. Organic contaminants have been found at elevated concentrations in tissues and eggs from great blue herons known to feed in Commencement Bay (IWET, 1990). Elevated concentrations of several metals have been identified in western grebes that winter at the head of Commencement Bay and adjacent waterways (Henney, et al., 1990) (Table 3). A study of marine birds showed significant eggshell thinning and low liver weight to occur in glaucous-winged gulls in the Commencement Bay area (Riley et al., 1983). Other work has documented extremely high levels of PCBs in the blubber of harbor seals, which spend parts of the year in the Commencement Bay environment, using the Gertrude Island haulout site in the South Puget Sound (National Status and Trends Program, 1987).

B. Potentially Affected Resources.

1. In General

The Puyallup Tribe, the Muckleshoot Tribe, NOAA, DOI, and the State of Washington have trusteeship over extensive natural resources that have been exposed to hazardous substances in the Commencement Bay environment. 33 U.S.C. § 1321(f)(5). Commencement Bay is an important estuarine habitat and supports a variety of commercially, recreationally, and spiritually and culturally important fish and wildlife species. Statutes that confer trusteeship to the above entities include § 311(f)(5) of the Clean Water Act, 33 U.S.C. § 1321(f)(5); § 1006(b) of the Oil Pollution Act of 1990, 33 U.S.C. § 2706(b); and, §§ 107(f) and 111(b) of CERCLA, 42 U.S.C. §§ 9607(f) and 9611(b). Natural resources affected or potentially affected include, but are not limited to, the following list:

Anadromous and resident fish of many species

Shellfish and seaweeds

Benthic and epibenthic species

Upland, aquatic, marine, estuarine, riverine, and wetland fish and wildlife habitats

Migratory birds

Threatened and Endangered Species

Mammals, including marine mammals, and several species of small mammals that are prey to other mammalian and avian species

Herbs, berries, and other vegetation

Surface waters and sediments

Groundwater

Air

2. Specific Resources.

a. Anadromous and resident fish of many species: A number of important anadromous fish, including four salmon species (chinook, coho, chum, and pink) and steelhead trout, subsist in the Commencement Bay environment during part of their life cycles (Dames and Moore 1981; Tetra Tech, 1985). Sockeye salmon are native to the Puyallup River system but are no longer abundant (Wampler, 1991). Juveniles from these species use the nearshore areas of Commencement Bay as a rearing habitat, whereas adults use deeper parts of the Bay primarily as a migratory pathway.

An extensive salmonid stocking effort occurs on the Puyallup watershed, and large numbers of Puyallup River salmon are commercially and recreationally harvested each year. Three hatcheries stock approximately four million chinook, coho, and chum salmon and steelhead juveniles each year. Other recreationally harvested species of fish present in the area included in TPCHD advisory against eating fish from Commencement Bay (NOAA, 1988):

- English sole
- Rock sole
- Sand sole
- Pacific tomcod
- Dover sole
- Starry flounder
- Pacific sanddab
- Walleye pollock

- Brown rockfish
- Quillback rockfish
- Speckled sanddab
- Copper rockfish
- Dungeness crab
- Red rock crab

Major adverse impacts on salmonid populations in the Commencement Bay environment are attributable to the loss of estuarine habitat and degradation of water quality in Commencement Bay and the lower Puyallup River. Juvenile and adult salmonids use the lower reaches of the Puyallup River and the nearshore areas of Commencement Bay as an essential transition zone between fresh and salt water (Meyer, et al., 1981; Dames & Moore, 1981). Chinook and chum salmon are especially dependent on these estuarine areas, as they spend approximately two to three months there before migrating to sea, whereas juvenile coho and steelhead move more rapidly through the lower river and nearshore area during their seaward migrations. Since juvenile chinook and chum salmon spend greater amounts of time in the estuarine environment than other anadromous fish, they could be more affected by deteriorating water quality in the lower river and nearshore areas of Commencement Bay (Dames & Moore, 1981). In addition, they may be adversely affected directly by chemicals in the water and sediments, or by consuming contaminated food on which they prey.

b. Shellfish and seaweeds: Mollusks, crabs, and shrimp are present throughout the Bay (Dames and Moore, 1981; NOAA, 1988). The intertidal and subtidal sediments of the Bay also support numerous benthic macroinvertebrates that provide forage for many of the fish. In turn, these fish as well as shellfish and benthic macroinvertebrates, are preyed upon by mammals, waterfowl, and other marine birds.

Shellfish of Commencement Bay historically have been economically and recreationally valuable resources (NOAA, 1988). Dungeness crabs are fished recreationally in Commencement Bay waterways and along the northeastern shore. Historically, numerous commercial and recreational pandalid shrimp fisheries operated in the Commencement Bay environment. Currently, there are no commercial shrimp fisheries and very limited recreational effort; however, surveys in the early 1980s found that recreational fisheries may be possible. Recreational fishing surveys have shown that fishing is most extensive on the beach between Brown's Point and the Hylebos Waterway.

Contaminant releases may have adversely affected the recreational and economic use of several shellfish species. Although shellfish other than crabs, including several types of clams, may be harvested recreationally in the intertidal areas of the Ruston-Pt. Defiance shore, the Washington Department of Health (DOH) has advised against this. The DOH has also found

the Commencement Bay environment to be uncertifiable for commercial harvests of shellfish due to the combined problems of bacteria and industrial contaminants (Cheney and Mumford, 1986).

c. Benthic and Epibenthic species: Some organisms near the base of the food chain are sensitive to certain contaminants present in the Commencement Bay environment. Therefore, contamination may have decreased the abundance of these food organisms needed by higher order consumers such as juvenile salmon.

d. Marine and Non-Marine Fish and Wildlife Habitats: Prior to industrial development, the entire head of Commencement Bay was part of the Puyallup River delta, a large, ecologically complex area made up of productive salt water marshes and tideflats. During this century, dredge and fill activities physically eliminated most of the Puyallup River delta and associated wetlands. Presently, the nearshore areas and waterways of Commencement Bay are used extensively as nursery habitats for numerous marine species (Tetra Tech, 1985; NOAA, 1988). These species feed on small epibenthic and benthic organisms abundant in wetlands, tideflats, and low-head beaches before migrating offshore. Wetlands within the marine areas of the bay are currently limited to approximately 4.5 hectares, most of which are near the mouth of the Hylebos Waterway. Contaminant effects potentially further diminish these remaining habitats. Upland areas have also been potentially affected by releases of hazardous substances, including metals, PAHs, and dioxins (Tetra Tech, 1985; EPA, 1987).

e. Threatened and Endangered Species: Federally listed endangered and threatened species found in Commencement Bay during part of their life cycles include the endangered peregrine falcon and the threatened bald eagle. The western pond turtle is a candidate species for listing as threatened or endangered present within the Commencement Bay site boundary (Gloman, personal communication, 1990; U.S. DOI, 1984).

f. Migratory Birds: Migratory birds, including waterfowl, marine birds, and shorebirds, utilize Commencement Bay and the Puyallup River system during different parts of their life cycle. Migratory birds utilize open water, intertidal wetlands, and upland habitat as feeding, rearing, and resting areas (Gloman, personal communication, 1990; U.S. DOI, 1984).

g. Mammals: Marine mammals bioaccumulate substances such as PCBs because they are at the top of the food chain and magnify contaminant concentrations by consuming larger numbers of organisms with lower concentrations (Osborne, et al., 1988). Mammals found in the Commencement Bay environment include

marine mammals, river otters, and several species of small mammals that are prey to other mammalian and avian species. Big game species, including deer, elk, and black bear were formerly found in the Commencement Bay and lower Puyallup River areas (Sullivan, personal communication, 1990). Marine mammals that utilize the waters in or near Commencement Bay include Gray and Minke whales, Orcas, False killer whales, California sea lions, and harbor porpoises. Gray whales usually feed along the bottom, where they are potentially exposed to elevated contaminant concentrations in bottom sediments (Calambokidis et al., 1991).

h. Herbs, Berries, and Other Vegetation: Vegetation in Commencement Bay has been exposed to long-term releases of hazardous materials. In the Commencement Bay environment the following vegetation has been traditionally used for food, basket weaving, or medicinal purposes: cedar, juniper, fern, camas, tiger lily, oak, gooseberry, spirea, blackcap, wild blackberry, strawberry, maple, hedge nettle, and yarrow (Sullivan, personal communication, 1990).

i. Surface Water and Sediments: The presence and spatial distribution of contaminants in sediments of the Commencement Bay environment, including the Puyallup River and some of its tributaries, is well documented (Tetra Tech, 1985; Ebbert and Prych, 1988). Contaminant concentrations in sediments vary throughout the environment, with contamination being most prevalent in the vicinity of drainages, wastewater outfalls, and disposal areas where contaminants are presently or were historically released. Contamination of the water column is not as well characterized as sediment contamination. Nonetheless, the presence of contaminants in surface water may injure and damage a number of resources which exist in or use the surface water source.

j. Groundwater: Three aquifers underlie the Commencement Bay environment. Regional groundwater flow is one of recharge in the upland areas and discharge to the Puyallup River valley and Puget Sound. Infiltrating precipitation in the upland areas southeast and southwest of the Superfund site tends to move downward and laterally toward the Puyallup River basin. Once in the deep sediments of the river basin, the groundwater moves upward and laterally to discharge into the river and Commencement Bay. Long-term releases of hazardous materials have potentially contaminated all three aquifers.

Groundwater contamination is evident within many portions of the Nearshore/Tideflats area because of past spills, use of unlined industrial waste ponds, and landfilling of hazardous materials. However, the absence of reliable groundwater flow data throughout most of the tideflats hampers

adequate assessment of groundwater contamination. Existing data does not adequately determine the magnitude of groundwater contamination, predict the route of groundwater flow from a contaminated area, or determine the loading of contaminants to the waterways through the groundwater pathway (Tetra Tech, 1985).

k. Air: A variety of industries have released hazardous materials into the atmosphere in the Commencement Bay environment. Deposition and contamination can occur directly as particles settle onto the water surface, or indirectly as they settle on land and are subsequently washed or blown into Puget Sound. The deposition of airborne particles may be responsible for contributing heavy metals, PAHs, dioxins, and other organic compounds to Puget Sound. These toxic chemicals are then added to the burden of chemicals in the sea-surface microlayer, the 50-micron boundary layer between the atmosphere and the ocean, the water column, and the sediments. The surface microlayer is an important zone, where the presence of contaminants could be critical because the larvae and juvenile stages of many organisms are found there in high numbers after spawning. These particular life stages are generally the most sensitive to contaminants. The resultant increase in toxicity may affect aquatic life and other natural resources in the Sound (Crecelius and Maykut, 1991).

All of these natural resources either have been or potentially have been affected by the release of hazardous substances. Further studies carried out at reasonable cost may identify other natural resources which have also been affected.

3. Services.

Services provided by the natural resources include, or formerly included, but are not limited to, the following (Sullivan, personal communication, 1990; Pacheco, personal communication, 1990; Wampler, 1991; EPA, 1989; U.S. DOI, 1984):

Habitat for trustee species, including foraging, shelter, migratory pathways, breeding and rearing areas, and other essentials to long-term survival.

Subsistence, commercial, and recreational harvest of fish, shellfish and waterfowl.

Primary and secondary contact recreation (swimming, diving and boating)

Consumptive and non-consumptive outdoor recreation, including hunting, fishing, wildlife viewing and photography and other activities.

Ceremonial, medicinal, and basket weaving uses of plants and herbs.

Cultural, spiritual and religious use.

Sacred places and ceremonies.

Other option and existence values.

Traditional foods.

V. A DAMAGE ASSESSMENT MAY BE UNDERTAKEN AT A REASONABLE COST.

Available data support the conclusion that contaminants have adversely affected natural resources in the Commencement Bay environment. Data suggesting that contaminant releases have or may have injured natural resources include bioaccumulation, concentrations exceeding state sediment quality standards, benthic community alterations, laboratory toxicity testing, and histopathological abnormalities in field-caught animals (Tetra Tech, 1985). Other types of injury, and injury to resources other than those described above can likely be documented. Definition and quantification of these injuries may require the collection of additional data; however, the cost of acquiring these data and other anticipated costs of the damage assessment are expected to be substantially less than the anticipated damage amount determined by a damage assessment.

VI. RESPONSE ACTION ALONE WILL NOT RESTORE NATURAL RESOURCES.

Recent efforts to mitigate injury to natural resources in Commencement Bay have focused primarily on source control. A number of groups assist and oversee industrial operations that have historically discharged contaminants to Commencement Bay. These include the Urban Bay Action Team, a branch of Ecology that issues administrative orders on source control for the TPCHD; the TPCHD, which maps contaminant sources, reviews permits, and provides monitoring and sampling assistance; the City of Tacoma, which promulgates effluent standards and monitors industrial discharges; and joint activity between TPCHD and the City of Tacoma, in which the entities identify publicly owned outfalls which may act as contaminant sources (EPA, 1989). Although these actions may control the amount of contamination which enters Commencement Bay, they contemplate no remedial measures and take no steps to compensate the Trustees for past or ongoing injury.

Response actions specified by EPA's Record of Decision (ROD) for the CB/NT Superfund Site will reduce the extent of contamination, but will neither fully eliminate contamination nor adequately restore injured resources within the Commencement Bay environment. The ROD recommends a combination of contaminant source control, natural recovery, and active sediment remediation. Source control is to be accomplished over the next 8 years through use of a range of all known available and reasonable methods of treatment (AKARTS). Remediation of sediment contamination combines a 10-year monitoring program of natural recovery and site restrictions with a limited range of sediment confinement technologies, including in-place capping, confined aquatic disposal, nearshore disposal, and upland disposal. Thus, given the long-term focus of remediation, injury to natural resources will be ongoing at least until contaminant source control and active sediment remediation are fully implemented.

VII. EVALUATION AND CONCLUSIONS

A. Evaluation of Criteria Addressed at the Preassessment Phase.

As noted earlier, 43 C.F.R. Part 11 defines criteria for determining whether to proceed past the preassessment phase to a full assessment. These criteria, and the corresponding conclusions based on this preassessment screen, are presented below.

1. **A discharge or release of a hazardous substance has occurred.** It is well documented that releases of appreciable quantities of listed hazardous substances have occurred over a broad geographic area of the Commencement Bay environment.

2. **Natural resources for which the Tribes and federal and state trustees can assert trusteeship have been, or are likely to be, adversely impacted.** Natural resources over which the federal government, the State of Washington, the Puyallup Tribe, and Muckleshoot Tribe may assert trusteeship have been and are likely to continue to be adversely impacted. Existing field data indicate that contaminant levels may be readily linked to observed impacts on these resources.

3. **The nature, quantity and concentration of the substances released have the potential to cause injury to such natural resources.** Hazardous substances have been measured at concentrations shown to adversely affect sediment, waters, benthic infauna, fish, birds, and other important natural resources.

4. **Data sufficient for the preparation of an assessment are either readily available or likely to be obtained at a reasonable cost.** While additional data gathering efforts are required, there is an extensive body of scientific information available upon which portions of the NRDA can be based. Additional data and analysis can be obtained at reasonable cost, and the expected costs of resource restoration will exceed the costs of preparing the assessment.

5. **Superfund remedial response activities (at or about the facility from which the release occurred) will not remedy past and ongoing injury to natural resources.** Response actions on the NPL Site may, to a certain extent, mitigate ongoing natural resource injuries. Extensive remedial action, restoration and/or replacement of natural resources will be needed to completely address injuries to natural resources within the trusteeship of the Puyallup Tribe, the Muckleshoot Tribe, DOI, the Department of Commerce, and the State of Washington.

B. Conclusions.

In light of the above, the Trustees conclude that significant quantities of hazardous substances from various facilities have been and continue to be released, both directly and indirectly, into the Commencement Bay environment. Such releases have entered the environment through multiple pathways and have exposed an extensive body of natural resources to concentrations of hazardous substances at injury-causing levels.

Based upon the information set forth herein and their experience and expertise in these matters, the Trustees conclude there is a high likelihood that natural resources in the Commencement Bay Environment have incurred significant damage. Therefore, the Trustees shall proceed with preparation of a natural resource damage assessment.

VIII. REFERENCES

Calambokidis, J., Steiger, G.H., Evenson, J.R., Cubbage, J.C., and Osborne, R.W., 1991. Gray whales in Puget Sound and the Straits of Juan de Fuca. Proceedings of the First Annual Meeting on Puget Sound Research, Puget Sound Water Quality Authority, Olympia, Washington.

Cheney, D.P., and Mumford, T.E., Jr., 1986. Shellfish and seaweed harvests of Puget Sound. University of Washington Press, Seattle, Washington.

Crecelius, E.A., and Maykut, N., 1991. Significance of airborne contaminants to the marine water quality of Puget Sound. Proceedings of the First Annual Meeting on Puget Sound Research, Puget Sound Water Quality Authority, Olympia, Washington.

Dames & Moore, 1981. Commencement Bay studies, technical report. Volume III, fish and wetlands. Prepared for the U.S. Army Corps. of Engineers, Seattle, Washington. December 1981. Dames & Moore, Seattle Washington. 130 pp. + appendices.

Ebbert, J.C., and Prych, E.A., 1991. Copper and lead in Puyallup Valley streambed sediments. Proceedings of the First Annual Meeting on Puget Sound Research, Puget Sound Water Quality Authority, Seattle, Washington.

Environmental Protection Agency (EPA), 1989. Commencement Bay Nearshore/Tideflats Record of Decision (ROD). 119 pp. + appendices.

Gloman, N.J., November 6, 1990, Personal Communication. (Letter to Mr. Chuck Albertson, NOAA) U.S. Fish and Wildlife Service, Olympia, Washington.

Henney, C.J., L.J. Blus, B.A. Grove, 1990. Western grebe (Aechmophorus occidentalis) wintering biology and contaminant accumulation in Commencement Bay, Puget Sound, Washington. Canadian Field-Nat. 104(3): 460-472.

Institute of Wildlife and Environmental Toxicology (IWET), 1990. Organochlorine contaminants in great blue herons collected from Puget Sound. Report submitted to U.S. Fish and Wildlife Service and Washington Department of Wildlife, Olympia, Washington.

Meyers, J.H., T.A. Pearce, and R.S. Boomer, 1981a. An examination of the food habits of juvenile chum and chinook

salmon in Hylebos Waterway. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Olympia, Washington.

National Oceanic and Atmospheric Administration (NOAA), 1988. Superfund Natural Resource Survey for Commencement Bay — Nearshore/Tideflats, Tacoma, Washington. NOAA/Ocean Assessments Division, Seattle, Washington.

National Status and Trends Program, 1987. A summary of selected data on chemical contaminants in tissues collected during 1984, 1985, and 1986. NOAA Technical Memorandum Nos. OMA 38. Ocean Assessments Division, Office of Oceanography and Marine Assessment, NOAA, Rockville, Maryland. 114 pages.

Osborne, R., Calambokidis, J., and Dorsey, E.M., 1988. A guide to marine mammals of greater Puget Sound, Island Publishers, Anacortes, Washington.

Pacheco, W., 12 July 1990, Preassessment Screen Determination for Commencement Bay Nearshore/Tideflats Superfund Site by the Muckleshoot Tribe. Personal Communication (letter to Lew Consiglieri, NOAA). Muckleshoot Indian Tribe. Fisheries Department, Auburn, Washington.

PTI Environmental Services, 1989. Commencement Bay Nearshore/Tideflats Feasibility Study, Development of sediment cleanup goals. Prepared for the Washington Department of Ecology and the U.S. Environmental Protection Agency, Region X.

Riley, R.G., Crecelius, E.A., Fitzner, R.E., Thomas, B.L., Gurtisen, J.M., and Bloom, N.S., 1983. Organic and inorganic toxicants in sediment and marine birds from Puget Sound. NOAA Technical Memorandum OMS-1, 127 pages.

Sullivan, W., 8 June 1990. Preassessment Screen Determination for Commencement Bay Nearshore/Tideflats Superfund Site by the Puyallup Tribe of Indians. Personal Communication (letter to Lew Consiglieri, NOAA). Puyallup Tribe of Indians, Environmental Programs, Tacoma, Washington.

Tetra Tech, 1985. Commencement Bay Nearshore/Tideflats remedial investigation. Final Report. Prepared for the Washington Department of Ecology, Olympia, Washington and the U.S. Environmental Protection Agency, Seattle, Washington.

Tetra Tech, 1987. Commencement Bay Nearshore/Tideflats feasibility study assessment of the potential success of source control. Draft Report. Prepared for the Washington Department of Ecology, Olympia, Washington and the U.S. Environmental Protection Agency, Seattle, Washington.

U.S. Environmental Protection Agency, 1991. Commencement Bay Nearshore/Tideflats consolidated potentially responsible party listing, EPA, Region X, Seattle, Washington.

U.S. Environmental Protection Agency, 1987. The national dioxin study, tiers 3, 5, 6, and 7. EPA document 440/4-87-003. Office of water regulations and standards, Washington, D.C.

U.S. Department of the Interior, 1984. Preliminary natural resource survey for the Commencement Bay sites, Tacoma, Washington (letter from Bruce Blanchard, U.S. DOI Environmental Project Reviews, to Gene Lucero, U.S. EPA Office of Waste Programs Enforcement).

Wampler, P.L., 1991. Changes in population and distributions of anadromous fish, demersal fish, and shellfish utilizing nearshore habitat in Commencement Bay, 1860 to 1988. U.S. Fish and Wildlife Service, Olympia, Washington.

Table 1. Maximum concentrations of selected contaminants in marine surface sediments of Commencement Bay and corresponding lowest AET among the amphipod, oyster, and benthic infauna measurements (mg/kg, ppm, dry weight for metals and ug/kg, pb, dry weight for organic chemicals; Tetra Tech, 1985).[1]

Contaminant	Sediment Concentration	AET	WA Sediment Management Standards
Arsenic	12,200	57[B]	57
Copper	14,300	390[L]	390
Lead	6,250	450[B]	450
4-Methylphenol	96,000	670[L]	670
LPAHs[2]	21,000	5,200[L]	5,200
HPAHs[3]	82,000	17,000[L]	17,000
Dibenzofuran	2,000	540[L]	540
PCB[4]	2,000	1,000[B]	130

[1] All values are presented as dry-weight normalized in order to readily compare RI results and WA state standards. The standards, as promulgated by the Washington Department of Ecology, are normalized for total organic carbon. The values listed here are dry weight equivalents, as converted from promulgated standards by Barrick et al., 1988 and PTI, 1989.

[2] Low molecular weight polynuclear aromatic hydrocarbons.

[3] High molecular weight polynuclear aromatic hydrocarbons.

[4] The WA Sediment Management STandards for PCB are based upon a Microtox bacteria bioassay which the EPA elected not to use for setting Commencement Bay sediment cleanup levels due to concerns that the test was not sufficiently developed at the time. The EPA set the sediment value cleanup objective at 150 ppb for PCBs according to a method combining equilibrium partitioning and human health risk assessment methods. For the other listed contaminants, the WA Sediment Standards and the EPA Commencement Bay sediment cleanup objectives are equivalent.

[A] AET for amphipod mortality bioassay.

[L] AET for oyster larvae abnormality bioassay.

[B] AET for depression of indigenous benthic infauna.

Table 2. Maximum mean concentrations of selected contaminants in English sole and crab muscle tissue (Tetra Tech, 1985).

	English Sole (ug/kg wet weight; ppb)	Crab (ug/kg wet weight; ppb)
Copper	346	--
Lead	---	930
Mercury	81	220
PCBs	354	232

Table 3. Concentrations of selected contaminants in great blue herons and western grebes (metals ug/g, ppm; dry weight; organics ug/g wet weight, ppm) (IWET, 1990; Henney et al., 1990).

	Great Blue Heron (ug/g)		Western Grebe
	Eggs	Breast Tissue	(ug/g)
PCBs	21	4.4	6.37
DDE	1670	83.3	1.77
Chlordane	--	--	0.21
Mercury	--	--	2.48
Arsenic	--	--	2.70
Copper	--	--	13.15
Cadmium	--	--	0.85

ATTACHMENT A

CURRENT (July 1991) COMPREHENSIVE LIST OF
POTENTIALLY RESPONSIBLE PARTIES
FOR THE COMMENCEMENT BAY NEARSHORE/TIDEFLATS
SUPERFUND SITE

Airo Services, Inc.

AK-WA Shipbuilding

Allied Chemical Corp.

Anderson, Stephen

AOL Express, Inc. (formerly listed as Gateway Consolidators)

APEX Forge & Tool Co.

ASARCO, Inc.

Atochem North America (formerly listed as Penwalt Corporation)

Babet Fund III (formerly listed as Babet Financial Company)

Barthel Chemical Co.

Barthel, Loretta

Bonneville Power Administration

Brazier Forest Industries (formerly listed as Brazier Forest Products)

Bronger, Ken

Buffelen Woodworking Company

Burlington Northern Railroad Co.

Cascade Timber Co.

Cenex Agriculture, Inc.

Certainteed Corp.

Champion International

Chemical Processors, Inc.

Chevron USA, Inc.

Chicago Milwaukee Corp.

City of Tacoma

Coast Craft, Inc.

Coast Iron & Marine Works

Cole Investment Co.

Cole Screenprint Co.

Collins Transport

Cook's Marine Specialties

Coski, Bernard

Dent Doctor, The

Dunlap Towing Company

Dykman, Marvin and Glee

Executive Bark (formerly listed as B&L Trucking & Construction Co.)

F.O. Fletcher, Inc. (formerly listed as Fletcher Oil Company)

Fick Foundry

Foss Maritime Co.

General Chemical Corp. (formerly listed as One Newco, Inc.)

General Metals, Inc.

George Scofield Co., Inc.

Georgia Pacific Resins, Inc.

Glein Investments

Globe Machine Manufacturing

Griffin Galbraith Fuel Co.

Harmon Cabinets, Inc.

Hertz Equipment Rental Corp.

Howard, Donna

Hub Equipment co.

Huke, Robert

Hygrade Food Products Corp.

Industrial Rubber & Supply Co. (formerly listed as Industrial Rubbery Supply)

International Transportation Services

J. & G. Investments

J.M. Martinac Shipbuilding Corp.

Jones Chemicals, Inc.

Jones, Lewis

Jones Washington Stevedoring

Jones-Goodell Corporation

Joseph Simon & Sons

Kaiser Aluminum & Chemical Corp.

Liquid Air Products

Lone Star Industries

Louisiana Pacific Corp.

Manke Lumber Company, Inc.

Mann Russel Electronics

Marine Industries Northwest

Marine Iron Works, Inc.

May, Annon W., et al.

McFarland-Cascade (formerly listed as Cascade Pole)

McKenzie, Eva

Milgard Manufacturing, Inc.

Mintercreek Development

Mobile Oil Corp.

Modern Properties Partnership (formerly listed as Modern Properties, Inc.)

Modutech Marine, Inc.

Murray Pacific Corp.

Nars, Ragnar

Nelson, Carl

Norcore Plastics

Nordlund Boat Company, Inc.

Nordlund Properties, Inc.

North American Environmental

North Pacific Plywood

Northwest Container Corp., Inc.

Northwest Processing, Inc.

NuLife Fertilizers

Occidental Chemical Corporation

Oline, Donald

Oline, Ron & Brad et al.

Olympic Chemical Corp.

Oregon Washington Railroad and Navigation Company

PABCO Roofing Products

Pacific Marine Repair

Pacific Rail Services

Pacific Rim Packaging Corp.

Pacific Storage

Pan Pacific Trading Co.

Parker Paint Manufacturing Co., Inc.

Paxport Mills, Inc.

Pederson Oil

Petroleum Reclaiming Services, Inc.

Pickering Industries

Pioneer Painting Co. (formerly listed as Pioneer-Gudmundson Painting Co.)

Poligen Corp.

Port of Tacoma

PRI (Pacific Resources) Northwest, Inc.

Puget Sound Plywood

Rail & Locomotive Equipment Company

Rainier Plywood Co.

Rheem Container Corp.

Samson Marine of Tacoma

Sea-Land

Seaport Bark Supply

Shell Oil co.

Shortt Saw & Knife

Shortt, William

Simpson Tacoma Kraft Co.

Solidus Corp.

Sound Battery

Sound Refining Co.

Stevedoring Services of America

Stone Investments

Stracke, Clarence

Suburban Propane

Superior Oil Co.

Superlon Plastics

Sussman, Leslie

Tacoma Boatbuilding Co., Inc.

Tacoma Port Angeles Auto Freight

Tatco

Taylor Way Properties, Inc. (formerly listed as Taylor Way Investment Corp.)

Totem Marine Moorage Association (formerly listed as Moorage Association and Totem Boat Haven)

U.S. Naval and Marine Corps

Union Pacific Railroad Company

Unocal Corp. (formerly listed as Union Oil Co.)

USG Interiors (formerly listed as United States Gypsum Co.)

Vance Lift Truck

Washington Belt & Drive Systems

Washington Department of Transportation

Washington Dept. of Natural Resources

West Coast Grocery Co.

Western Fish and Oyster

Western Machine Works, Inc.

Western Plastics Corp.

Western Superior Structurals Manufacturing (formerly listed as Western Engineering

Weyerhaeuser Company

William Drury Co.

Woodworth & Company, Inc.

Wright Marine Towing, Inc.