



FINAL

**Sediment Management Standards
Cleanup Action Decision:**

Duwamish/Diagonal CSO/SD

July 25, 2002

**Prepared by
Washington State Department of Ecology
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1.0 INTRODUCTION

This Cleanup Action Decision has been prepared by the Washington State Department of Ecology (Ecology) for cleanup of contaminated sediment at the Duwamish/Diagonal combined sewer overflow (CSO) and storm drain (SD) outfalls in the Lower Duwamish Waterway in Seattle WA (Figure 1). Cleanup is being conducted by the King County Department of Natural Resources and Parks (KCDNRP, formerly Metro) on behalf of the Elloitt Bay/Duwamish Restoration Program (EBDRP) Panel. Cleanup of this site represents partial fulfillment of the terms of a 1991 consent decree settling a Natural Resource Damages lawsuit. The Duwamish/Diagonal site is within the Lower Duwamish Waterway Superfund site that was listed by the U.S. Environmental Protection Agency (EPA) on September 13, 2001.

The EBDRP sponsored Duwamish/Diagonal cleanup project began in 1994, under provisions of Chapter 173-204 WAC the State Sediment Management Standards (SMS). Because of the Lower Duwamish Waterway Superfund listing, this project is being coordinated with EPA in order to ensure compliance with CERCLA (also known as Superfund). Ecology considers the Duwamish/Diagonal project to be a partial cleanup action under WAC 173-204-550 (3), due to the potential for additional cleanup needs to be identified in sediments adjacent to this site.

The draft Duwamish/Diagonal Cleanup Study Report (December 2001) proposed a cleanup area of about 5-acres in size (actual size is 4.8 acres). However, during the public review process in February 2002, comments were received that recommended the site be expanded to remove an upstream area of high sediment chemistry called a chemical hot spot. The primary concern was that the 5-acre cleanup area would be recontaminated with PCBs when the chemical hot spot was dredged in the future. The EBDRP Panel had previously discussed the potential recontamination problem created by the upstream hot, but it appeared that the cost to address the upstream hot spot was beyond the available sediment remediation budget. In response to the concerns expressed about PCB recontamination and because lower contaminated sediment disposal costs freed up substantial project budget, the EBDRP Panel requested that an evaluation be conducted to determine if the upstream hot spot could be cleaned up using the remaining EBDRP sediment remediation funds. An expanded project was designed that removes the upstream hot spot and the cost of this expanded project was within the remaining EBDRP sediment remediation funds. Based on this new information, the EBDRP Panel now proposes an expanded Duwamish/Diagonal cleanup project of approximately 7.0 acres (original Area A plus added Area B).

Contaminated sediment for the expanded 7.0 acre site will be isolated from the environment by constructing an engineered sediment cap that maintains existing bottom elevations. A layer of contaminated sediment at least 3 feet thick will be dredged from the site to provide the space necessary to install the isolating sediment cap without increasing the existing bottom elevations. Sediment removed during cleanup will be tested to determine the appropriate disposal method. When KCDNRP discussed the

expanded project proposal with Ecology and EPA, it was agreed that a stand-alone document would be created that describes the revised cleanup project. This document was provided to these regulatory agencies in advance of this Cleanup Decision Action memo. At some point in the future, the stand-alone document describing the expanded area will be included in the responsiveness summary that will be attached to the finalized Cleanup Study Report.

In addition to the expanded project document, a second stand-alone document was prepared for the regulatory agencies. That document contains a complete summary of source control activities related to discharge pipes and other potential sources near the cleanup area, because this information was required by Ecology prior to preparing this Cleanup Action Decision memo. The Duwamish/Diagonal project schedule is to begin construction of the cleanup action by November 2003, when the dredging window opens. Numerous permits are required before the project goes to construction. King County cannot officially start the permitting activities until the project is approved by Ecology.

This Cleanup Action Decision provides Ecology's determination that the proposed cleanup action is consistent with the requirements of Chapter 173-204 WAC Sediment Management Standards. This determination was made after King County provided additional information to Ecology to supplement the draft Cleanup Study Report. Additional information provided includes the following addenda to the Cleanup Study Report: the April 2002 Expanded Area for Duwamish/Diagonal Cleanup Project, the April 2002 Source Control Summary for Duwamish/Diagonal Sediment Cleanup Project, and the April 2002 Response to Reviewers Comments on the draft Cleanup Study Report.

This determination was made with the agreement that Ecology, EPA, KCDNRP, the City of Seattle, and other appropriate parties will work closely together to develop a source identification and control plan for the Duwamish/Diagonal project. In addition, Ecology, EPA and KCDNRP will continue to discuss technical issues related to planning and design for the cleanup, in an effort to achieve the most effective cleanup possible for this project.

This Cleanup Action Decision document for the Duwamish/Diagonal project is being made available for public comment along with the:

- April 2002 Expanded Area for Duwamish/Diagonal Cleanup Project addendum,
- April 2002 Source Control Summary Document for Duwamish/Diagonal Sediment Cleanup Project addendum,
- April 2002 Response to Reviewers Comments on the draft Cleanup Study Report,
- Updated Public Involvement Plan, and
- The SEPA checklist and DNS prepared by KCDNRP (May 6, 2002).

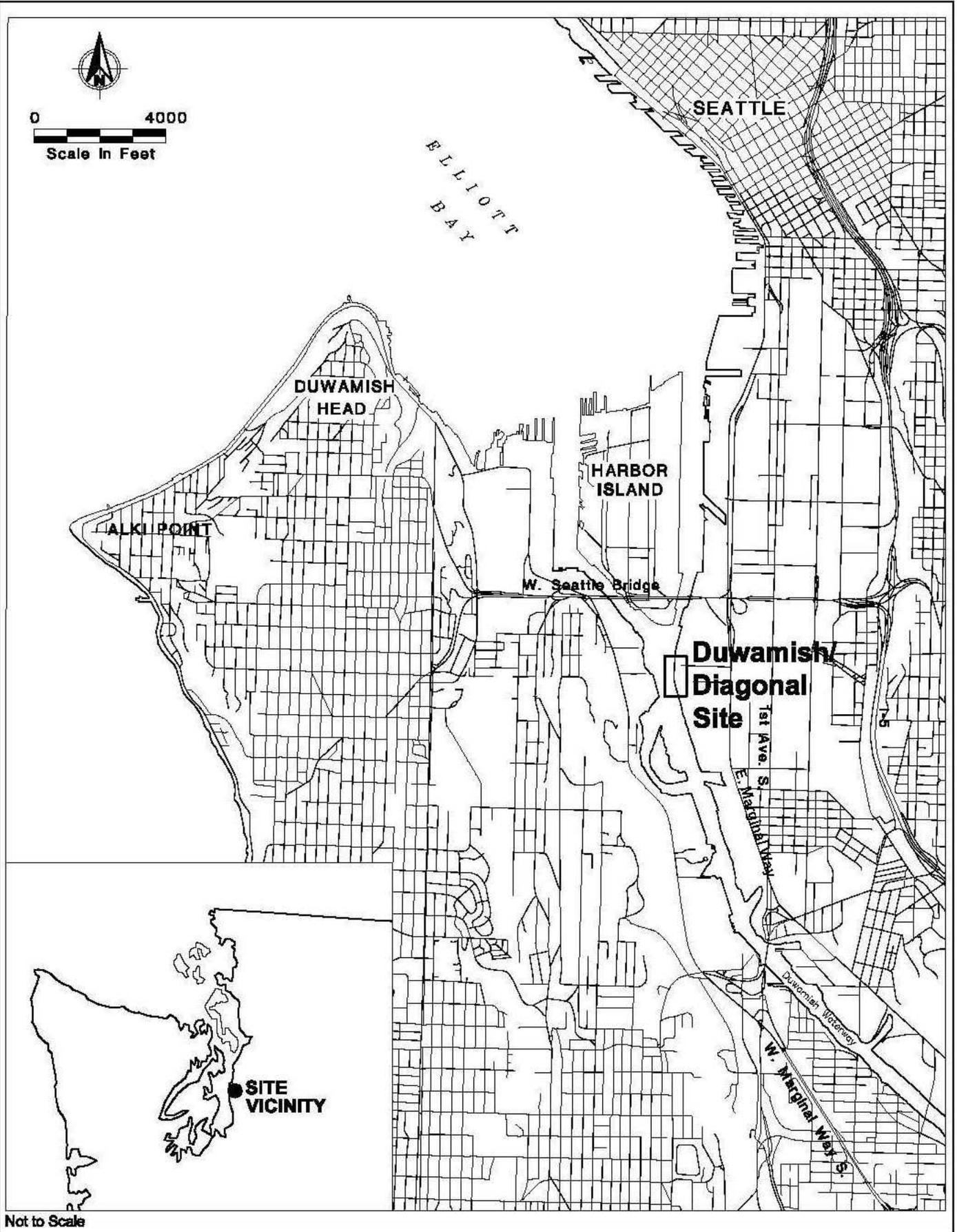


Figure 1. Vicinity map of the Duwamish/Diagonal sediment remediation project in Seattle, Washington.

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2.0 SITE DESCRIPTION

This section describes the discharge facilities that have been located at the site, sources of contamination, and the regulatory history of the site. Much of the information in this and subsequent sections is condensed from the Duwamish/Diagonal CSO/SD Sediment Cleanup Study Report (EBDRP 2001), and the reader is referred to that report for greater detail.

2.1 FACILITIES AND SOURCES OF CONTAMINATION

There are four discharge pipes located inshore of the expanded cleanup site. The Duwamish CSO and Diagonal CSO/SD are two different outfall pipes that are located about 100 feet apart on the east bank of the Duwamish River and across from the north end (down stream end) of Kellogg Island (Figure 1). The Duwamish CSO is a submerged outfall that is owned and maintained by King County (County). The Diagonal CSO/SD outfall is a large shoreline discharge that is owned and maintained by the City of Seattle (City). The historic outfall for the Diagonal Avenue Sewage Treatment Plant that closed in 1969 is located about 500 feet upstream of the Diagonal CSO/SD outfall. The Diagonal Avenue South storm drain is a small (12-inch) pipe located in the high intertidal area at the upstream end of the cleanup site.

The Duwamish CSO outfall is an emergency by-pass for the Duwamish Pump Station that receives combined sewage and storm water from the Duwamish Siphon (flow travels east under the river in siphon lines) and from the upstream portion of the Elliott Bay Interceptor. CSO discharges from this facility have been controlled to less than one overflow event per year and none are known to have occurred since 1989. A combined sewer overflow event would be triggered at this facility only if the level in the pump station wet well exceeded a maximum set point. Combined wastewater in the Duwamish Siphon originates from the Delridge Trunk Sewer and the Chelan Avenue Regulator Station, which are located on the west side of the Duwamish River. Flow in the Elliott Bay Interceptor originates from basins upstream and down stream of the East Marginal Way Pump Station.

The Diagonal CSO/SD carries both separated storm water and limited CSO discharges originating from both the City and County in the Diagonal and Hanford basins. CSO discharges from City lines have been controlled to less than one overflow event per year in five of six CSO locations, which yielded at least a 90 percent reduction (the remaining 10 percent is estimated at 0.5 million gallons per year). CSO discharges from County lines had been predicted to be controlled to one overflow event per year, but new flow modeling for these basins revealed that CSO volumes were reduced by about 80 percent with about 20 percent remaining (an estimated 65 million gallons per year [MGY] remain). Separated storm water from the Diagonal and Hanford basins originates from a combined drainage area of about 2,585 acres and is estimated to have an annual average

volume of about 1,230 MGY. The annual flow varies each year depending on the amount of rainfall in the drainage basin.

The Diagonal Avenue South storm drain (12-inch) serves a relatively small drainage basin of about 12 acres that runs a short distance back from the river along Diagonal Avenue and is mostly paved. The volume of storm water has not yet been determined, but would be small (0.5 percent) compared to the volume from the Diagonal CSO.SD. The former Diagonal Avenue treatment plant discharged primary treated wastewater from 1940 to 1969. Plant capacity was 7-8 million gallons per day with only a two-hour waste retention time.

In addition to CSO flow reduction projects, both City and County staff implemented watershed source control activities including public education, business inspections and response to citizen complaints. The City has been trying to locate the source of a recurrent oil sheen at the discharge. As a source control action, the City will clean contaminated sediment from the bottom of the Diagonal storm drain line which is about a mile long and is installed at an elevation that allows river water to fill the pipe at high tide. Source control modeling was conducted as part of the Cleanup Study for this site and indicated the potential of recontamination by phthalate compounds that are commonly present in storm water discharges.

Along with the storm water and CSO related chemicals, the site also contains high levels of polychlorinated biphenyls (PCBs) in sediments offshore from the outfalls. Near the Duwamish/Diagonal outfalls, it appears that high PCBs were present in river sediments when the outfalls and cross-river siphon pipes were constructed in 1966 and 1967. Recent sampling for the site assessment report showed high PCBs extended to the bottom of the 9-foot cores only in the area along the siphon alignment, which suggests that high PCBs were involved in the dredging and backfilling for the siphon line buried in the river in 1966/67. During the 30 years after the siphon was installed, some of the highest PCB sediments near the Diagonal outfall have been covered with a layer of sediment containing lower PCB values.

The highest PCB values in surface sediment occur in the localized chemical hot spot located offshore from the former Diagonal Avenue treatment plant that closed in 1969. This hot spot may have been reduced in size by a dredging project conducted in 1977 that removed contaminated sediment downstream of the outfall to provide a near shore docking area and moved the shoreline about 100 feet inshore.

2.2 REGULATORY AND PROJECT HISTORY

In 1991, the SMS (Chapter 173-204 WAC) were promulgated, including site identification criteria and cleanup standards for contaminated sediments. Also in 1991, the EBDP Panel was formed under terms of a consent decree and is composed of tribes and federal, state, and local agencies. The consent decree settled a Natural Resources Damage lawsuit brought by NOAA against the City of Seattle and Metro (now King County) for alleged damages to natural resources associated with discharges from CSOs and storm drains located in Elliott Bay and the Duwamish River. Under the consent decree, \$24 million was provided to conduct sediment cleanup, habitat restoration, and source control in areas of Elliott Bay and the Duwamish River associated with Metro and City of Seattle outfalls.

In 1992, a Sediment Remediation Technical Working Group was established by the Panel to identify and rank candidate sites for cleanup and to carry out the cleanup projects selected. Based on preliminary sediment sampling data, 24 potential cleanup sites were identified and ranked by the Panel, according to several criteria, including degree of contamination, completeness of source control, and public comment (EBDRP 1994a). From these sites, three high-ranking sites were selected for cleanup: Central Seattle Waterfront, Norfolk CSO, and Duwamish/Diagonal CSO/SD. Two Panel sponsored cleanup projects were previously completed and include the Pier 53-55 sediment capping project along the Seattle waterfront, and the Norfolk CSO project near the head of navigation in the Duwamish River.

Metro (now King County) was selected by the Panel to act as the project manager for the Duwamish/Diagonal CSO/SD cleanup. In 1994, the Duwamish/Diagonal Cleanup Study Plan and associated documents were prepared, which detailed sediment sampling needed at the site and the decision process for using the data to select a cleanup action alternative (EBDRP 1994b-e). Field investigations were started in August 1994 and were continued in November 1995 and again in May through September 1996 (EBDRP 1995, 1996a, 1996b). A draft Site Assessment report was completed in March 1997 (EBDRP 1997), but project work was stopped later in 1997 due to a spending freeze on EBDP planning and design funds. When the project started again in 2000, new sediment chemistry data was available from a 1998 EPA study and showed there was a more localized area of PCBs in this area of the river than previously indicated. A draft Cleanup Study Report was completed December 2001 (EBDRP 2001). This report identifies site boundaries and levels of contamination, evaluates several possible cleanup alternatives, and identifies a preferred alternative for cleanup. Public comment on this report took place from January 23 to March 1, 2002. The April 2002 Response to Reviewers Comments on the draft Cleanup Study Report presents the comments and responses.

In April 2002, at the request of Ecology and EPA, two addenda to the draft Cleanup Study Report were prepared: the Expanded Area for Duwamish/Diagonal Cleanup Project, and the Source Control Summary.

Finally, this Cleanup Action Decision has been prepared by Ecology to document that the proposed cleanup method is consistent with the Sediment Management Standards, in accordance with WAC 173-204-580. Final design, permitting activities, and construction contract bidding will take place in 2002/2003. Currently, the cleanup action is scheduled for completion in early 2004.

3.0 REGULATORY AUTHORITY AND TYPE OF CLEANUP

The Sediment Management Standards were promulgated under the authority of the State Water Pollution Control Act, Chapter 90.48 RCW and the Model Toxics Control Act, Chapter 70.105D RCW, among others. Ecology may select either of these authorities under which a cleanup may be conducted, as described in WAC 173-204-550, Types of Cleanup and Authority. Because the cleanup is being conducted offshore of a Storm Drain and CSO outfall permitted under the NPDES program, Ecology has selected Chapter 90.48 RCW, the State Water Pollution Control Act, as the appropriate authority for cleanup of the Duwamish/Diagonal CSO/SD site. Now that the project is within the boundaries of the Lower Duwamish Waterway Superfund site, the project will also need to be consistent with the CERCLA requirements for removal actions conducted prior to issuance of the final record of decision (ROD) for the Lower Duwamish Waterway (U.S. EPA 1993).

Because this cleanup is being conducted pursuant to a federal Consent Decree (to which Ecology is party), the cleanup does not fall neatly into any of the "types of cleanup" categories defined in WAC 173-204-550(3). Under the Consent Decree, the Panel is required to conduct sediment cleanup projects with a total value of \$ 12 million near City or County outfalls. Specific cleanup sites were not identified in the decree, but were developed through the Sediment Technical Remediation Work Group process with full public participation. As the cleanup process proceeded, the Panel provided each of the project plans and reports to Ecology for review and comment to ensure consistency with the Sediment Management Standards. Because the Lower Duwamish Waterway became a Superfund site in 2001, the Panel also coordinated with EPA for review and comment to ensure consistency with CERCLA.

4.0 CLEANUP STUDY SUMMARY

Various plans and reports have been prepared to support the cleanup project. A list of relevant Panel documents is provided in the bibliography at the end of this Cleanup Action Decision. All project documents can be reviewed in the public repositories listed in the Public Participation Plan for this site (EBDRP 1994e). This section summarizes documents providing information on the nature and extent of contamination at the site, alternatives for cleanup, and the proposed cleanup action.

4.1 SITE INVESTIGATION

In 1992, Metro collected six preliminary sediment samples from the Duwamish/Diagonal area to provide the Panel with data needed to screen and rank outfalls for potential cleanup. Data from these six samples was used to conduct a preliminary evaluation of the site under the Sediment Management Standards. Three chemicals were found to exceed the State Cleanup Screening Levels (CSL), which indicated the site was a potential sediment cleanup area. In 1994, the Panel selected the Duwamish/Diagonal CSO/SD site as one of the cleanup sites to be funded from the settlement. The County conducted three subsequent phases of sampling at the site (Phase 1.0, 1.5, and 2.0) to evaluate the aerial extent of contamination near the outfall and the depth of contamination. EPA conducted a separate sampling investigation in the Lower Duwamish Waterway that provided additional information used in the site assessment conducted for Duwamish/Diagonal.

- **Phase 1.0** was conducted in August 1994 to identify preliminary site boundaries. Because the extent of contamination was unknown, sampling stations were placed along three transects parallel to the shoreline. Data from these 35 stations were compared to the Sediment Management Standards chemical criteria to identify a preliminary estimate of the area of contamination. Two sediment cores were collected in front of the outfalls to provide preliminary information on the depth of contamination.
- **Phase 1.5** was conducted in November 1995. Ten stations were placed beyond the previous grid of 35 stations to better define the outside boundary of sediment contamination.
- **Phase 2.0** was conducted in 1996 and involved three sampling activities. In May and June a total of 14 sediment cores were collected to allow the depth of contamination to be determined to a depth of 9 feet. Each 9-foot core was divided into three sections (0-3 ft, 3-6 ft, and 6-9 ft) and various sections of cores were analyzed to determine the depth of contamination at each station. In July, three additional surface sediment chemistry samples were taken near the upstream chemical hot spot to better define the boundary of the hot spot. In September, bioassay testing was performed at 7 surface sample stations to help establish both the upstream and down stream boundary for

where no biological toxicity occurred at the site. If biological testing shows no toxicity for a station, then the Sediment Management Standards consider the station to pass the Sediment Quality Standard even if chemical levels at the station exceed the numeric sediment standard values.

- **EPA Sampling** was conducted in 1998 to obtain the data EPA needed to perform a Superfund National Priority Listing (NPL) analysis. EPA collected surface sediment chemistry data at about 300 stations in the Lower Duwamish Waterway and Weston reported the chemistry results in 1999 (Weston 1999). The EPA data lead to the Lower Duwamish Waterway being added to the Superfund site list in 2001. All of the relevant EPA data from stations located in the section of river near the Duwamish/Diagonal site were incorporated into the Duwamish/Diagonal Cleanup study report.

The combined data for the entire Duwamish/Diagonal study area showed a number of pollutants that exceeded State Sediment Quality Standards, including 6 metals, 3 chlorobenzenes, 2 phenols, 2 phthalates, total LPAHs, total HPAHs, and PCBs. To focus the cleanup investigation on chemicals related to the Duwamish/Diagonal outfalls, the chemicals of concern for the site were selected from stations in the general area of the outfalls. Four chemicals of concern were selected for defining the cleanup area and include mercury, PCBs, bis (2-ethylhexyl) phthalate, and butyl benzyl phthalate.

For each of the four chemicals of concern, the entire combined data set for the study area was used to generate detailed contour plots showing which bottom areas exceed the sediment criteria values. Bis(2-ethylhexyl)phthalate and PCBs were the two chemicals with the highest measured values that exceed numeric sediment standards and these chemicals also account for the largest spatial area above the Sediment Quality Standard (SQS). For bis(2-ethylhexyl)phthalate (BEP) the highest values occurred near the Duwamish/Diagonal outfalls and the second highest values occurred at the chemical hot spot located upstream near the old treatment plant outfall. For PCBs, the highest values near the Duwamish/Diagonal outfalls are buried under what appears to be a newer layer of sediment containing lower PCBs, which may have originated from Diagonal storm drain. The highest surface PCB values measured in this area of the river were found upstream off the old treatment plant outfall, but this hot spot was separated by an area of lower PCB concentration.

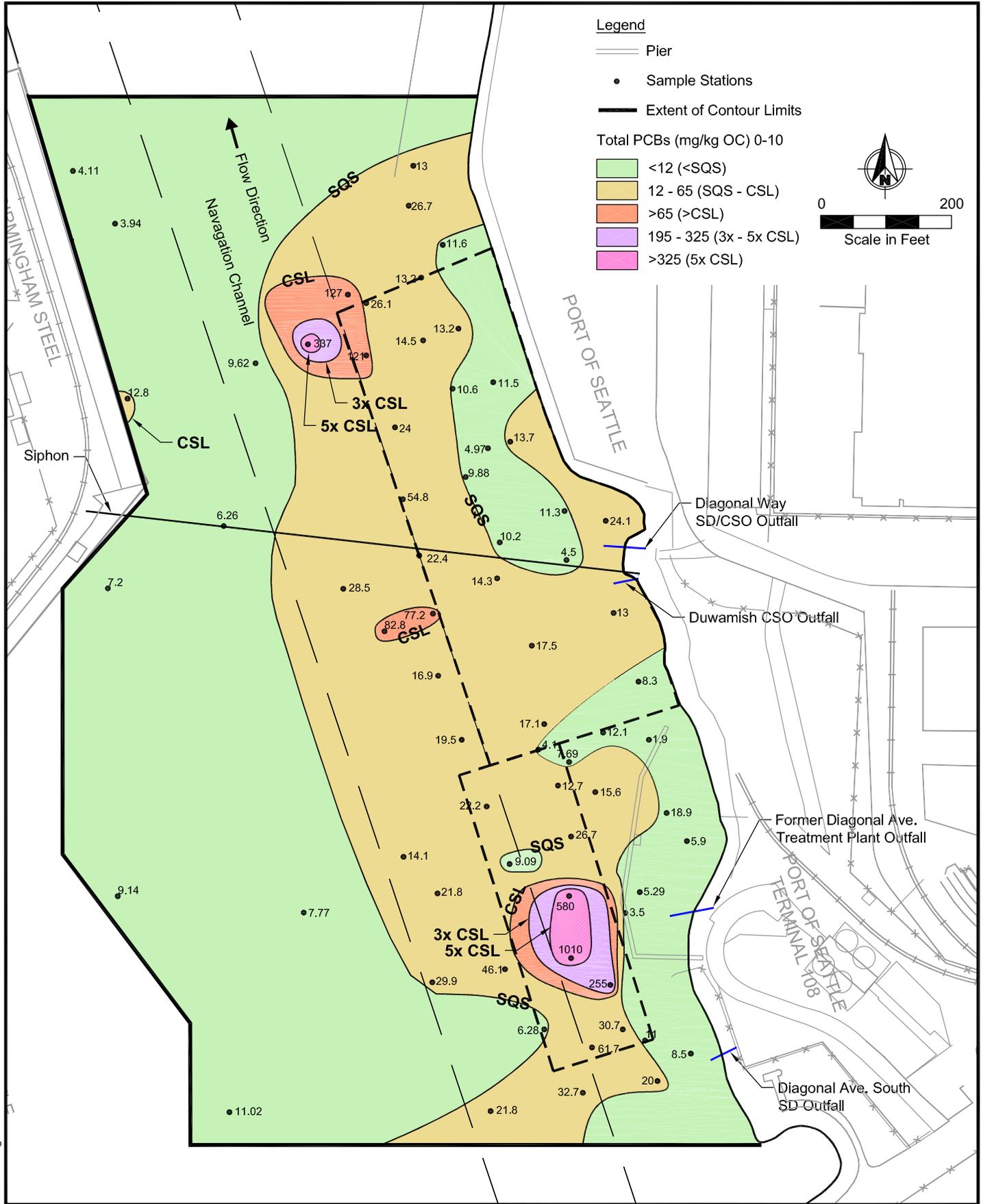
4.2 CLEANUP LEVELS AND SITE BOUNDARIES

It is appropriate to cleanup the site to the more stringent SQS cleanup level because the primary objective of the Panel is to restore natural resources in the vicinity of the areas affected by CSOs and storm drain outfalls. Because the cleanup action includes installing a thick-layer isolating cap of clean sediments after dredging away a layer of contaminated sediments, the SQS standard is met over the entire surface area of the cap.

The selection of cleanup boundaries for this project must fulfill two requirements, according to the Natural Resource Damages settlement consent decree. First, the contamination must be attributable to King County and/or City of Seattle municipal outfalls. Second, there is approximately \$8 million dollars remaining in the sediment cleanup settlement account established by the consent decree, and the cleanup cannot exceed this amount. Therefore, the cleanup boundaries enclose the maximum acreage of sediment contamination from the Duwamish/Diagonal CSO/SD that can be remediated for the \$8 million available.

Boundaries of the expanded cleanup action currently proposed for the Duwamish/Diagonal CSO/SD site enclose two generally rectangular areas as shown in Figures 2, 3, and 4, which also show chemical contour lines for PCBs, BEP, and butyl benzyl phthalate. In the larger down stream rectangle cleanup area (Area A), the upstream and down stream cleanup boundaries were set by the bioassay stations that showed no toxicity or only minor toxicity. The offshore cleanup boundary was set at the edge of the closest navigation channel (east channel line) because chemistry values along the east navigation channel line are similar to bioassay stations that showed little or no toxicity. The inshore boundary was set as close to shore as possible without collapsing the existing rip rap riverbank. In the navigation channel, there are adjacent and nearby sediment sampling stations outside the boundary of the proposed cleanup area that exceed the CSL for BEP and PCBs, and the SQS for butyl benzyl phthalate. Ecology and EPA will continue to work with KCDNRP and the EBDRP panel to determine if it is appropriate to incorporate these stations into the current cleanup project.

In the smaller upstream rectangular cleanup area (Area B), the boundary was established to remove all sediments above the CSL value for PCBs plus a large area of surrounding sediment that exceeds the SQS for PCBs. The inshore boundary does not extend to the shoreline because surface sediments with PCB values below the SQS were located on the inshore side of the existing loading pier. The offshore boundary extends about 50 feet into the navigation channel to remove PCBs above the CSL. The down stream boundary of this rectangular cleanup area (Area B) was extended to connect with the downstream rectangular cleanup area (Area A) to remove additional sediment above the SQS for PCBs. In the inshore area, there are adjacent sediment sampling stations outside the boundary of the proposed cleanup area that exceed the CSL for BEP. Ecology and EPA will continue to work with KCDNRP and the EBDRP panel to determine if it is appropriate to incorporate these stations into the current cleanup project.



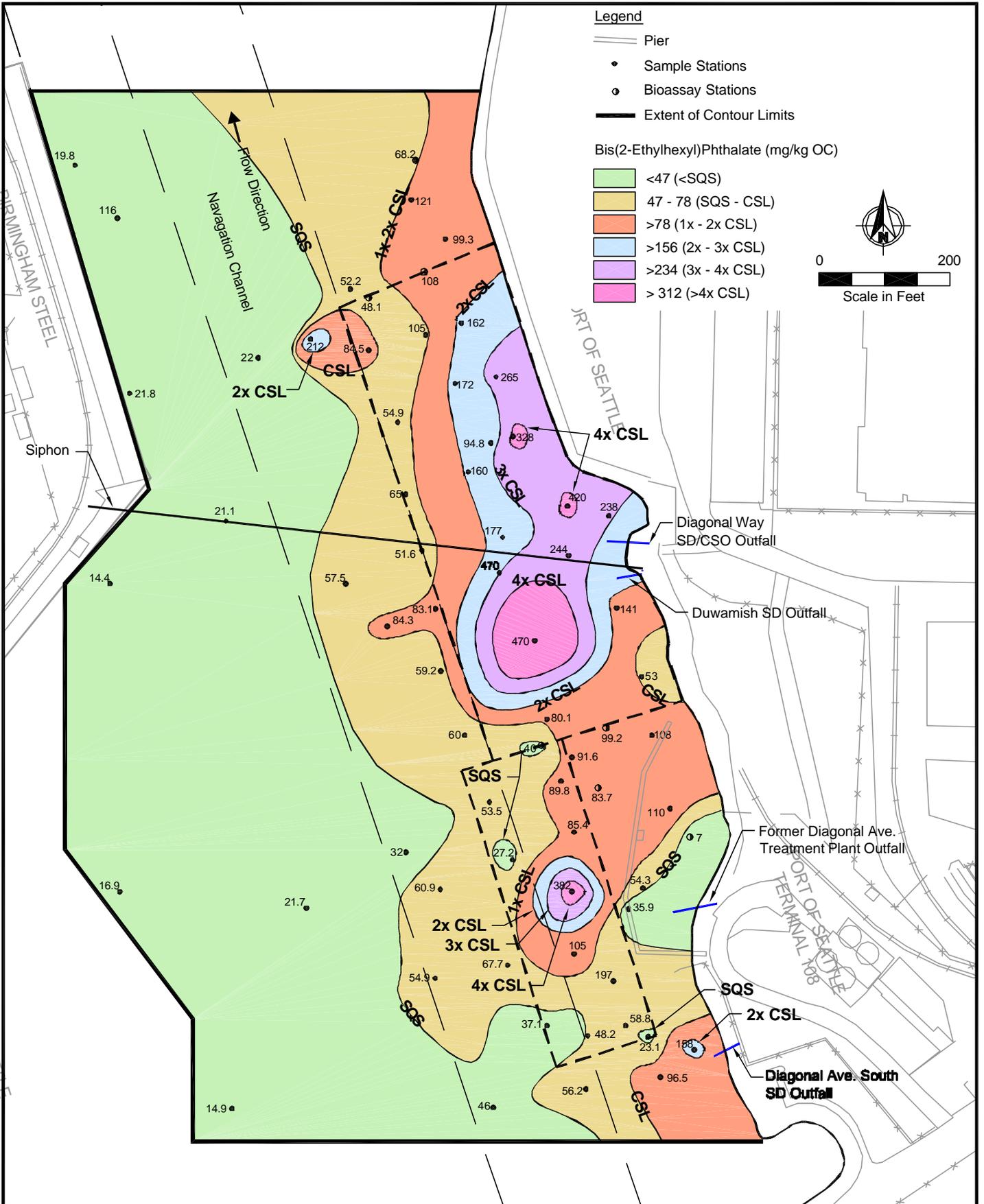
Duwamish/Diagonal Sediment Remediation Project

Total PCBs (mg/Kg OC) Contours in Surface Sediments (0-10 cm)

Figure 2

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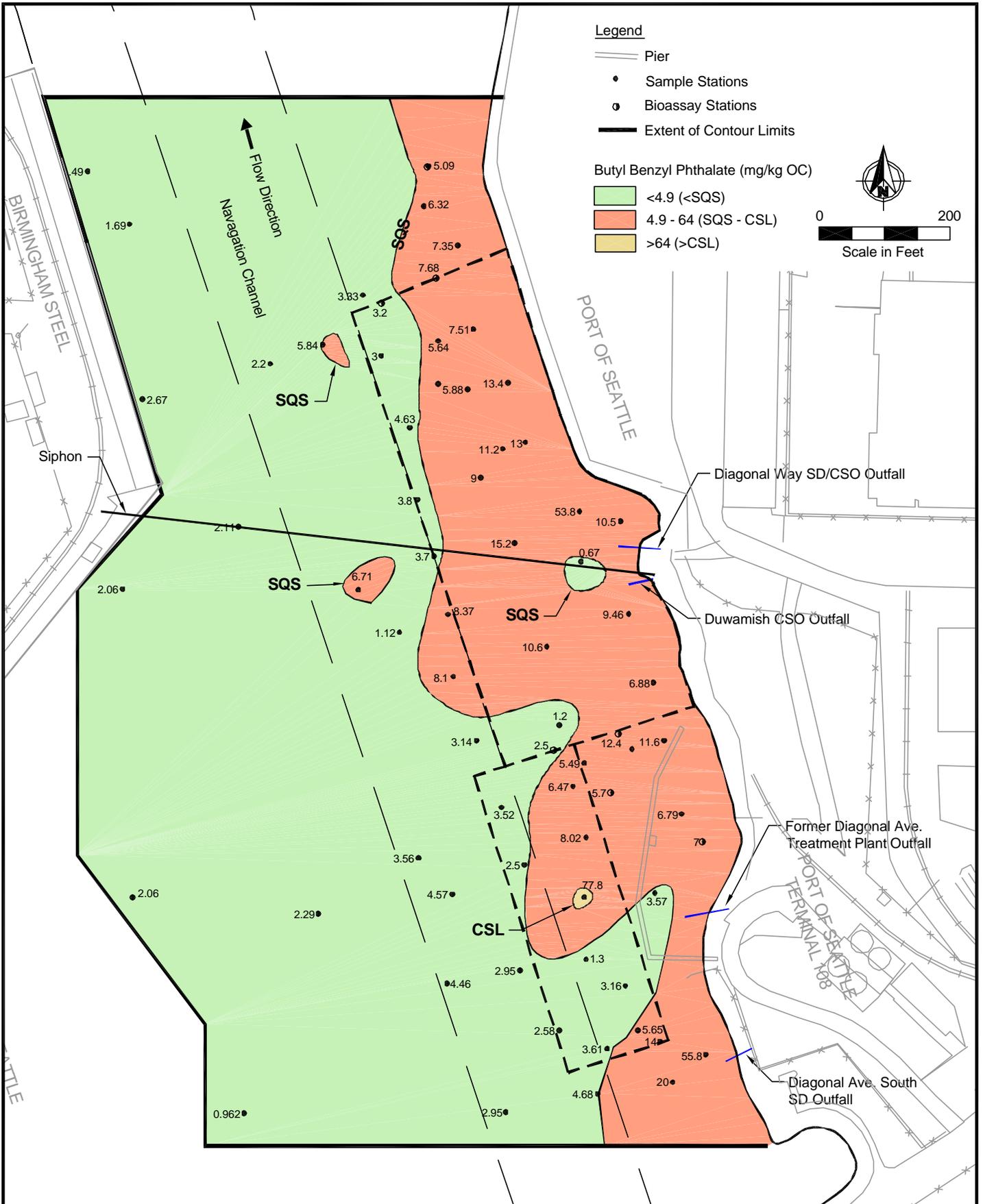
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Duwamish/Diagonal Sediment Remediation Project

Bis(2-ethylhexyl)phthalate
Concentrations in Surface Sediments

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Duwamish/Diagonal Sediment Remediation Project

Butyl Benzyl Phthalate (mg/kg OC) Contours
in Surface Sediments (0-10 cm)

Figure 4

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It is important to recognize that the SQS standards are not intended to be protective of human health and ecological risks due to bioaccumulative chemicals such as PCBs. Even though there are areas beyond the partial cleanup site boundaries that contain elevated sediment contamination, plans are in place to develop risk-based cleanup decisions under the Lower Duwamish Waterway Superfund investigation that will address these areas. After the risk-based decision process has identified sediment contaminants of concern, and set cleanup standards for the Lower Duwamish Waterway, additional cleanup actions may need to be taken adjacent to this project to achieve cleanup of the entire site. The Superfund Record of Decision will establish the final cleanup levels for the Lower Duwamish Waterway. For these reasons, the cleanup action currently proposed for the Duwamish/Diagonal CSO/SD site is considered by both Ecology and EPA to be a partial cleanup action.

The sediment cap will isolate the contaminated sediments that are left in-place after the surface layer is dredged to provide room for the cap. The depth of contamination at the cleanup site is greatest for PCBs. Over most of the site, PCBs exceed SQS or CSL criteria values down to a depth of 6 feet or 9 feet below the surface sediments. It is possible that in a few places PCBs exceed standards to a depth greater than 9 feet (near the Siphon), but this was not determined because the maximum core depth was 9 feet below the surface sediments. Over most of the site, BEP exceeds SQS or CSL criteria values down to a depth of 3 feet or 6 feet below the surface sediments. Mercury is also present above CSL, and will be removed or capped.

4.3 CLEANUP ALTERNATIVES EVALUATED

The Cleanup Study Report describes various alternatives for cleaning up contaminated sediments at the site. A wide range of technologies was initially considered and screened for applicability using the following criteria:

- Technical effectiveness
- Implementability
- Cost-effectiveness
- Environmental impacts

Because this is a relative small site in a dynamic river environment, a focused feasibility study was considered more appropriate than a detailed evaluation of a wide range of alternatives. Using the criteria above, a number of technologies were screened out so the more realistic alternatives could be evaluated in detail. The results of the screening are briefly discussed below:

- **Natural Recovery.** Natural recovery can be an alternative if it is determined that natural processes will, by themselves, result in an area cleaning itself up over time. Natural processes that may result in recovery include burial with clean sediments and degradation of organic chemicals. The allowable natural recovery period under the

SMS is no more than 10 years. This option is not considered likely to be effective at the Duwamish/Diagonal site due to low sedimentation rates and the presence of persistent chemicals such as PCBs. This alternative is also not consistent with the mandate of the Panel to clean up contaminated sites and restore natural resources. Therefore, natural recovery was screened out from further consideration.

- **Dredging Technologies.** Both mechanical and hydraulic dredging were evaluated for application to the site. Mechanical dredging is cost-effective, technically feasible, and has few environmental impacts if properly conducted. This technology was retained for consideration. Hydraulic dredging is also a proven technique. However, large amounts of potentially contaminated water are entrained during dredging, requiring a large dewatering area and possible treatment and disposal of water. At this time, hydraulic dredging is not considered to be the best dredging method for this site, due to the recognized difficulties of properly handling the large volumes of hydraulic dredge material. However, if it becomes apparent during the design phase of this project that hydraulic dredging may have some utility, it will be reconsidered.
- **Treatment and Disposal.** In recent years, treatment of contaminated sediments has received increasing attention and evaluation at both federal and state levels. A report recently released by Washington Department of Natural Resources (WADNR) evaluated sediment treatment methods that could be used in conjunction with a Sediment Multi-User Remediation Facility (SMURF). The five technologies evaluated were bioremediation, soil washing, light aggregate production, plasma arc glass production, and stabilization into cement. Currently, there is no SMURF established in the Puget Sound area, and the prospective viability and availability of such a facility is uncertain. Despite this uncertainty, there are reasons to carry this alternative forward as one type of off-site disposal. Both MTCA and CERCLA have a stated preference for permanent treatment remedies and the SMURF cost analysis provided by WADNR indicated the cost could be competitive with other off-site disposal options. The availability and cost of using treatment in connection with a SMURF will be one of the off-site disposal options assessed during remedial design of the Duwamish/Diagonal project.
- **Capping in Place.** Capping contaminated sediments with a layer of clean sediment is effective because the pollutants are isolated from the biological environment. The cap design is engineered to provide the required isolation thickness and to remain stable against forces such as erosion. Sediments to be used as clean cap material are often obtained from navigation projects in clean areas, such as the turning basin in the Duwamish River. Caps are usually divided into two categories based on thickness. Thin caps are often one foot or less in thickness and are preferred when navigation depths must be maintained. Thick caps are usually a minimum of three feet thick and provide maximum isolation of underlying contaminated sediment. Only thick layer capping is retained for further consideration for this site because the Duwamish River is a busy industrial shipping waterway, which requires greater cap durability than a thin layer cap can provide. If conditions permit, caps can be placed without dredging the contaminated sediment. However, in some cases it is necessary to dredge away

some of the contaminated sediment before installing the cap. Due to the recognized concern for maintaining existing bottom elevations for navigation and habitat in the Duwamish River, a separate capping alternative was added that includes excavating enough sediment to provide room for the cap to avoid increasing bottom elevations.

- **Confined Aquatic Disposal (CAD).** This alternative involves dredging contaminated sediments and consolidating them in a depression underwater, then capping with clean sediments. Through this alternative, widespread surface contamination can be consolidated into a small area and isolated from aquatic life by a clean sand cap. CAD construction typically requires a relatively flat area with a depression that can be filled or dredged out. There is too much bottom slope at the Duwamish/Diagonal cleanup site to allow construction of an on-site CAD; therefore, this option is dropped from consideration. If an off-site CAD facility became available in the future it would be considered as one of many off-site disposal options. Development of an off-site CAD facility would not be the responsibility of the Duwamish/Diagonal project and the facility would need to be able to accept dredged material based on the project construction schedule. It is beyond the scope of this option to consider stockpiling contaminated sediments for use at a future CAD facility.
- **Nearshore Confined Disposal (NCD).** Similar to the CAD alternative described above, sediments are dredged and consolidated within a disposal facility built along the shoreline. Contaminated sediments are contained by a clean berm and are capped by clean sediments, but the contaminated sediment must remain wet. Most of the shoreline in the cleanup area is unsuitable for construction of an on-site NCD due to steep slopes in the inshore area and the existing bank is stabilized with riprap. One flat area exists near the outfall, but this area is considered to be important shallow water habitat for juvenile salmon and would not be approved for use as an on-site NCD facility. If an off-site NCD site became available in the future, this site would be considered as one of the many off-site disposal options to be considered during design.
- **Upland Disposal.** Under this alternative, contaminated sediments are dredged and transported to an upland landfill. Various types of landfills are available, depending on the type and degree of contamination of the sediments. Testing of the Duwamish/Diagonal sediments indicate that all sediments are suitable for disposal in a RCRA Subtitle D Landfill.

Based on the above evaluation, three alternatives were retained as feasible alternatives for cleanup at this site. The first alternative was to install a thick layer cap approximately 3 feet thick over the entire 7.0 acres, which would raise most of the bottom elevation 3 feet except near the outfall and navigation channel. At these two locations, a minimum amount of excavation would be conducted to avoid increasing the bottom elevation. The second alternative was to install a thick layer cap approximately 3-feet thick, but first the entire site would be excavated about 3 feet so that after the cap is installed the bottom elevations remain the same as before capping. Excess excavation would be needed along

the channel to insure the cap is below the required navigation depth of minus 30 feet. The third alternative was to dredge down to the bottom of the contamination layer in order to remove as much contamination as possible. Pre-dredge bottom elevations would be restored by backfilling the site with clean sand. For each of the three alternatives, the recommended disposal option for all contaminated dredge material was upland disposal at a landfill or equivalent disposal facility.

The preferred cleanup alternative selected by the Panel was the second alternative, which involves installing a thick layer cap and also maintaining the existing bottom elevations by first excavating over the entire site to provide room for the cap. A thick cap was selected because this approach is considered to provide similar environmental protection as removing most of the contaminated sediments, but at a significantly lower cost. The Panel selected the capping option that maintains existing bottom elevations because concern has been expressed against increasing bottom elevations in the Duwamish River.

4.4 DESCRIPTION OF THE SELECTED CLEANUP ACTION

The revised Duwamish/Diagonal project proposes to achieve the State Sediment Management Standards (SMS) throughout two rectangular cleanup areas (Area A and Area B) by removing a layer of contaminated sediment and installing in each area an engineered isolating sediment cap that maintains existing water depths and river bottom elevations. The two rectangular cleanup areas are adjacent to each other and are located on the east side of the Duwamish River as shown in Figures 2, 3, and 4. Cleanup Area A is the larger of the two areas at about 4.8 acres and is located adjacent to two discharge pipes (Duwamish CSO and Diagonal CSO/SD). Cleanup Area B is smaller in size at about 2.1 acres and is located offshore from an abandoned sewage treatment plant that closed in 1969. Sediments at both cleanup areas have concentrations that exceed the SQS values for PCBs, mercury, bis(2-ethylhexyl)phthalate, and butyl benzyl phthalate.

The EBD RP Panel recommended applying the same preferred cleanup method in both Area A and B since the areas are similar and adjacent. Chapters 8 and 9 of the Cleanup Study Report provided the detailed alternatives evaluation for Area A. The preferred alternative recommended in the report was Alternative 3 (CAPPING WITH NO CHANGE IN ELEVATIONS) based on the eight criteria set forth in the SMS regulation. The EBD RP Panel approved this alternative as environmentally protective and cost effective. Alternative 2 (MAXIMUM PRACTICABLE CONTAINMENT BY CAPPING) was rejected because this alternative reduced the bottom depths by about 3 feet, which is considered undesirable for navigation, tribal fishing activities, and impacts to habitat. Alternative 4 (MAXIMUM PRACTICABLE REMOVAL OF CONTAMINANTS) was rejected because the volume of contaminated material to be dredged and the associated costs were about twice as much as Alternative 3 without providing significant environmental benefit. Alternative 4 included 82,000 cubic yards of dredged material at a cost of \$10.6 million compared to Alternative 3, which had a dredged volume of 42,500 cubic yards and a cost of \$5.89 million. Alternative 1 (NO ACTION) was rejected

because natural recovery at the site would not cleanup the area within the 10-year time frame required by the SMS.

The preferred cleanup alternative is described in detail in the Cleanup Study Report and the Expanded Area Addendum. In summary, the selected cleanup action consists of the following components:

- Approximately 62,000 cubic yards of in-place contaminated sediments containing PCBs and other chemicals above the SQS standards will be excavated to provide space for the cap. The proposed dredging elevations are shown in Figure 5 and these include excess dredging along the navigation channel. Because in-place sediment will expand by about 10 percent when it is dredged, the volume of dredge material that will be transported to a disposal site will be about 68,200 cubic yards. Dredged sediments will be placed on a barge where preliminary dewatering will occur by letting excess water pass through multiple layers of filtered fabric before the water returns to the river. The barge will be towed to either an off-site transfer facility or an approved off-site disposal facility. The disposal facilities under consideration are a Subtitle D landfill and also a SMURF, CAD or NCD if one of these facilities became available during the design process and is approved by Ecology. At this point in time no SMURF, CAD or NCD has been identified, so a Subtitle D landfill was assumed to be the disposal facility. If a Subtitle D landfill is used, the barge will be towed to a downstream transfer area along the shoreline, where the sediment will be loaded into railcars or trucks for transport to an approved landfill. Ecology retains the right to approve another disposal facility if one is identified during the design process.
- Approximately 62,000 cubic yards of clean material will be used to install the thick layer, isolating cap that will return the site to the pre-dredge bottom elevations. The minimum cap thickness is about 3 feet, but in many places the cap will be thicker due to the shape of dredge cuts that were excavated into the river bottom. Preference will be given to obtain as much capping material as possible from the routine turning basin maintenance dredging conducted by the USACE in the Duwamish River.
- After the cap is installed, the existing rip-rap bank will be given a dressing layer of armor stone and fish mix (approximately 1,700 cubic yards) to ensure long-term stability of the slope and create a more fish-friendly slope. No in-water work would be performed during the time that juvenile salmonids migrate through the area.

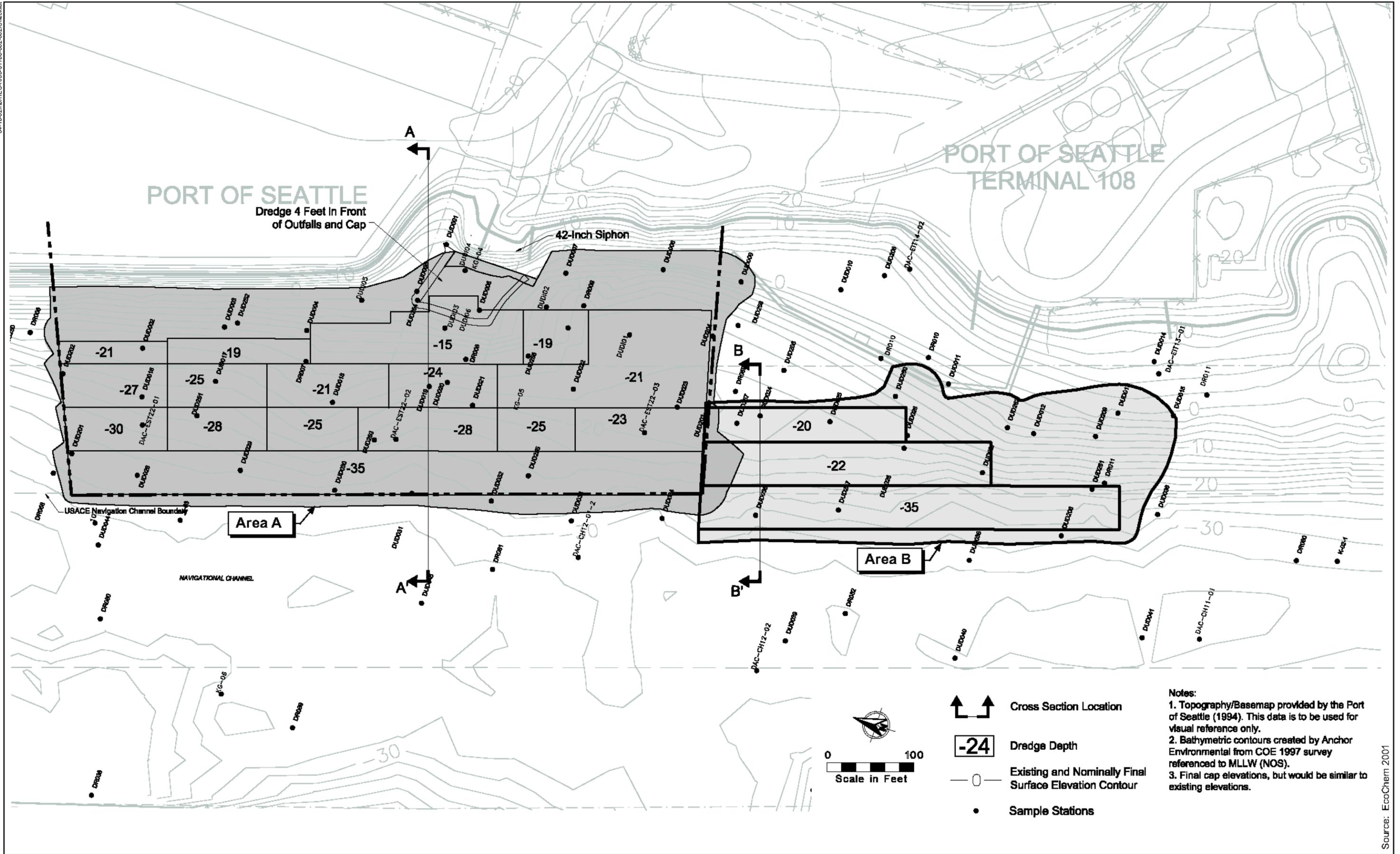


Figure 5. Duwamish/Diagonal sediment remediation project dredge prism schematic, with cross section and sample station locations.

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5.0 REGULATORY DETERMINATIONS

Based on the cleanup study results described above, and the reports referenced above and in the bibliography, Ecology has made the following determinations, required as part of the SMS Cleanup Action Decision:

- **The selected cleanup alternative will be protective of human health and the environment.** A properly engineered thick cap of clean sediment is protective of human health and the environment because the cap isolates the underlying contaminated sediment from the environment and provides a layer of clean sediment for biological interaction.
- **The selected cleanup alternative is consistent with the Sediment Management Standards.** A list of other federal, state, and local laws that are applicable is provided in Chapter 6 of the Cleanup Study Report (EBDRP 2001). Compliance with these laws will be achieved through the Corps of Engineers permitting process and associated state and local permits. Now that the Lower Duwamish Waterway has been listed as a Superfund site, the project is also being coordinated with EPA to meet CERCLA requirements that apply.

Due to the potential for recontamination with BEP, source control is not complete for this project. Ecology, EPA, KCDNRP, the City of Seattle, and other appropriate parties will work closely together to develop and implement a source identification and source control plan for the Duwamish/Diagonal project that will manage recontamination from the Duwamish/Diagonal CSO/SD to the extent practicable. In addition, Ecology, EPA and KCDNRP and the EBDRP will continue to discuss technical issues related to planning and design for the cleanup, in an effort to achieve the most effective cleanup possible for this project.

- **The selected cleanup alternative will achieve compliance with the specific sediment cleanup standards selected for this site.** The thick cap meets the SQS cleanup standard selected for the site, which is the goal of all cleanups in the State. The area that is capped can also be considered to be protective of human health because the contaminants are isolated from the environment. However, Ecology and EPA consider this project to be a partial cleanup, because contaminants are present in surface sediments beyond the Duwamish/Diagonal cap boundary. Studies are being conducted as part of the Lower Duwamish Waterway Superfund activities that will identify any adjacent sediment cleanup needs.

- **The Panel has provided opportunities for public participation consistent with SMS and SEPA requirements.** The Public Participation Plan for the Duwamish/Diagonal site was reviewed and approved by Ecology in 1994 (updated in April 2002) under SMS. This plan has been followed throughout the process. All plans and reports have been made available for public review and comment, and comments addressed when received. A SEPA check list and DNS have been prepared and submitted for public review.
- **The selected alternative includes monitoring.** Various types of monitoring are included as part of the project. There will be monitoring of the dredging and capping activities to insure the construction is carried out according to the dredge and cap plans. Monitoring will be performed on some dredged sediment to verify the PCB levels are appropriate for upland disposal. Also, there will be long-term monitoring of the cap over a 10-year period to document cap stability and recontamination of surface sediments. The monitoring plan is provided as Appendix Q of the Cleanup Study Report. Ecology and EPA will continue to work with KCDNRP on the development of this monitoring plan.

Based on the above findings, the Department of Ecology approves the selected cleanup alternative for the Duwamish/Diagonal CSO/SD project.

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