EXHIBIT B
Cleanup Action Plan

Whatcom Waterway Site
Bellingham, Washington

Issued by:

Washington State Department of Ecology

Toxics Cleanup Program

Northwest Regional Office, Bellevue

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Declarative Statement

Consistent with the Model Toxics Control Act, Chapter 70.105D RCW, as implemented by the Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC, it is determined that the selected cleanup actions are protective of human health and the environment, attain federal and state requirements that are applicable or relevant and appropriate, comply with cleanup standards, provide for compliance monitoring, use permanent solutions to the maximum extent practicable, provide for a reasonable restoration time-frame, and consider public concerns raised during public comment.

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1 Introduction

This *Cleanup Action Plan* (CAP) describes the cleanup action proposed by the Department of Ecology (Ecology) for the cleanup of contamination at the Whatcom Waterway Site (site) in Bellingham. The plan was developed using information presented in the final *Supplemental Remedial Investigation/Feasibility Study for the Whatcom Waterway Site* (RI/FS; RETEC, 2006) and the *Draft Supplemental Environmental Impact Statement: Bellingham Bay Comprehensive Strategy, Whatcom Waterway Cleanup Site* (DSEIS; Ecology, 2006a). This document has been prepared to satisfy the requirements of the Model Toxics Control Cleanup Act (MTCA), Chapter 70.105D RCW, administered by Ecology under the MTCA Cleanup Regulation, Chapter 173-340WAC.

1.1 Site Description

The site is located within Bellingham Bay. The location and characteristics of the site are shown in Figure 1-1. Property ownership is summarized in Figure 1-2.

The site includes lands that have been impacted by contaminants historically released from industrial waterfront activities, including mercury discharges from the former Georgia Pacific Corporation's (GP's) chlor-alkali plant, wood waste and degradation products from historic log rafting activities, phenolic compounds from pulp mill wastewater discharges, as well as other industrial releases. Surface sediment contamination from other historic industrial activities, which comprise part of separate cleanup sites (the Central Waterfront Site, I&J Waterway Site, Cornwall Avenue Landfill Site and R.G. Haley Site), overlays subsurface contamination from this site in four areas of the Waterfront as shown in Figure 1-1.

The chlor-alkali plant was constructed by GP in 1965 to produce chlorine and sodium hydroxide for use in bleaching and pulping wood fiber. The chlor-alkali plant discharged mercury-containing wastewater into the Whatcom Waterway during the late 1960s and 1970s. Initial environmental investigations of the site identified mercury in sediment at concentrations that exceed applicable standards, as well other contaminants from industrial releases. Section 2 provides an overview of the site's history and current conditions.

1.2 Purpose and Scope

The main state law that governs the cleanup of contaminated sites is MTCA. MTCA regulations define the process for the investigation and cleanup of contaminated sites. When contaminated sediments are involved, the cleanup standards and other procedures are also regulated by the Sediment

Management Standards (SMS), Chapter 173-204 WAC. MTCA regulations specify criteria for the evaluation and conduct of a cleanup action. SMS regulations dictate the standards for cleanup. Under both, the cleanup must protect human health and the environment, meet state environmental standards and standards in other laws that apply, and provide for monitoring to confirm compliance with site cleanup standards.

This CAP was developed using information presented in the RI/FS and DSEIS. Ecology issued the DSEIS along with the draft RI/FS for public comment in October of 2006. The RI/FS was then approved by Ecology on June 29, 2007. The RI/FS summarizes over ten years of environmental investigations performed under Ecology direction to characterize the nature and extent of contamination at the site. The RI/FS also screens cleanup technologies and evaluates different potential cleanup alternatives consistent with MTCA regulatory criteria. The EIS evaluates environmental impacts associated with the site cleanup, and potential mitigation measures that could be used to address these impacts. Additional information about the RI/FS and EIS is provided in Section 2.

The purpose of this CAP is to describe Ecology's proposed cleanup action for the site, consistent with MTCA and SMS requirements. Consistent with the requirements of WAC 173-340-380, this document provides the following information:

- Summary of project background and current environmental conditions (Section 2).

- Cleanup requirements applicable to the site, including cleanup standards and other federal, state, and local laws applicable to the cleanup action (Section 3).

- Summary description of the remedial alternatives evaluated in the RI/FS (Section 4)

- Rationale for selection of the proposed cleanup alternative (Section 5).

- A description of the cleanup action proposed by Ecology, consistent with MTCA requirements (Section 6). That section includes a description of the types, levels, and amounts of hazardous substances that will remain on site as part of the cleanup, and the measures that will be used to prevent migration and contact with those substances. Compliance monitoring and contingency actions, as well as institutional controls are also described in Section 6.

- Description of the schedule for implementation of the cleanup action (Section 7).

As a result of public comment Ecology has not made significant changes to the draft Consent Decree and its exhibits, including the draft CAP. Therefore, Ecology is issuing a final Consent Decree, which includes a final CAP and final Public Participation Plan, and a final SEIS concurrent with this Responsiveness Summary.

The final Consent Decree will now be signed by the Potentially Liable Parties and by Ecology. After the Consent Decree has been signed it will be entered into the records of Whatcom County Superior Court. Entry of the Consent Decree into court records establishes the effective date for the Consent Decree, and initiates the schedule of required cleanup activities defined in the Consent Decree and its exhibits.

Following entry of the Consent Decree in court the cleanup will move forward into remedial design and permitting which is expected to take between 2 and 3 years. As part of the design and permitting phase of the cleanup, a draft Engineering Design Report (EDR) will be issued for public review and comment. The draft EDR is expected to be released for public review in late 2009 or early 2010. The draft EDR will contain design details on the proposed caps and other cleanup elements, as well as a Construction Quality Assurance Project Plan and a Compliance Monitoring and Contingency Response Plan. The objective of the plans is to confirm that cleanup standards have been achieved, and also to confirm the long-term effectiveness of cleanup actions at the Site. The plans will contain discussions on duration and frequency of monitoring; the trigger for contingency response actions. Following Ecology approval of the EDR, detailed construction plans and specifications will be developed, and construction of the cleanup action will be implemented.

Construction of the cleanup action is expected to take 3 years following completion of remedial design and permitting. Long-term monitoring activities will be initiated following completion of construction activities

2 Site Background

This section describes background information relevant to the cleanup of the site. Information presented in this section includes the following:

- **Site History:** Section 2.1 describes the history of the site and vicinity, including a summary of previous site activities

- **Current Site Conditions:** Section 2.2 provides a brief summary of the environmental information developed during the 2006 RI/FS

- **Sediment Site Units:** Section 2.3 presents the Sediment Site Units that were developed during the 2006 RI/FS.

2.1 Site History

The site consists of lands located within and adjacent to the Whatcom Waterway in Bellingham, Washington (Figure 1-1). Current land ownership patterns are summarized in Figure 1-2. Mercury and other contaminants have been detected within the site at concentrations that exceed cleanup standards defined under MTCA and SMS regulations.

2.1.1 Site-Area Historic Uses

The site area has been used for industrial activities by multiple parties since the late 1800s. Industrial operations conducted within the area include, but are not limited to, the following:

- Coal shipping
- Log rafting and associated activities
- Pulp and paper mill operation
- Chemical manufacturing
- Cargo terminal operations
- Grain shipment
- Fish processing and cannery operations
- Bulk petroleum terminal operations (two facilities)
- Boatyard operation
- Handling of sand, gravel, and other mineral ores
- Municipal landfill operations
- Multiple lumber mills and a wood products manufacturing operations
- Operation of a co-generation power plant.

Pulp and paper mills have operated on the Pulp and Tissue Mill Site (Figure 1-1). In the early 1900s the mills were operated by Puget Sound Pulp and Timber. The mills were later sold to GP in the 1960s.

In 1965 GP constructed a Chlor-Alkali Plant adjacent to the Log Pond (an industrially-constructed pond open to the Whatcom Waterway). The plant operated between 1965 and 1999 using a mercury cell process to produce chlorine, sodium hydroxide, and hydrogen. Between 1965 and 1971, mercury-containing wastewaters from the Chlor-Alkali Plant were discharged directly into the Log Pond. Between 1971 and 1979 pretreatment measures were installed to reduce mercury discharges. Chlor-alkali plant wastewater discharges to the Log Pond area were discontinued in 1979 following construction of the Aerated Stabilization Basin (ASB).

The ASB facility was constructed by GP during 1978 and 1979 for management of wastewaters in compliance with the Clean Water Act. The outfall from the ASB continues to be owned by GP, and wastewater and sediment quality in that area are monitored under the National Pollutant Discharge Elimination System (NPDES) permit program (Permit No. WA-000109-1).

2.1.2 Summary of Previous Site Activities

2000 RI/FS and EIS

In 1996, the RI/FS process for the site was initiated under a MTCA Agreed Order (RI/FS Agreed Order) between GP and Ecology. Detailed sampling and analysis were performed in 1996 and 1998, and the 2000 RI/FS report was completed in July 2000 following public notice and opportunity to comment (Anchor and Hart Crowser, 2000).

In parallel with the RI/FS activities, the 2000 Bellingham Bay Comprehensive Strategy Draft EIS (2000 DEIS) was prepared. The EIS was both a project-specific DEIS, evaluating a range of cleanup alternatives for the site, and a programmatic DEIS, evaluating the Bellingham Bay Comprehensive Strategy. The Comprehensive Strategy was developed by an interagency consortium known as the Pilot. The Pilot brought together a cooperative partnership of agencies, tribes, local government, and businesses known collectively as the Pilot Work Group, to develop a cooperative approach to expedite source control, sediment cleanup, and associated habitat restoration in Bellingham Bay. As part of the approach, the Pilot Work Group developed a Comprehensive Strategy that considered contaminated sediments, sources of pollution, habitat restoration, and in-water and shoreline land use from a Bay-wide perspective. The strategy integrated this information to identify priority issues requiring action in the near-term and to provide long-term guidance to decision-makers. The Comprehensive Strategy was issued by Ecology as a *Final Environmental Impact Statement* in October of 2000 (Ecology, 2000).

The 2000 RI/FS and EIS documents would have formed the basis for Ecology's selection of a final cleanup action for the site under existing land uses. However, following completion of the 2000 documents, significant land use changes made it necessary to complete a supplemental FS and supplemental EIS for the site.

2002 Supplemental FS and EIS

During 1999 and 2000, GP closed the chlor-alkali plant, the pulp mill, and the chemical plant. The closure of the GP pulp mill dramatically reduced the water treatment needs associated with company operations. Since its construction in 1978, the ASB facility has received effluents from the chlor-alkali plant and pulp and tissue mills and contaminants in ASB sludges include mercury contamination. The contaminated ASB sludges were not addressed in the 2000 RI/FS remedial alternatives, because at that time it was an operational wastewater treatment facility. However, with the reduced treatment needs resulting from the plant closures, the contamination issues could be addressed as part of the cleanup of the site.

To address this new portion of the site, a new remedial alternative was evaluated in 2002 through a *Draft Supplemental FS* (Anchor, 2002; 2002 FS) and *Draft Supplemental EIS* (Ecology, 2002). The new remedial alternative proposed using a portion of the ASB as a nearshore fill disposal facility for disposal of contaminated materials removed from areas of the site outside the ASB and from other contaminated sediment sites in Bellingham Bay. The proposal included maintenance of a down-sized wastewater treatment facility constructed within the footprint of the existing ASB.

Additional Data Collection

Following completion of the 2002 *Draft Supplemental FS* and *Draft Supplemental EIS*, additional site data were collected under the terms of an Agreed Order with Ecology to inform future remedial design activities. The results of these investigations were summarized in a *Pre-Remedial Design Evaluation* report (Anchor, 2003). The pre-remedial design evaluation data collection included the following major work elements:

- Surface sediment sampling to document natural recovery rates and refine the boundaries of the area of sediment exceeding site cleanup standards

- Testing of subsurface samples located in the Outer Whatcom Waterway area

- Contaminant mobility testing for use in evaluation and design of confined disposal alternatives

- Geotechnical testing, column settling tests and consolidation tests of site sediments for use in dredging, capping, and confined disposal alternatives evaluations.

Additional data were collected in 2003 to better characterize contamination within the ASB, (RETEC 2006a, Appendix C). This work included testing of chemical and physical properties of the ASB sludges and underlying native sands. During 2004 additional characterization data were collected at the ASB facility, (RETEC 2006a, Appendix D). The investigation included testing of chemical and physical properties of the ASB berm sands, bathymetric surveys of the ASB, and dewatering tests of the ASB sludges. Sampling was performed between July and September of 2004.

Log Pond Interim Cleanup Action

In late 2000 and early 2001, GP implemented an interim action to clean up sediment contamination in the Log Pond area of the site (Log Pond Interim Action). The work was performed under the terms of an Agreed Order with Ecology (Log Pond Agreed Order) and authorized under Clean Water Act Permit No. 2000-2-00424 administered by the U.S. Army Corps of Engineers (Corps). The Log Pond project beneficially reused 43,000 cubic yards of clean dredging materials from the Swinomish navigation channel and from the Squalicum Waterway. The materials were used to cap contaminated sediments in the Log Pond, and to improve habitat substrate and elevations for use by aquatic organisms. The habitat restoration component of the project was voluntarily implemented by GP in accordance with the Bellingham Bay Comprehensive Strategy.

Monitoring of the Log Pond Interim Action has been performed in Year 1, Year 2 and Year 5 (Anchor, 2001b, 2002b, and RETEC 2006a: Appendix I). Results of monitoring have confirmed that the majority of the cap is meeting performance objectives; however, some erosion has occurred at the shoreline edges where the cap was the thinnest, exposing mercury contaminated sediment. As part of the final cleanup of the site, contingency actions will be taken to contain exposed contaminants and to prevent cap erosion (Appendix A).

2006/2007 Supplemental RI/FS and EIS

In January of 2005 the Port of Bellingham (Port) acquired 137 acres of GP waterfront property. As part of the transfer agreements, the Port agreed to be the lead entity working under Ecology direction to clean up multiple sites, including the Whatcom Waterway Site. Following completion of the property transaction, the Port was added as a signatory to existing Agreed Orders between Ecology and GP.

When the original 2000 RI/FS was approved by Ecology, land use in and around the site was designated and used for industrial purposes, therefore the remedial alternatives under consideration reflected those uses. However, land use plans have changed. The City of Bellingham and the Port are moving towards mixed-use zoning designations. In addition, the Port has made a recommendation to the Washington State delegation to support legislation which would eliminate the Inner Whatcom Waterway Federal Channel designation to provide for multi-purpose uses and to develop the ASB portion of the site for aquatic uses.

The new Supplemental RI/FS was approved by Ecology on June 29, 2007 after notice and opportunity for public comment and is now the final RI/FS given the expected land use at the site. The document integrates previous site investigations and studies and provides a comprehensive evaluation of site conditions and cleanup options under current and anticipated land uses. Ecology issued a DSEIS consistent with the State Environmental Policy Act (SEPA) and with the programmatic elements of the Pilot Comprehensive Strategy. The DSEIS evaluates the potential environmental impacts associated with the RI/FS remedial alternatives and potential mitigation measures that could be used to address these impacts.

2.2 Current Site Conditions

This section provides a brief overview of the current site conditions developed as part of the RI/FS and as summarized in the Conceptual Site Model (CSM). The key elements of the CSM include the following:

- Contaminants and sources
- Nature and extent of impacts
- Contaminant fate and transport processes
- Exposure pathways and receptors.

Graphical illustrations of the CSM are included in Figures 2-1 and 2-2. Tables 2-1 through 2-4 summarize the information on which the CSM is based.

2.2.1 Contaminants and Sources

As measured by relative concentration and frequency of detection, the principal contaminants in the site sediments are mercury, 4-methylphenol, and phenol. Table 2-1 summarizes the principal contaminants and sources for the site. The table includes a summary of the status of source control activities.

- Mercury contamination is predominantly from historical sources. The primary source of mercury within the site sediments was the discharge of mercury-containing wastewaters from the chlor-alkali plant between 1965 and the 1970s. This historic source of mercury contamination has been controlled. Following initial pollution control upgrades by GP in the early 1970s, direct discharge of chlor-alkali plant wastewaters to the Whatcom Waterway was terminated. In 1999 the chlor-alkali plant was closed by GP, eliminating the generation of mercury-containing wastewater. The remediation of the Log Pond area in 2000 and 2001 controlled the secondary source of mercury, by capping impacted sediments in this area. Some regional and natural sources of mercury continue to exist, but these natural and regional sources are not expected to result in exceedances of site screening levels.

- Phenolic compounds are predominantly from historical sources. The primary sources of phenolic compounds within the site sediments include historical wood products handling and log rafting, historical pulp mill discharges prior to implementation of primary and secondary wastewater treatment, and potential lesser contributions from historical stormwater and wastewater discharges. These sources have been controlled. Wood products handling activities are less common than they were historically, and additional regulatory and permitting requirements minimize the potential for discharges of wood wastes to sediments. Pulp mill wastewater discharges were better controlled after the 1960s and 1970s, and discharge of process wastewaters to the Whatcom Waterway was terminated in 1979. The pulp mill was closed by GP in 2000, terminating the discharge of pulp and chemical plant wastewaters to the ASB.

Because primary contamination sources have been controlled, the main focus of the remaining site cleanup actions will be to address secondary contamination sources (i.e., the residual contamination in sediments at the site).

A number of other contaminated sites are located in the vicinity of the site and are being addressed by Ecology. These sites do not represent a current source control concern for site sediments or surface water quality. Section 7 of this CAP describes how cleanup activities at adjacent sites will be coordinated with the Whatcom Waterway cleanup activities.

2.2.2 Nature and Extent of Contamination

The nature and extent of contamination impacts within the site are described in detail in the RI/FS report (RETEC, 2006a & 2006b). Table 2-2 provides a quick summary of the principal RI activities and their findings. These findings are graphically displayed in the CSM in Figures 2-1 and 2-2. Site screening levels discussed in this section are defined in Section 3.

- **Waterway Sediments:** The Whatcom Waterway sediments generally consist of a layer of soft, silty, impacted sediments. The elevation and thickness of the impacted layer varies with location, but is generally between 2 and 10 feet in thickness. The sediments are thickest in historically dredged and filled areas along the Inner Whatcom Waterway. The impacted Waterway sediments are subject to natural recovery by ongoing deposition of clean sediments primarily from the Nooksack River. Except in some high-energy, nearshore areas offshore of the ASB, the impacted sediments are covered by a layer of clean sediments of various thicknesses. These clean sediments have been naturally deposited, and the surface sediments of the bioactive zone comply with sediment screening levels protective of environmental receptors. This process of natural recovery is expected to continue into the foreseeable future. Mercury concentrations within the site subsurface sediments are typically in the low part-per-million range, and average subsurface mercury concentrations decrease with distance from the Log Pond source area. Phenolic compounds are also present in the Waterway in the low part-per-million range. The highest phenolic concentrations were detected in subsurface sediments within the Inner Whatcom Waterway, near the historic pulp mill effluent discharge locations from the 1950s and 1960s. The impacted sediments are underlain by clean, native sandy sediments of varying thicknesses.

- **Log Pond Sediments:** The Log Pond area was the location of the historic mercury-containing wastewater discharge from the chlor-alkali plant during the 1960s and 1970s. Subsurface sediments in this area contain the highest mercury levels present at the site. Removal of these sediments was not technically feasible and the area was remediated by capping in 2000 and 2001 as part of an interim cleanup action performed by GP under Ecology direction. Sediment monitoring since that time has confirmed that the majority of the cap is meeting performance objectives. The cap is successfully preventing underlying contaminants from migrating upward through the cap. Monitoring of groundwater discharges in the cap area has demonstrated no ongoing impacts to surface water quality or cap conditions from the adjacent chlor-alkali plant upland areas. Biological monitoring has demonstrated that the capped area has recovered biological functions for benthic and epibenthic organisms, for juvenile salmonids and shellfish. Tissue monitoring has demonstrated that bioaccumulation risks have been successfully controlled, and crab tissue sampled from the area is not significantly different from crab tissue collected from clean reference sites. Some wave-induced erosion has occurred at the shoreline edges where the cap was the thinnest, exposing sediment with elevated mercury concentrations. As part of the cleanup of the site, contingency actions will be implemented to contain exposed contaminated sediment and to prevent cap erosion (Appendix A).

- **ASB Area:** Figure 2-2 provides a graphical summary of the conditions in the ASB area. The ASB was originally constructed as a stone, sand and clay berm, enclosing a basin dredged in 1978. Some impacted sediments exist underneath portions of the berm. However, the berm consists primarily of clean materials imported at the time of construction. Testing and engineering evaluations have shown that the berm materials are of sufficient quality for reuse. A thick layer of wastewater treatment sludges has accumulated within the ASB. These sludges are soft, flocculant, high-organic materials containing elevated levels of mercury, phenolic compounds, and other contaminants. However, the sludges have not significantly impacted the clean native sands underlying the basin.

- **Starr Rock Area:** Site investigations have documented the nature and extent of contamination present at the former Starr Rock dredge disposal site. This area is located in a deep-water, low energy portion of the site. Natural recovery has occurred in this area and impacted mercury and phenol-impacted sediments have been covered by clean sediments. There are no current exceedances of site cleanup standards in this area.

2.2.3 Fate and Transport Processes

Sediments within the site are acted upon by natural and anthropogenic forces that affect the fate and transport of sediment contaminants. Significant fate and transport processes evaluated as part of the RI/FS include the following:

- **Sediment Natural Recovery:** Sediments in most areas of the site are stable and depositional, and clean sediments continually deposit on top of the sediment surface. RI/FS investigations have documented depositional rates and have verified that patterns of deposition and natural recovery are consistent throughout most areas of the site. The exception to this general observation is in nearshore, high-energy areas where recovery rates are reduced by the resuspension of fine-grained sediments. In all other areas of the site, cleaner sediments are consistently observed on top of impacted sediments. As part of the 2000 RI/FS, site data and recovery models were used to produce quantitative estimates of natural recovery rates. These estimates were then empirically verified by re-sampling surface sediments and comparing observed recovery rates with model predictions.

- **Erosional Processes:** The effects of wind/wave erosional forces represent the principal natural process affecting sediment stability. The RI/FS identifies high-energy, nearshore areas where the natural deposition of fine-grained sediments does not occur, or occurs at slower rates. In these areas, fine-grained sediments can be resuspended, mixed, and/or transported by wave energy. The erosional forces vary with location, water depth, sediment particle size and shoreline geometry. These forces are minimal in deep-water areas which represent the majority of the site.

- **Navigation Dredging and Shoreline Infrastructure:** Navigation dredging and the construction of associated shoreline infrastructure have been prominent features of the site, and have shaped the current lithology. The RI/FS includes extensive discussion of historic and future navigation and infrastructure issues that could affect the fate of the site sediments.

- **Other Processes:** As part of the evaluation of sediment stability, the RI/FS included a discussion of bioturbation, prop wash, and anchor drag. These processes can result in periodic disturbances of the sediment column, and can enhance mixing of surface sediments with underlying sediments. These processes are all ongoing and are incorporated in the empirically measured rates and performance of natural recovery. However, they are relevant in the evaluation of the long-term stability of subsurface sediments. Prop-wash in particular will affect sediment stability in near-shore navigation areas.

2.2.4 Exposure Pathways and Receptors

The RI/FS discusses the principal environmental receptors and exposure pathways applicable to the site and the site screening levels used to evaluate protection of these receptors. Exposure pathways and receptors are illustrated in Figures 2-1 and 2-2, and are summarized in Table 2-3.

Protection of Benthic Organisms

The primary environmental receptors applicable to the site consist of sediment-dwelling organisms. These benthic and epibenthic invertebrates are located near the base of the food chain and are important indicators of overall environmental health. Both chemical and biological monitoring is used to test for potential toxic effects. Chemical and biological standards specified under SMS are used to screen for such effects. The use of SMS whole-sediment bioassays provides an ability to test for potential synergistic effects between multiple chemicals, and to test for potential impacts associated with parameters that may not have been measured as part of chemical testing.

Protection of Human Health

Mercury is one of the primary contaminants present at the site. Mercury can be converted to methylmercury, which in turn can bioaccumulate through the food chain. As part of the previous RI/FS (Anchor & Hart Crowser, 2000), a bioaccumulation screening level (BSL) was developed that would be protective of both recreational and tribal fishing and seafood consumption practices. This information is summarized in Section 4 of the current RI/FS. The BSL was developed using conservative exposure assumptions, to ensure that the value would be protective. An additional degree of protectiveness has been obtained in the way that the BSL is applied to site decision-making. Specifically, the BSL has been applied as a “ceiling” value for all surface sediments, including individual data points or clusters. This application provides a substantial additional degree of protectiveness, because it is the area-weighted average sediment mercury concentration that drives biological risks. Area-weighted average concentrations within the site are currently between two and three times lower than the BSL itself. The RI/FS considers remediation of all areas exceeding the BSL on a point-by-point basis, even though the area-weighted average is already below the BSL. This application of the BSL further reduces the potential risks. The result is to maintain a robust level of protectiveness, in excess of that required to protect human health under reasonable assumptions.

Protection of Ecological Health

As with human health, ecological receptors can be impacted by mercury bioaccumulation. However, the application of the BSL to cleanup at the site ensures protectiveness to ecological receptors. The protectiveness of the BSL to ecological receptors was evaluated in several ways as part of the RI process. First, the protectiveness of the BSL was evaluated against potential marine mammal exposures. Second, bioaccumulation testing has been performed on sediments from the site at concentrations exceeding the BSL, demonstrating no significant bioaccumulation at these sediment concentrations. Third, tissue monitoring has been performed at the site as part of the Log Pond Interim Action. That monitoring has shown that compliance with the BSL prevents the accumulation of mercury in crab tissue in comparison to clean reference areas. Based on these three lines of evidence, compliance with the mercury BSL and with SMS criteria for benthic organisms results in protection of ecological receptors.

Other Considerations

The RI/FS includes evaluations of remedial technologies that may trigger new exposure pathway and receptor risks. For example, dredging of impacted sediments triggers short-term risks at the point of dredging and in material handling areas, and during transport of these materials to the disposal location. Additional exposure pathways and receptors are potentially affected at the location of dredge material disposal. The RI/FS included engineering testing that was focused on providing empirical data necessary to evaluate these additional exposure pathways and receptor risks. These data were then used as part of the RI/FS, in conjunction with applicable regulatory guidelines and requirements, to evaluate the feasibility, protectiveness, and costs of different remedial strategies.

2.3 Sediment Site Units

In the RI/FS, the different portions of the site were divided into different areas or “Sediment Site Units” (RETEC, 2006b). The sediment site units were developed based on differences in the following parameters:

- Physical Factors, including bathymetry, sediment particle size and texture, wood material distribution, wind and wave energies, and the characteristics of adjacent shorelines

- Land Use and Navigation, including upland zoning, shoreline infrastructure, navigation uses, natural resources, ongoing waterfront revitalization activities, and potential interrelationships between cleanup considerations and these factors

- Natural Resources, including the types of existing aquatic habitats within the Site Unit

- Contaminant Distribution, including patterns of surface and subsurface contamination and relative contaminant concentrations.

Figure 2-3 shows the Whatcom Waterway Site Units. The site units as described in the RI/FS are numbered 1 through 8 as shown on Figure 2-3, and are carried forward as part of this CAP. An additional site unit, designated Unit 9, is shown in Figure 2-3 and addresses areas of subsurface sediments containing elevated mercury levels and located beyond the boundaries of Units 1 through 8. A brief summary of each site unit is provided below.

2.3.1 Outer Whatcom Waterway (Unit 1)

The Outer Whatcom Waterway includes portions of the site located offshore of the Bellingham Shipping Terminal. Unit 1 is divided into three subareas:

- **Units 1A and 1B:** These sub-areas are located offshore of the Bellingham Shipping terminal and connect the outer portions of the Whatcom Waterway to deepwater areas of Bellingham Bay

- **Unit 1C:** This portion of the Waterway is located immediately adjacent to the Bellingham Shipping Terminal. Based on bathymetry, this unit is subdivided into Units 1C1, 1C2, and 1C3.

2.3.2 Inner Whatcom Waterway (Units 2 and 3)

The Inner Waterway extends from the Bellingham Shipping Terminal to the head of the Waterway at Roeder Avenue. The Roeder Avenue Bridge crosses the Waterway at that location and precludes navigation further upstream. The Inner Waterway has been subdivided into two units designated “Unit 2” and “Unit 3.” Each of these site units has been further subdivided as described below.

- **Unit 2A:** Shoaled areas at the head of the 30-foot portion of the 1960s federal navigation channel

- **Unit 2B:** An area between the Whatcom Waterway and the ASB that has been considered for future construction of an access channel as part of ASB marina reuse

- **Unit 2C:** Deep areas of Unit 2, including portions of the federal channel where water depths currently exceed 24 feet below Mean Lower Low Water (MLLW)

- **Unit 3A:** An emergent tideflat area located at the head of the Waterway, adjacent to the Roeder Avenue Bridge

- **Unit 3B:** The shoaled area of the 18-ft federal channel in between the emergent tideflat of Unit 3A and Unit 2A.

2.3.3 Log Pond (Unit 4)

The Log Pond area was remediated as part of an Interim Remedial Action, completed by GP in 2000 and early 2001. The Log Pond action included placement of a sediment cap to remediate site sediments, and additional actions to enhance nearshore aquatic habitat in that area. Multiple rounds of monitoring have confirmed that the majority of the cap is meeting performance objectives however some erosion has occurred at the shoreline edges where the cap was the thinnest, exposing mercury contaminated sediment. As part of the cleanup of the site, contingency actions will be taken to contain exposed contaminants and to prevent cap erosion (Appendix A).

2.3.4 Areas Offshore of ASB (Unit 5)

The area offshore of the ASB is a relatively shallow-water area, the majority of which has not been dredged for navigation uses. This area of the site is designated as Unit 5. Unit 5 is subdivided into three subareas:

- **Unit 5A:** Deeper water areas offshore of the ASB. Surface sediments within this area currently comply with cleanup standards. However, exceedances were noted during the 1996 RI sampling event.

- **Unit 5B:** High-energy nearshore areas on the “shoulder” of the ASB. Some surface sediments within this area have mercury concentrations that remain above cleanup standards.

- **Unit 5C:** Shallow-water areas along the southeastern shoulder of the ASB, adjacent to the Inner Waterway. As with Unit 5A, surface sediment quality within Unit 5C currently complies with cleanup standards. However, exceedances were noted during the 1996 RI sampling event.

2.3.5 Areas near Bellingham Shipping Terminal (Unit 6)

Unit 6 consists of the aquatic lands to the south and southeast of the Whatcom Waterway and Bellingham Shipping Terminal. This area has been subdivided into three subareas:

- **Unit 6A:** Deepwater areas of Unit 6 that comply with sediment cleanup standards. Surface sediments within this area currently comply with cleanup standards. However, exceedances were noted during the 1996 RI sampling event.

- **Units 6B and 6C:** Deepwater and intermediate-depth areas near the former barge dock where exceedances of bioassay criteria were noted in surface sediments during recent sampling in 2002.

2.3.6 Starr Rock (Unit 7)

Starr Rock consists of a sediment disposal area used for management of sediments dredged from the Whatcom Waterway and adjacent berth areas during the late 1960s. The area was designated for sediment disposal under project USACE permits. The area is located in submerged offshore areas near the natural Starr Rock navigation obstruction. This area is designated as Unit 7. Surface sediments within this area currently comply with cleanup standards. However, exceedances were noted during the 1996 RI sampling event.

2.3.7 ASB (Unit 8)

Unit 8 consists of the interior of the ASB. This facility was constructed by GP in 1978 for treatment of wastewater from pulp and tissue mill operations.

2.3.8 Remaining Areas of the Site (Unit 9)

Unit 9 consists of the remaining areas of the Site (beyond the boundaries of Units 1 through 8) that contain low-level subsurface mercury contamination. No exceedances of surface sediment cleanup standards have been noted within this area of the site in either the 1996 or 2002 sampling events.

3 Cleanup Requirements

This section describes the cleanup requirements that must be met by the cleanup of the site. Consistent with MTCA and SMS requirements, this section addresses four types of requirements:

- **Cleanup Levels (Section 3.1):** A "cleanup level" is the concentration of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions (WAC 173-340-200)

- **Point of Compliance (Section 3.2):** The "Point of Compliance" defines the point or points on a site where cleanup levels must be met (WAC 173-340-200)

- **Sediment Cleanup Action Objectives (Section 3.3):** Sediment cleanup action objectives are narrative statements about the types of actions that must be performed to ensure compliance with the cleanup levels at the points of compliance

- **Applicable Local, State, and Federal Laws (Section 3.4):** In addition to the requirements of the SMS and the MTCA, other laws apply to the cleanup. Section 3.4 discusses applicable laws and how they will be addressed during implementation of the cleanup action.

3.1 Cleanup Levels

The Site is defined by sediment contamination from industrial waterfront activities, including mercury discharges from the former GP chlor-alkali plant, wood waste and degradation products from historic log rafting activities, phenolic compounds from pulp mill wastewater discharges, as well as other industrial releases. Cleanup standards applicable to sediments are defined by the SMS as described in Section 3.1.1 below. Some cleanup alternatives may trigger the applicability of cleanup standards for other media, particularly soil and groundwater. These potentially-relevant cleanup standards are described in Section 3.1.2.

3.1.1 Sediment Cleanup Levels

The SMS, Chapter 173-204 WAC, govern the identification and cleanup of contaminated sediment sites and establish two sets of numerical chemical criteria against which surface sediment concentrations are evaluated. The more conservative Sediment Quality Standards (SQS) provide a regulatory goal by identifying surface sediments that have no adverse effects on human health or biological resources. The minimum cleanup level (MCUL) (equivalent to the Cleanup Screening Level), represents the regulatory level that defines minor adverse effects.

The SQS is Ecology's preferred cleanup goal, although Ecology may approve an alternate cleanup level within the range of the SQS and the MCUL if justified by a weighing of environmental benefits, technical feasibility, and cost. Chemical concentrations or confirmatory biological testing data may define compliance with the SQS and MCUL criteria.

The primary cleanup levels for the site are defined as the SQS, as measured using bioassay testing procedures. Chemical numeric standards may also be used to evaluate SQS, but bioassays are given preference under SMS regulations because they are considered a more direct and representative measure of potential biological effects. The bioassay test methods that may be used to evaluate compliance with the SQS are defined in current Ecology regulations and guidance and include tests using the amphipod, larval and juvenile polychaete tests.

In addition to the evaluation of benthic effects and compliance with the SQS, cleanup levels at the site must protect against other adverse effects to human health and the environment, including food chain effects associated with the potential bioaccumulation of mercury.

Based on the series of sediment investigations performed for surface and subsurface sediments in 1996, 1998, and 2002, the key constituents of concern for the sediments in the site include mercury and phenolic compounds. The chemical SQS for mercury is 0.41 mg/kg. The chemical MCUL for mercury is 0.59 mg/kg. These levels apply to total mercury, which is the parameter measured directly through chemical testing. The main phenolic compound detected at elevated concentrations at the site was 4-methylphenol. The SQS and MCUL values for 4-methylphenol are both 0.67 mg/kg. The phenolic compounds phenol and 2,4-dimethylphenol were noted sporadically in surface sediments. The SQS and MCUL values for 2,4-dimethylphenol are both 0.029 mg/kg.

Protection of Benthic Organisms

The primary environmental receptors applicable to the site consist of sediment-dwelling organisms. These benthic and epibenthic invertebrates are located near the base of the food chain and are important indicators of overall environmental health. Both chemical and biological monitoring is used to test for potential toxic effects. Chemical and biological standards specified under SMS are used to screen for such effects. The use of SMS whole-sediment bioassays provides an ability to test for potential synergistic effects between multiple chemicals, and to test for potential impacts associated with parameters that may not have been measured as part of chemical testing.

Protection of Human Health and Ecological Receptors

In addition to the evaluation of benthic effects and compliance with the SQS, cleanup levels at the site must protect against other adverse effects to human health and the environment, including food chain effects associated with the potential bioaccumulation of mercury. As summarized in the RI/FS (RETEC, 2006a), a site-specific sediment BSL of 1.2 mg/kg mercury was developed that would be protective of both recreational and tribal fishing and seafood consumption practices. This BSL provides an area-wide average concentration of mercury in sediments that is protective of subsistence-level human consumption of seafood from Bellingham Bay. Bioaccumulation testing performed as part of the RI/FS and related studies has demonstrated that sediment mercury concentrations below this value do not present a risk of food chain effects to ecological receptors. The BSL has conservatively been applied as a cleanup level that must be met for surface sediments within the site, whether or not the area-wide average concentration of mercury exceeds the BSL. Specifically, the BSL has been applied as a “ceiling” value for all surface sediments at the site, including individual data points or clusters. The FS considers remediation of all areas exceeding the BSL on a point-by-point basis, even though the area-weighted average is already below the BSL. This application of the BSL further reduces the potential risks associated with the site. The result is to maintain a robust level of protectiveness, in excess of that required to protect human health under reasonable assumptions. This conservative application of the BSL provides a substantial additional level of protectiveness to site cleanup decisions.

As with human health, ecological receptors can be impacted by mercury bioaccumulation. However, the application of the BSL to cleanup at the site ensures protectiveness to ecological receptors. The protectiveness of the BSL to ecological receptors was evaluated in several ways as part of the RI process. First, the protectiveness of the BSL was evaluated against potential marine mammal exposures. Second, bioaccumulation testing has been performed on sediments from the site at concentrations exceeding the BSL, demonstrating no significant bioaccumulation at these sediment concentrations. Third, tissue monitoring has been performed at the site as part of the Log Pond Interim Action. That monitoring has shown that compliance with the BSL prevents the accumulation of mercury in crab tissue in comparison to clean reference areas. Based on these three lines of evidence, compliance with the mercury BSL and with SMS criteria for benthic organisms results in protection of ecological receptors.

3.2 Points of Compliance

Consistent with the SMS regulations, sediment cleanup levels apply to the sediment bioactive zone. For Bellingham Bay this has been determined to be the upper 12 centimeters of the sediment column (Anchor and Hart Crowser, 2000). The cleanup levels do not directly apply to subsurface sediments, but the SMS require that the potential risks of the current and/or future exposure of deeper sediments be considered and be minimized through the implementation of the cleanup action.

3.3 Sediment Cleanup Action Objectives

Based on the site conditions and current regulations, the cleanup action objectives for the site include the following:

- **Surface Sediments:** Use appropriate technologies including active and/or passive measures to ensure compliance with site cleanup standards as defined in Section 3.1 for the sediment bioactive zone

- **Subsurface Sediments:** Where subsurface sediments have the potential to become exposed, use appropriate technologies including active and/or passive measures to ensure long-term compliance with site cleanup standards in surface sediments in the bioactive zone as defined in Section 3.2.

3.4 Applicable Local, State, and Federal Laws

Cleanup actions must comply with applicable local, state, and federal laws. In certain cases a permit is required. In other cases the cleanup action must comply with the substantive requirements of the law but are exempt from the procedural requirements of the law RCW70.105D.090; WAC173-340-710.

Additionally, persons conducting remedial actions have a continuing obligation to determine whether additional permits or approvals are required or whether additional substantive requirements for permits or approvals must be met.

3.4.1 Required Permits and Approvals

Cleanup actions at the site are anticipated to require the following permits:

- Permit for discharge of dredged, excavated or fill material to waters of the United States pursuant to Section 404 of the Clean Water Act.

  It is anticipated that the cleanup of the site will be performed using a Federal 404 Individual permit issued by the Corps. The federal permitting process includes review of issues relating to wetlands, tribal treaty rights, threatened and endangered species, habitat impacts, historical/archeological resources, dredged material management, environmental impacts in accordance with the National Environmental Policy Act, and other factors. The time required to complete 404 permitting and associated regulatory reviews can vary from one to several years. The following describes several of the federal permitting issues:

- Endangered Species Act Review

  The site area is potential habitat for threatened and/or endangered species therefore cleanup actions will be subject to Endangered Species Act review. The National Marine Fisheries Service and the United States Fish and Wildlife Service will perform the review as part of the 404 permit process.

- Historical/Archaeological Review

  As part of the 404 permit process, the Corps will review the cleanup actions to determine whether they will disturb historical or archaeological resources.

- Puget Sound Dredged Material Management Program

  In Puget Sound, the open water disposal of sediments is managed by the Dredged Material Management Program (DMMP). This program is administered jointly by the Corps, the US Environmental Protection Agency, the Washington State Department of Natural Resources, and Ecology. The DMMP has developed the Puget Sound Dredged Disposal Analysis (PSDDA) protocols which include testing requirements to determine whether dredged sediments are appropriate for open-water disposal. The DMMP has also designated disposal sites throughout Puget Sound. As part of the 404 permit process the Corps will ensure dredged material is managed in accordance with the requirements of the DMMP.

- National Environmental Policy Act (NEPA) Review

  Construction projects are subject to environmental impact review under SEPA and/or NEPA regulations. The SEPA review for the cleanup of the site was completed by Ecology through the DSEIS. NEPA review will be completed by the Corps through the 404 permit process.

- Water Quality Certification from the State of Washington pursuant to Section 401 of the Clean Water Act.

  As part of the 404 permitting process, a section 401 water quality certification must be obtained from Ecology. Certification ensures that the 404 permitted actions will comply with state water quality standards and other aquatic resource protection requirements under Ecology's authority.

- National Pollutant Discharge Elimination System Waste Discharge Permit for discharge of pollutants to waters of the United States pursuant to Section 402 of the Clean Water Act.

  The cleanup of the site will generate waste water that will be either discharged to the local sanitary sewer system or to surface water. Discharge of pollutants to surface water requires a permit under section 402 of the Clean Water Act to ensure compliance with state water quality standards. National Pollutant Discharge Elimination System permits are obtained from Ecology.

- Washington State Scientific Collection Permit for the collection of foodfish, shellfish, or wildlife or their nests and/or eggs for the purpose of research or display pursuant to WAC 220-20-045 and WAC 232-12-276.

  Post-cleanup monitoring of the site will require the collection of Dungeness crab to ensure that mercury tissue concentrations remain below applicable standards. The Washington State Department of Fish and Wildlife issues this permit as part of their management and protection of the resource.

3.4.2 Substantive Requirements

The cleanup will also meet the substantive requirements of permits or approvals that are procedurally exempt under RCW 70.105D.090. The substantive requirements of the following permits, known at this time to be applicable to the cleanup, will be followed:

- **Hydraulic Project Application –** projects involving in-water construction activities typically require a hydraulic project application (HPA). HPAs are issued by the Washington Department of Fish and Wildlife (WDFW), and define state requirements for construction activities in order to avoid unnecessary disturbance to fish, shellfish, and wildlife.

- **Shoreline Management Substantial Development Permit –** projects within the City Limits of Bellingham and within 200 feet of the ordinary high water mark of Bellingham Bay typically must obtain a Shoreline Management Substantial Development Permit (Shoreline Permit). Shoreline Permits are issued by the City, and include requirements to protect the ecological function of shorelines.

The WDFW and the City will be consulted as part of cleanup design and permitting to identify applicable substantive requirements, and to ensure these requirements are addressed.

4 Description of Remedial Alternatives Considered in the RI/FS

This section includes a summary of the eight remedial alternatives that were considered in the RI/FS. Table 4-1 provides a concise summary of the remedial alternatives and the technologies applied. Figures 4-1 through 4-8 illustrate the design concept of each of the alternatives. The alternative descriptions below as well as the associated figures have been refined from those presented in the RI/FS to more clearly describe and depict the proposed cleanup actions.

4.1 Alternative 1

Alternative 1 uses containment, monitored natural recovery, and institutional controls to comply with SMS cleanup standards and MTCA cleanup requirements. Alternative 1 is illustrated in Figure 4-1. Alternative 1 makes the least use of active remedial technologies of all of the alternatives considered.

No dredging or capping would be performed in the Outer Waterway (Unit 1), the Inner (Units 2 & 3) Waterway, offshore of the ASB (Units 5A and 5C), south of the Bellingham Shipping terminal in Unit 6A, or near Star Rock (Unit 7) or in outlying site areas (Unit 9). Surface sediments in Unit 1 currently comply with SMS criteria. Subsurface impacted sediments in Unit 1 would remain in place beneath the clean surface sediments. The majority of Units 2 and 3 have naturally recovered, with some surface contamination remaining in nearshore berth areas along the Colony Wharf portion of the Central Waterfront Site. Additional recovery time would be required to achieve full restoration of this area. Surface sediments in Units 5A and 5C, 6A, 7, and 9 currently comply with site-specific cleanup goals. Areas in which natural recovery has resulted in concentrations below SMS criteria would be monitored to document the continued effectiveness of natural recovery at complying with cleanup levels.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Offshore of the ASB (Unit 5B), exceedances of site-specific cleanup goals would be remediated using capping, with some pre-capping dredging where necessary to optimize final cap surface elevations. The area south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) will be remediated using a cap. The cap would be constructed of coarse granular materials and would be designed to resist potential prop-wash erosion effects.

The sludges within the ASB (Unit 8) would be remediated using a thick cap. Prior to cap placement, the treatment equipment (aerators, weirs, etc.) would be removed from the ASB.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.2 Alternative 2

Alternative 2 uses monitored natural recovery, institutional controls, containment, and removal and disposal to comply with SMS cleanup standards and MTCA cleanup requirements. Removed sediments would be disposed in a new Confined Aquatic Disposal (CAD) facility that would be developed offshore of the Cornwall Avenue Landfill. Alternative 2 is illustrated in Figure 4-2.

The outer portion of the Waterway (Unit 1) would be dredged to a minimum depth of 35 feet below MLLW. Where technically feasible, the dredging depths would be increased to allow dredging to the base of the impacted sediments in the channel areas. Anticipated dredge depths vary from 35 feet below MLLW to about 41 feet below MLLW. Some capping may be required in areas that are not technically feasible to dredge (to be determined during remedial design and permitting).

Sediment dredging would be performed as necessary in the Inner Waterway (Units 2 and 3) in accordance with use and maintenance of the historic 1960s federal navigation channel configuration. Anticipated dredge depths vary from 18 feet below MLLW to about 35 feet below MLLW. Residual sediments would be capped with a minimum 3 foot thick cap.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Offshore of the ASB (Unit 5B), exceedances of site-specific cleanup goals would be remediated using capping, with some pre-capping dredging where necessary to optimize final cap surface elevations. The area south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) would be remediated using a cap. The cap would be constructed of coarse granular materials and would be designed to resist potential prop-wash erosion effects.

The sludges within the ASB (Unit 8) would be remediated using a thick cap. Prior to cap placement, the treatment equipment (aerators, weirs, etc.) would be removed from the ASB.

Sediments in Units 5A and 5C, 6A, 7, and 9 currently comply with site-specific cleanup goals. Areas in which natural recovery has resulted in concentrations below SMS criteria would be monitored to document the continued effectiveness of natural recovery at complying with cleanup levels.

Sediments removed during dredging activities would be barged to the Cornwall CAD site location, and placed within the containment facility. Dredging methods used would likely be mechanical, reducing the entrained water management concerns applicable to hydraulic dredging, and producing dredge materials with physical properties appropriate for CAD site management.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.3 Alternative 3

Alternative 3 uses a combination of monitored natural recovery, institutional controls, containment, and removal and disposal technologies to comply with SMS cleanup standards and MTCA cleanup requirements. Removed sediments would be disposed in a nearshore fill within the majority of the ASB. Alternative 3 is illustrated in Figure 4-3.

The outer portion of the Waterway (Unit 1) would be dredged to a minimum depth of 35 feet below MLLW. Where technically feasible, the dredging depths would be increased to allow dredging to the base of the impacted sediments in the channel areas. Anticipated dredge depths vary from 35 feet below MLLW to about 41 feet below MLLW.

Sediment dredging would be performed as necessary in the Inner Waterway (Units 2 and 3) in accordance with use and maintenance of the historic 1960s federal navigation channel configuration. Anticipated dredge depths vary from 18 feet below MLLW to about 35 feet below MLLW. Residual sediments would be capped with a minimum 3 foot thick cap.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Offshore of the ASB (Unit 5B), exceedances of site-specific cleanup goals would be remediated using capping, with some pre-capping dredging where necessary to optimize final cap surface elevations. The area south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) would be remediated using a cap. The cap would be constructed of coarse granular materials and would be designed to resist potential prop-wash erosion effects.

Sediments in Units 5A and 5C, 6A, 7, and 9 currently comply with site-specific cleanup goals. Areas in which natural recovery has resulted in concentrations below SMS criteria would be monitored to document the continued effectiveness of natural recovery at complying with cleanup levels.

The sludges within the ASB (Unit 8) would be contained within the existing ASB. Most sludges would be buried beneath the sediment removed from cleanup areas outside the ASB. A portion of the ASB would still be needed for wastewater treatment. Sludges within this area would be dredged and consolidated within the fill area. Construction sequencing would involve initial lowering of the water level of the ASB, followed by the removal of the wastewater treatment equipment (aerators, weirs, etc.). Dredging of sludges from the future edge of the nearshore fill would then be conducted. A berm would be constructed along this alignment. Finally, the remaining sludges would be dredged from the area outside of the berm, for consolidation within the new fill area. Because construction within the ASB would disrupt the bentonite sealant present along the bottom and sides of the ASB, some additional measures (in addition to lowering of the water level of the ASB during construction) may be required to prevent significant water leakage through the berm during and after construction. These actions may include driving of sheet-piling, placement of new bentonite sealant, or other measures. Some residual sludges would likely remain in the dredged area of the ASB, and these would be managed by sediment capping.

Dredging activities could potentially be conducted using either hydraulic or mechanical dredging. Mechanical dredging and hydraulic dredging would need to be evaluated during remedial design to optimize project design and ensure protection of water quality during the dredging, both at the point of dredging and at the point of disposal for any generated waters. Sediments dredged from the Waterway would be contained within the ASB fill.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.4 Alternative 4

Alternative 4 uses removal and upland disposal technology, in addition to institutional controls, monitored natural recovery, and containment to comply with SMS cleanup standards and MTCA cleanup requirements. The alternative uses capping in-place for management of the ASB sludges. Alternative 4 is shown in Figure 4-4.

The outer portion of the Waterway (Unit 1) would be dredged to a depth of approximately 35 feet below MLLW. After removal of sediments to -35 feet MLLW, a thick sediment cap would be placed over residual impacted sediments. The cap would be designed to resist erosive forces of prop wash, and to prevent aquatic wildlife exposures.

The majority of the Inner Waterway (Units 2 & 3) would be dredged for effective water depths of between 18 feet and 22 feet. The central portion of the Waterway would be dredged to depths at least 5 feet below the planned effective water depth. A sediment cap would then be applied over any residual sediments, with the cap grading from a minimum thickness of 3 feet to a maximum thickness of 6 feet near the Log Pond. Shoreline slopes would be stabilized using appropriately designed side-slopes and materials that maximize nearshore habitat quality and quantity, while maintaining stability under the planned site uses described in Section 6.4.1.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Offshore of the ASB (Unit 5B), exceedances of site-specific cleanup goals would be remediated using capping, with some pre-capping dredging where necessary to optimize final cap surface elevations. The area south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) would be remediated using a cap. The cap would be constructed of coarse granular materials and would be designed to resist potential prop-wash erosion effects.

Sediments in Units 5A and 5C, 6A, 7, and 9 currently comply with site-specific cleanup goals. Areas in which natural recovery has resulted in concentrations below SMS criteria would be monitored to document the continued effectiveness of natural recovery at complying with cleanup levels. The sludges within the ASB (Unit 8) would be remediated using a thick cap. Prior to cap placement, the treatment equipment (aerators, weirs, etc.) would be removed from the ASB.

Mechanical dredging methods would likely be used as hydraulic dredging is not feasible without a large area for management of produced dredge waters and for separating entrained waters from dredge materials. Detailed dredging and construction procedures would be determined in project design and permitting.

Sediments dredged from Units 1A and 1B would be disposed via either beneficial reuse in the Inner Waterway or in-water disposal through the DMMP, subject to PSDDA testing and suitability determinations. Other sediments removed during dredging may be barged to an offload facility within Port-owned property. The sediments would be transferred to lined railcars for transportation to an appropriately-permitted offsite disposal facility (e.g. Subtitle D permitted landfill that can accept wet sediments for reuse as daily cover). Other disposal facilities that have appropriate environmental permits may be used, subject to applicable regulations and logistical considerations.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.5 Alternative 5

Alternative 5 uses multiple technologies to comply with SMS cleanup standards and MTCA cleanup requirements. Institutional controls, monitored natural recovery, and containment are used in various portions of the site. Removal and upland disposal are used for ASB sludges and impacted sediments from outside of the ASB. The ASB sludges are treated to achieve volume reduction. Clean material removed from the ASB berm is reused. Alternative 5 is shown in Figure 4-5.

The outer portion of the Waterway (Unit 1) would be dredged to a depth of approximately 35 feet below MLLW. After removal of sediments to -35 feet MLLW, a thick sediment cap would be placed over residual impacted sediments. The cap would provide a sufficient thickness of cap material to allow for future waterway maintenance dredging, and would provide resistance against potential erosion by prop wash.

The majority of the Inner Waterway (Units 2 and 3) would be dredged for effective water depths of between 18 feet and 22 feet. The central portion of the Waterway would be dredged to depths at least 5 feet below the planned effective water depth. A sediment cap would then be applied over any residual sediments, with the cap grading from a minimum thickness of 3 feet to a maximum thickness of 6 feet near the Log Pond. Shoreline slopes would be stabilized using appropriately designed side-slopes and materials that maximize nearshore habitat quality and quantity, while maintaining stability under the planned site uses described in Section 6.4.1.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Offshore of the ASB (Unit 5B), exceedances of site-specific cleanup goals would be remediated using capping, with some pre-capping dredging where necessary to optimize final cap surface elevations. The area south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) would be remediated using a cap. The cap would be constructed of coarse granular materials and would be designed to resist potential prop-wash erosion effects.

Sediments in Units 5A and 5C, 6A, 7, and 9 currently comply with site-specific cleanup goals. Areas in which natural recovery has resulted in concentrations below SMS criteria would be monitored to document the continued effectiveness of natural recovery at complying with cleanup levels.

Sludges in the ASB (Unit 8) would be removed, treated to achieve volume reduction and disposed at a permitted off-site disposal facility. The design concept is based on a five-step process. First, the water level in the ASB would be lowered and the connection between the ASB and the outfall plugged. Second, the water treatment equipment (aerators, weirs, etc.) would be removed, and the tops of the berms removed. These berm materials consist of clean sand and stone materials used to construct the ASB and can be reused within other portions of the project area. Third, the majority of the ASB sludges would be removed, likely by hydraulic dredging. The sludge solids would be separated from entrained waters and would be managed by upland disposal. Water from the sludge removal would be returned to the ASB in a closed-loop system, to minimize the overall generation of contaminated waters. During the fourth step, the impacted waters from the ASB would be pumped out, treated to remove suspended and dissolved contaminants, and discharged to the sanitary sewer. If sewer capacity is limited, the treated waters would be managed using a permitted temporary surface water discharge. Finally, the residual solids within the dewatered ASB would be removed by land-based excavation equipment. Following cleanout of the sludges the ASB would be filled to appropriate elevations with surface water, and the berm opened. Some additional impacted sediment would be generated for upland disposal at the time the new access channel to the ASB (Unit 2-B) was created.

For dredging of Units 1, 2 and 3 outside the ASB, mechanical dredging methods would likely be used as hydraulic dredging is not feasible without a large area for management of produced dredge waters and for separating entrained waters from dredge materials. Detailed dredging and construction procedures would be determined in project design and permitting.

Sediments dredged from Units 1A and 1B would be disposed via either beneficial reuse in the Inner Waterway or in-water disposal through the DMMP, subject to PSDDA testing and suitability determinations. Other sediments removed during dredging would be barged to an offload facility. The sediments would be transferred to lined railcars for transportation to an appropriately-permitted offsite disposal facility (e.g. Subtitle D permitted landfill that can accept wet sediments for reuse as daily cover). Other disposal facilities that have appropriate environmental permits may be used, subject to applicable regulations and logistical considerations.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.6 Alternative 6

Alternative 6 is similar to Alternative 5 in that it uses multiple technologies to comply with SMS cleanup standards and MTCA cleanup requirements. Institutional controls, monitored natural recovery and containment are used in various portions of the site. Removal and upland disposal are used for ASB sludges and impacted sediments from outside of the ASB. The ASB sludges are treated to achieve volume reduction. Clean material removed for the ASB berms is reused. The principal difference between the two alternatives is the extent of dredging near the Bellingham Shipping Terminal (Unit 1-C). The depth of dredging in this site unit would extend to the extent technically feasible. Alternative 6 is shown in Figure 4-6.

The depth of dredging in the outer portion of the Waterway (Unit 1) would range from 35 feet to 41 feet below MLLW. Dredging would need to address geotechnical and structural integrity limitations associated with existing piers and structures in the terminal area. However, it is expected that most portions of Unit 1 could be remediated, without requiring subsequent application of a thick cap.

The majority of the Inner Waterway (Units 2 and 3) would be dredged for effective water depths of between 18 feet and 22 feet. The central portion of the Waterway would be dredged to depths at least 5 feet below the planned effective water depth. A sediment cap would then be applied over any residual sediments, with the cap grading from a minimum thickness of 3 feet to a maximum thickness of 6 feet near the Log Pond. Shoreline slopes would be stabilized using appropriately designed side-slopes and materials that maximize nearshore habitat quality and quantity, while maintaining stability under the planned site uses described in Section 6.4.1.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Offshore of the ASB (Unit 5B), exceedances of site-specific cleanup goals would be remediated using capping, with some pre-capping dredging where necessary to optimize final cap surface elevations. The area south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) would be remediated using a cap. The cap would be constructed of coarse granular materials and would be designed to resist potential prop-wash erosion effects.

Sediments in Units 5A and 5C, 6A, 7, and 9 currently comply with site-specific cleanup goals. Areas in which natural recovery has resulted in concentrations below SMS criteria would be monitored to document the continued effectiveness of natural recovery at complying with cleanup levels.

Sludges in the ASB (Unit 8) would be removed, treated to achieve volume reduction and disposed at a permitted off-site disposal facility. The design concept is based on a five-step process. First, the water level in the ASB would be lowered and the connection between the ASB and the outfall plugged. Second, the water treatment equipment (aerators, weirs, etc.) would be removed, and the tops of the berms removed. These berm materials consist of clean sand and stone materials used to construct the ASB and can be reused within other portions of the project area. Third, the majority of the ASB sludges would be removed, likely by hydraulic dredging. The sludge solids would be separated from entrained waters and would be managed by upland disposal. Water from the sludge removal would be returned to the ASB in a closed-loop system, to minimize the overall generation of contaminated waters. During the fourth step, the impacted waters from the ASB would be pumped out, treated to remove suspended and dissolved contaminants, and discharged to the sanitary sewer. If sewer capacity is limited, the treated waters would be managed using a permitted temporary surface water discharge. Finally, the residual solids within the dewatered ASB would be removed by land-based excavation equipment. Following cleanout of the sludges the ASB would be filled to appropriate elevations with surface water, and the berm opened. Some additional impacted sediment would be generated for upland disposal at the time the new access channel to the ASB (Unit 2-B) was created.

For dredging of Units 1, 2 and 3 located outside the ASB, mechanical dredging methods would likely be used as hydraulic dredging is not feasible without a large area for management of produced dredge waters and for separating entrained waters from dredge materials. Detailed dredging and construction procedures would be determined in project design and permitting.

Sediments dredged from Units 1A and 1B would be disposed via either beneficial reuse in the Inner Waterway or in-water disposal through the DMMP, subject to PSDDA testing and suitability determinations. Other sediments removed during dredging would be barged to an offload facility within Port-owned property. The sediments would be transferred to lined railcars for transportation to an appropriately-permitted offsite disposal facility (e.g. Subtitle D permitted landfill that can accept wet sediments for reuse as daily cover). Other disposal facilities that have appropriate environmental permits may be used, subject to applicable regulations and logistical considerations.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.7 Alternative 7

Alternative 7 uses the same technologies as Alternatives 5 and 6 to comply with SMS cleanup standards and MTCA cleanup requirements. These include institutional controls, monitored natural recovery, containment, removal and disposal, treatment, and reuse. Alternative 7 is shown in Figure 4-7.

Similar to Alternatives 5 and 6, Alternative 7 uses hybrid technologies to accomplish the remediation of the site. The ASB is remediated using removal, treatment, and upland disposal technologies, consistent with Alternatives 5 and 6. The Outer Whatcom Waterway areas are similarly remediated by dredging and upland disposal, as in Alternative 6. Unlike the preceding Alternatives 5 and 6, Alternative 7 removes buried impacted sediment from the Inner Whatcom Waterway in accordance with use and maintenance of the historic 1960's federal channel configuration.

Under Alternative 7 dredging would be conducted consistent with the dredge prisms used in Alternative 2 and Alternative 3. Impacted sediments that are more than 5 feet below the 1960s channel project depth would be capped in place, using a 3-foot thick sediment cap. Capping may also be used in nearshore berth areas where full sediment removal is infeasible, or where the shoreline infrastructure does not allow sediments to be removed without compromising side-slope stability or the integrity of existing structures.

Other aspects of Alternative 7 remain the same as in Alternative 6. These include the capping of the ASB shoulder and barge dock area, the contingency actions in the Log Pond, and the use of monitored natural recovery for other bottom areas that currently comply with site cleanup levels.

As with Alternative 6, the design concept for Alternative 7 assumes that dredged sediments and ASB sludges would be shipped by rail to the upland disposal location. Rail shipment is more fuel efficient and provides fewer traffic conflicts than truck transportation.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

4.8 Alternative 8

Alternative 8 uses the same range of technologies evaluated for Alternatives 5, 6 and 7 to comply with SMS cleanup standards and MTCA cleanup requirements. However, the extent of dredging and upland disposal is expanded under Alternative 8 relative to the preceding alternatives. Alternative 8 is shown in Figure 4-8.

Dredging in the Outer Waterway (Unit 1) would be conducted to native bottom sediments except where that is not technically feasible. Dredging would need to address geotechnical and structural integrity limitations associated with existing piers and structures in the terminal area. However, it is expected that most portions of Unit 1 could be remediated, without requiring subsequent application of a thick cap.

Sediment dredging would be performed as necessary in the Inner Waterway (Units 2 & 3) in accordance with use and maintenance of the historic 1960s federal navigation channel configuration. Anticipated dredge depths vary from 18 feet below MLLW to about 35 feet below MLLW. Residual sediments would be capped with a minimum 3 foot thick cap. Due to historical encroachment of the shoreline on the federal channel boundaries, many of the Inner Whatcom Waterway shoreline areas have fill and bulkheads up to or near to the pierhead line. Most of these bulkheads would require replacement and/or substantial upgrades in order to maintain shoreline stability in these areas during and after dredging. Docks may also have to be upgraded or replaced in order to accommodate federal channel dredging and future use. Containment by capping with appropriate institutional controls would be required for areas where removal is not technically feasible.

The Log Pond area (Unit 4) was previously remediated as part of an Interim Action implemented in 2000. Contingency actions in the Log Pond will include placement of additional capping material along the shoreline edges of the existing cap, and construction of energy-dissipating groins to ensure long-term stability of the cap edges (Appendix A).

Exceedances of site-specific cleanup goals offshore of the ASB (Unit 5), near the Bellingham Shipping Terminal (Unit 6), and Starr Rock (Unit 7), would be remediated via dredging with upland disposal. Sediments in these areas that currently exceed cleanup standards, as well as those that currently comply with cleanup standards would be removed. As with portions of the Inner Whatcom Waterway, some residual sediments would remain in areas where removal was not technically feasible. Additional subsurface contaminated sediments would remain within Unit 9 and would be managed by monitored natural recovery and institutional controls.

As with Alternatives 5, 6 and 7, the ASB (Unit 8) sludges would be removed, treated to reduce volume, and disposed at a permitted upland disposal facility. Removal methods are the same as in the preceding alternatives.

For dredging of Units 1, 2, 3, 5, 6 and 7 located outside the ASB, mechanical dredging methods would likely be used as hydraulic dredging is not feasible without a large area for management of produced dredge waters and for separating entrained waters from dredge materials. Detailed dredging and construction procedures would be determined in project design and permitting.

Sediments dredged from Units 1A and 1B would be disposed via either beneficial reuse or in-water disposal through the DMMP, subject to PSDDA testing and suitability determinations. Other sediments removed during dredging would be barged to an offload facility. The sediments would be transferred to lined railcars for transportation to an appropriately-permitted offsite disposal facility (e.g. Subtitle D permitted landfill that can accept wet sediments for reuse as daily cover). Other disposal facilities that have appropriate environmental permits may be used, subject to applicable regulations and logistical considerations. The design concept for Alternative 8 estimates disposal of approximately 1.26 million cubic yards of dredged sediments and the disposal of approximately 412,000 cubic yards of sludges removed from the ASB. This is a dramatic increase in the disposal volumes over the preceding alternatives.

In all areas where contamination remains on-site, institutional controls would be necessary to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

5 Basis for Selection of the Proposed Cleanup Action

The RI/FS evaluated a range of remedial alternatives as described in Section 4, and provided a comparative evaluation of those alternatives against MTCA remedy selection criteria. As part of its cleanup decision for the site, Ecology reserves the right to consider other information, including issues raised during public comment, and/or to conduct its own evaluation of alternatives to assist in making its cleanup decision.

This section presents a revised evaluation of remedial alternatives 5 through 8 that refines the work performed in the RI/FS. Alternatives 1 through 4 are not evaluated by Ecology as possible cleanup actions for the site, for two reasons. First, Alternatives 1 through 4 cannot be executed given the Port's aquatic use plans for the ASB portion of the site. Second, the Port has proposed removal of contaminated sludges and sediments from the ASB portion of the site, which represents the most permanent cleanup alternative for this Site Unit. Given that a permanent cleanup alternative has been proposed by the property owner for this one area of the site, only those cleanup alternatives that incorporate this approach to the ASB (Alternatives 5-8) are considered in Ecology's evaluation.

The revised evaluation of Alternatives 5 - 8 has been conducted using MTCA and SMS criteria as outlined below. These criteria govern the evaluation of remedial alternatives and the identification of preferred alternatives. Although the RI/FS also evaluated the proposed alternatives against these criteria, the format of Ecology's analysis differs somewhat from the analysis contained in the RI/FS. This section describes Ecology's analysis and the basis for its selection of Alternative 6 for implementation at the site. This section includes the following information:

- Description of the MTCA and SMS evaluation criteria and remedy selection process (Section 5.1).
- Description of the proposed cleanup technologies (Section 5.2)
- Presentation of each alternative and how it addresses each of the MTCA and SMS criteria (Section 5.3)
- MTCA disproportionate cost analysis, used to identify preferred alternative(s) that are permanent to the maximum extent practicable (Section 5.4)
- Summary and conclusions (Section 5.5).

5.1 MTCA and SMS Evaluation Criteria

The MTCA and SMS regulations contain explicit criteria for the evaluation and selection of cleanup alternatives. This section provides an overview of these regulatory criteria. The consistency of each alternative with these criteria is then discussed in the subsequent sections.

5.1.1 MTCA Threshold Requirements

Cleanup actions selected under MTCA must comply with several basic requirements. Alternatives that do not comply with these criteria cannot be considered valid cleanup actions under MTCA. WAC 173-340-360(2)(a) lists four threshold requirements for cleanup actions. All cleanup actions must:

- Protect human health and the environment
- Comply with cleanup standards
- Comply with applicable laws
- Provide for compliance monitoring.

All of the four project alternatives contained in this evaluation of alternatives are designed to meet these threshold requirements.

5.1.2 Other MTCA Minimum Requirements

Under MTCA, when selecting from alternatives that meet the threshold requirements, the selected action must also address the following three criteria:

- **Provide a reasonable restoration time-frame (WAC 173-340-360(2)(b)(ii)).** MTCA places a preference on those alternatives that, while equivalent in other respects, can be implemented in a shorter period of time. MTCA includes a summary of factors that can be considered in evaluating whether a cleanup action provides for a reasonable restoration time-frame (WAC 173-340-360(4)). As described in Section 5.1.4, SMS regulations place a specific preference on remedies that can be completed and meet standards within a 10-year restoration time-frame.

- **Use permanent solutions to the maximum extent practicable (WAC 173-340-360(2)(b)(i)).** MTCA specifies that when selecting a cleanup action, preference shall be given to actions that are "permanent solutions to the maximum extent practicable." The regulations specify the manner in which this analysis of permanence is to be conducted. Specifically, the regulations require that the costs and benefits of each of the project alternatives be balanced using a "disproportionate cost analysis" (WAC 173-340-360(3)(e)). The criteria for conducting this analysis are described in Section 5.1.3 below.

- **Consider Public Concerns (WAC 173-340-360(2)(b)(iii)).** Ecology considers public comments submitted during the 2006 RI/FS and 2006 EIS process in making its preliminary selection of a cleanup alternative for the site.

5.1.3 MTCA Disproportionate Cost Analysis

The MTCA analysis of disproportionate costs is used to evaluate which cleanup alternatives, among those that otherwise meet threshold requirements, are permanent to the maximum extent practicable. WAC 173-340-360(2)(b); 173-340-360(3). This analysis compares the relative benefits and costs of cleanup alternatives. Seven criteria are used in the disproportionate cost analysis as specified in WAC 173-340-360(3)(f):

- Protectiveness
- Permanence
- Costs
- Long-Term Effectiveness
- Short-Term Risk Management
- Implementability
- Considerations of Public Concerns.

The analysis compares the relative benefits of each alternative against those provided by the most permanent alternative. A majority of these benefits are environmentally based while others are related but non-environmental, such as "implementability."

The comparison of costs and benefits may be quantitative, but is more often qualitative, or subjective. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative (WAC 173-340-360(e)(i)). Where two or more alternatives are equal in benefits, the department shall select the less costly alternative (WAC 173-340-360(e)(ii)(c)).

At this site, quantitative data is available regarding the estimated amount of contamination that will be removed (dredged), the estimated areas that will be contained (capped) and the estimated areas of monitored natural recovery under each alternative. This data has been used by Ecology to help inform a qualitative analysis of the protectiveness, permanency, and long-term effectiveness of each alternative below. Quantitative data is not available for a comparison of all the benefits of each cleanup alternative, however. Benefits criteria fall into both environmental and other related non-environmental categories. As described above, these categories are essentially subjective. For this reason, the agency's analysis of which alternative is permanent to the maximum extent practicable is largely qualitative. The MTCA regulation allows the agency to use best professional judgment to assess benefits qualitatively, and to use its discretion to favor or disfavor qualitative benefits (WAC 173-340-360(3)(e)(ii)(C)).

In an effort to better document its qualitative analysis for this site, Ecology assigned weighting factors to each of the six non-cost benefits criteria. The weighting factors are subjective and serve to represent Ecology's opinion on the importance of each benefits criterion at this site, relative to its mandate to protect human health and the environment. These factors are discussed in the following section and in Section 5.4, and are shown in Table 5-2. It is important to note that the costs and benefits of cleanup are site-specific; Ecology may therefore conduct its analysis differently for other sites.

General descriptions of each of the seven MTCA criteria used in the disproportionate cost analysis are described below consistent with WAC 173-340-360(f).

Protectiveness

Overall protectiveness is a parameter that considers many factors. First, it considers the extent to which human health and the environment are protected and the degree to which overall risks at a site are reduced (WAC 173-340-360(3)(f)(i)). It also considers the time required to reduce risk at the facility and attain cleanup standards. Both on-site and off-site risks resulting from implementing the alternative are considered. Finally, it measures the improvement of the overall environmental quality at the site. At this site, Ecology feels a weighting factor of 30% is appropriate for protectiveness. This represents the greatest value of all categories and is justified based on its overarching importance relative to the ultimate goal of environmental cleanup and protection of human health and the environment, especially given the importance for restoring the health of Puget Sound and considering the uses of the Whatcom Waterway. This also includes those concerns brought forward by the public which were related to overall protectiveness.

Permanence

The permanence of remedies under MTCA is measured by the relative reduction in toxicity, mobility or volume of hazardous substances, including both the original contaminated media, and to a lesser degree the residuals generated by the cleanup action as this is included in short term risk management (WAC 173-340-360(3)(f)(ii)). A weighting factor of 20% is assigned to Permanence for this site. This weighting factor is associated with the need or lack thereof for further action in the future. This factor, along with Long-term Effectiveness, is of second-greatest importance given the significance of restoring the health of Puget Sound, considering the uses of the Whatcom Waterway, and in particular considering that mercury is a heavy metal that is non-biodegradable and will persist in the environment indefinitely. Ecology consequently feels at this site that a high level of certainty must come with the final environmental cleanup, so that future actions will not be necessary. This criterion is intimately associated with overall protectiveness, but incorporates a greater factor of time.

Remedy Costs

The analysis of costs under MTCA includes all costs associated with implementing the alternative, including design, construction, long-term monitoring and institutional controls (WAC 173-340-360(3)(f)(iii)). Costs are intended to be comparable among different project alternatives to assist in the overall analysis of relative costs and benefits of different alternatives. Costs are evaluated against remedy benefits in order to assess cost-effectiveness and remedy practicability. It should be noted that costs for habitat enhancement, redevelopment and/or other non-cleanup related shoreline stabilization are not included. No weighting factor is applied to this quantitative category.

Long-Term Effectiveness

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the remedy (WAC 173-340-360(3)(f)(iv)). The MTCA regulations contain a specific preference ranking for different types of technologies that is considered as part of the comparative analysis. The preference ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineering controls, and institutional controls and monitoring. The regulations recognize that in most cases the cleanup alternatives will combine multiple technologies to accomplish remedial objectives. The preference ranking must be considered along with other site-specific factors in the ranking of long-term effectiveness. A weighting factor of 20% is assigned to Long-Term Effectiveness for this site. This weighting factor is associated with a measure of certainty related to the robustness of the action as well as the confidence in the technology used for protection of human health and the environment. Again, Ecology feels at this site that a high level of certainty must come with the final environmental cleanup, so that future actions will not be necessary. Another factor also considered is the probability that the current physical and biological processes present at the site will respond in a predictable way as measured by past occurrences. This includes such factors as currents, ocean levels, erosion, and seismic activity as well as others. This factor, along with Permanence is of second-greatest importance at this site for the same reasons expressed above. This criterion is similar to Permanence in that it too is intimately associated with overall protectiveness, but incorporates a greater level of predictability and consistency of natural processes over time.

Short-Term Risk Management

Short-term risk management is a parameter that measures the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action (WAC 173-340-360(3)(f)(v)). Cleanup actions carry short-term risks such as potential mobilization of contaminants during construction, or safety risks typical to large construction projects. In-water dredging activities carry a relatively high risk of problems with water quality and potential sediment recontamination compared with capping including introduction of excess residuals into areas that were not contaminated. Generally, a majority of short-term risks can be managed through the use of best practices during project design and construction, and other risks are inherent to project alternatives. The weighting factor of short-term risk management at this site is 10%. This lower rating is based upon the limited temporal aspect associated with the risk at this site. Generally short-term risk is actively monitored during the entire period the risk exists. This allows for relatively instantaneous correction or remediation of the potential risk as it occurs. As stated above, because the risk is short-lived its overall environmental risk to human health and the environment is limited. At this site in particular then, short-term risks and technical and administrative implementability are less important in selecting an alternative, because each alternative can be more easily modified to reduce short-term risk and improve implementability, but the same is not true for protectiveness and long-term effectiveness.

Implementability

Implementability is an overall measurement expressing the relative difficulty and uncertainty of implementing the project. It includes technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work (WAC 173-340-360(3)(f)(vi)). It also includes administrative factors associated with permitting and completing the cleanup. The weighting factor assigned for this criterion is 10%. Although an important consideration, implementability is less associated with environmental concerns than the above-mentioned factors. Additionally, often cost is an issue within this category, however it is captured in the cost category above and is therefore not duplicated in this assessment category. Engineering design considerations are often of primary importance in this category and are often refined during the development of the engineering and design report. Again, short-term risks and technical and administrative implementability are less important in selecting an alternative for this site, because each alternative can be more easily modified to reduce short-term risk and improve implementability, but the same is not true for protectiveness and long-term effectiveness.

Consideration of Public Concerns

The public involvement process under MTCA is used to identify public concerns regarding alternatives (WAC 173-340-360(3)(f)(vii)). The extent to which an alternative addresses those concerns is considered as part of the remedy selection process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the site. It is important to acknowledge here, however, that the public concerns voiced during the public involvement process can also be included in the other categories identified above such as Permanence and Long-Term Effectiveness. Those concerns that can be included in those other categories are incorporated into those categories rather than here. Employing this method of separating and compartmentalizing issues within the appropriate categories ensures that the proper emphasis and weighting of these issues are being applied to each factor within these categories. It prevents both underemphasizing the environmental concerns and overemphasizing other issues by avoiding the duplication of the same issue within multiple categories. As a result, the relative weighting of public concerns is established at 10% for this site. While this at first glance may appear low, in reality a majority of these issues are incorporated in the direct environmental categories Overall Protectiveness, Permanence and Long-term Effectiveness which have the greatest weighting factors.

5.1.4 SMS Evaluation Criteria

Remedy evaluation criteria under SMS regulations are generally the same as under MTCA. The SMS alternatives evaluation criteria are specified in WAC 173-204-560(4)(f)-(k). Most of these SMS evaluation criteria overlap with those of MTCA. The SMS evaluation criteria include the following:

- Overall protection of human health and the environment
- Attainment of cleanup standards
- Compliance with applicable state, federal and local laws
- Short-term effectiveness
- Long-term effectiveness
- Ability to be implemented
- Cost
- The degree to which community concerns are addressed
- The degree to which recycling, reuse, and waste minimization are employed
- Analysis of environmental impacts consistent with SEPA requirements.

Requirements under SMS for cleanup decisions are specified in WAC 173-204-580(2)-(4). This portion of the regulation specifies factors that are to be considered by Ecology in making its cleanup decision. Most of these requirements also overlap with those of MTCA. SMS cleanup decision requirements including the following:

- Achieve protection of human health and the environment
- Comply with applicable state, federal, and local laws
- Comply with site cleanup standards
- Achieve compliance with sediment source control requirements
- Provide for landowner review of the cleanup study and consider public concerns raised during review of the draft cleanup report
- Provide adequate monitoring to ensure the effectiveness of the cleanup action
- Provide a reasonable restoration time-frame
- Consider the net environmental effects of the alternatives
- Consider the relative cost-effectiveness of the alternatives in achieving the approved site cleanup standards
- Consider the technical effectiveness and reliability of the alternatives.

Like MTCA, the SMS regulations include a requirement for a reasonable restoration time-frame. However, the SMS include an explicit preference for restoration time-frames that are less than 10 years (WAC 173-204-580(3)). Longer restoration time-frames may be authorized, but only where it is not practicable to accomplish the remedy within a ten-year period.

Of the SMS evaluation criteria listed above, all but two are accomplished as part of the MTCA evaluation of alternatives. The two exceptions are 1) the completion of a SEPA analysis of environmental impacts, and 2) the analysis of net environmental effects of the alternatives. These two criteria are addressed as part of the DSEIS. That document assesses environmental impacts of the remedial alternatives. Net environmental effects as defined under SMS are also captured by this analysis. Because the DSEIS addresses specific SMS regulatory requirements it is considered an integral part of the analysis of alternatives. However, the information contained in that document is not repeated in this evaluation of alternatives, to avoid unnecessary redundancy. Other SMS criteria are addressed within the scope of the MTCA evaluation criteria.

5.2 Proposed Cleanup Technologies

The RI/FS screened a range of cleanup technologies in accordance with MTCA, and SMS guidance to identify those that are capable of meeting cleanup standards. Retained technologies were used to develop remedial alternatives. The cleanup technologies assembled to develop Alternatives 5 through 8 are summarized below.

- **Treatment for Volume Reduction:** Treatment of low-solids material, such as the ASB sludges, for volume reduction using centrifuges, hydrocyclones or other mechanical dewatering equipment.
- **Removal by Mechanical Dredging:** Mechanical dredging using appropriate equipment and skilled operators for areas of the site outside the ASB.
- **Removal by Hydraulic Dredging:** Hydraulic dredging to remove ASB sludges, or for localized work within the Whatcom Waterway.
- **Removal by Excavation:** Excavation of dry residual sludges in the ASB by appropriate land-based equipment.
- **Subtitle D Landfill Disposal:** Disposal of contaminated material generated from removal operations at a permitted off-site Subtitle D disposal facility.
- **Containment by Capping:** Isolation of contaminated sediment with clean material.
- **Monitored Natural Recovery:** Monitoring to assess the status of the natural deposition of clean sediment in areas of the site.
- **Institutional Controls:** Limits or prohibitions on activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.

Based on the detailed evaluation presented in the RI/FS, Ecology agrees that the above cleanup technologies—including sediment capping—can be effective in meeting cleanup standards and other requirements for cleanup when appropriately applied. Alternatives 5 though 8 differ in how they apply the above technologies or in the degree to which they rely on any given technology. Ecology has therefore reviewed each alternative, below, to assess how it meets cleanup standards and other cleanup requirements under WAC 173-340-360(2).

5.3 Updated Evaluation of Alternatives 5-8

Table 5-1 summarizes the detailed evaluation of each of the four remedial alternatives against the MTCA and SMS criteria listed in Section 5.1. For each of the four remedial alternatives, these findings are discussed below. Section 5.4 then compares all the alternatives to determine which among them is permanent to the maximum extent practicable under WAC 173-340-360(3).

5.3.1 Alternative 5

Alternative 5 uses multiple technologies to comply with SMS cleanup standards. Removal, treatment for volume reduction, and upland disposal are used for ASB sludges. The remediated ASB is then reconnected with the marine surface waters of Bellingham Bay, and clean berm materials are reused as part of the cleanup action in other areas of the site. Dredging and capping of the Waterway is conducted based on the planned site uses described in Section 6.4.1, with dredged sediments managed by upland disposal. Institutional controls, monitored natural recovery, and containment are used in various portions of the site. Alternative 5 is shown in Figure 4-5.

MTCA Threshold Requirements

A comparison of Alternative 5 against applicable MTCA criteria is provided below. This information is summarized in Table 5-1. Alternative 5 complies with MTCA threshold criteria.

- **Protection of Human Health and the Environment:** Alternative 5 protects human health and the environment by complying with applicable cleanup standards, as discussed below. Although this alternative relies in part on containment via sediment capping, institutional controls and an institutional control plan (application and enforcement of restrictions on use of the Waterway) will be tailored appropriately to protect the integrity of the capped areas.

- **Compliance with Cleanup Standards:** Alternative 5 complies with the cleanup standards, as described in Section 3.1 of the RI/FS. Cleanup standards are achieved using removal, treatment, and upland disposal, combined with active containment measures including thick sediment capping. Alternative 5 does not rely on monitored natural recovery to meet cleanup standards. However, monitored natural recovery is applied in areas that already comply with cleanup standards for surface sediments, to ensure continued compliance in the long-term.

- **Compliance with Applicable State & Federal Laws**: By requiring appropriate project design and permitting, this alternative will comply with applicable state and federal laws.

- **Provisions for Compliance Monitoring:** Alternative 5 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 5 will be determined by both the start-date of construction and the duration of construction activities. The project will involve significant design and permitting issues. Approximately 2 years is assumed for completion of design and permitting. Construction activities will likely require 3 to 4 years for completion. Therefore, the restoration time-frame for this alternative is estimated at between 5 and 6 years. This restoration time-frame pertains to the time required to meet cleanup standards. For areas of the site that currently comply with cleanup standards but have remaining buried low-level contamination, long term monitoring in the range of 30 years is anticipated to be performed to ensure continued compliance with cleanup standards (monitored natural recovery).

Evaluation of Disproportionate Cost Analysis Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 5-1.

- **Overall Protectiveness:** The protectiveness of Alternative 5 is achieved through the use of active measures. Dredging, treatment and upland disposal at an off-site, permitted Subtitle D facility are used for remediation of the ASB. Dredging with upland disposal at an off-site, permitted facility and capping are used for both the Outer Waterway adjacent to the Bellingham Shipping Terminal and the Inner Waterway. Dredging and capping in the Waterway areas ensures protectiveness, by reducing the potential that land and navigation uses will resuspend residual subsurface contaminated sediments. The establishment of consistent depths and stable side-slopes in the Inner Whatcom Waterway reduces risks of recontamination from future construction activities or shoreline erosion. Contaminated sediments will remain in the Waterway, but these areas will be contained with a cap designed to resist prop wash and to be stable under anticipated wind and wave conditions as well as seismic events. Areas outside the Waterway that exceed applicable cleanup standards will also be contained with a cap. Institutional controls and an institutional control plan will be tailored to protect the areas capped.

- **Permanence:** Alternative 5 removes the ASB sludges. These sediments are treated to reduce their volume prior to disposal. Low-level buried contaminated sediments in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal that have the potential to be disturbed by dredging and navigation activities will be partially removed then contained using a thick cap to ensure long-term protection of aquatic organisms. Low-level buried contaminated sediments within the Inner Whatcom Waterway which have a low potential for disturbance will be partially removed then contained using a cap to ensure long-term protection of aquatic organisms. Contaminated sediments in other areas will also be contained using a cap.

- **Remedy Costs:** The probable cost of Alternative 5 is $42 million.

- **Long-Term Effectiveness:** Alternative 5 uses a hybrid remedy including a full range of remedial technologies. Those technologies include reuse, treatment, upland disposal, containment, monitored natural recovery, and institutional controls. All sediment areas that do not currently meet cleanup standards and the navigation areas are remediated using active measures. Residual sediments not removed from the Waterway will be contained by a thick sediment cap, providing a barrier against contaminated sediment resuspension, vertical upward migration of buried contaminated sediments and aquatic organism exposure. By removing the ASB sludges, Alternative 5 allows for reuse of the clean ASB berm materials. A portion of the material will be used as part of the capping and shoreline stabilization under the Alternative. The remaining materials may be used in subsequent habitat enhancement and/or redevelopment actions. Alternative 5 will require appropriate institutional controls, which will be tailored to protect the integrity of the capped areas.

- **Short-Term Risk Management:** Alternative 5 involves a complex, three-phase construction sequence. However, only the first and third phases of construction take place within the aquatic environment. The second phase of construction will take place within the ASB, prior to opening of the ASB berm. This will reduce the short-term risks to the extent possible. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. Dredging activities in the Waterway areas will need to use appropriate environmental dredge methods to minimize water quality impacts adjacent to the point of dredging, and at sediment offloading locations. Stormwater controls will need to be applied for upland sediment staging areas. The use of rail for shipment of sediments to the disposal location will minimize traffic impacts and associated risks. The phasing of all in-water construction activities will be timed to minimize impacts to juvenile salmonids and other aquatic organisms.

- **Implementability:** From a technical standpoint, Alternative 5 is fully implementable. The alternative uses capping, dredging, and common transportation and disposal technologies that are readily available, with experienced contractors available locally and nationally. The treatment technologies applied under this alternative are well-established methods of dewatering sludges from wastewater treatment impoundments and other sludge impoundments and have been applied during previous ASB maintenance activities by GP. The dredging and shoreline stabilization concepts applied in the Inner Whatcom Waterway under this Alternative are consistent with land use, navigation, and habitat enhancement planning for this area, improving administrative implementability. Alternative 5 provides for minimal shoreline infrastructure requirements, greatly simplifying and expediting project implementation. Alternative 5 also removes the ASB sludges enabling aquatic reuse of this area consistent with land use planning activities and land-owner objectives.

- **Consideration of Public Concerns:** Public concerns were provided to Ecology through review of the RI/FS and DSEIS.. Potential public concerns relevant to this alternative are mainly associated with maximizing the use of dredging and upland disposal, and minimizing the use of containment (capping) for management of contaminated sediments. Removal of contaminated material from the ASB accommodates land-owner plans for aquatic reuse of this area. Alternative 5 also preserves existing deep draft uses at the Bellingham Shipping terminal.

5.3.2 Alternative 6

Cleanup Alternative 6 is illustrated in Figure 4-6. Alternative 6 is in most respects the same as Alternative 5. The difference between the alternatives is that under Alternative 6 additional dredging is conducted in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal. Other features of the Alternative, including the removal of the ASB sludges and the remedial approach to the Inner Whatcom Waterway and areas outside the Waterway, are the same as in Alternative 5.

MTCA Threshold Requirements

A comparison of Alternative 6 against applicable MTCA criteria is provided below. This information is summarized in Table 5-1. Alternative 6 complies with all MTCA threshold criteria.

- **Protection of Human Health and the Environment**: Alternative 6 protects human health and the environment by complying with applicable cleanup standards, as discussed below. Although this alternative relies in part on containment via sediment capping, institutional controls and an institutional control plan (application and enforcement of restrictions on use of the waterway) will be tailored appropriately to protect the integrity of the capped areas.

- **Compliance with Cleanup Standards:** Alternative 6 complies with the cleanup standards, as described in Section 3.1 of the RI/FS. Cleanup standards are achieved using removal, treatment, and upland disposal, combined with active containment measures including thick sediment capping. Alternative 6 does not rely on monitored natural recovery to meet cleanup standards. However, monitored natural recovery is applied in areas that already comply with cleanup standards for surface sediments, to ensure continued compliance in the long-term.

- **Compliance with Applicable State & Federal Laws:** By requiring appropriate project design and permitting, this alternative will comply with applicable state and federal laws.

- **Provisions for Compliance Monitoring:** Alternative 6 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 6 will be determined by both the start-date of construction and the duration of construction activities. The project will involve significant design and permitting issues. Approximately 2 years will be required for design and permitting of the cleanup. Construction activities will occur in three phases and will take approximately 3 to 4 years to complete. The total restoration time-frame is therefore estimated at 5 to 6 years. This restoration time-frame pertains to the time required to meet cleanup standards. For areas of the site that currently comply with applicable cleanup standards but have remaining buried low-level contamination, long-term monitoring in the range of 30 years is anticipated to be performed to ensure continued compliance (monitored natural recovery).

Evaluation of Disproportionate Cost Analysis Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 5-1.

- **Overall Protectiveness:** The protectiveness of Alternative 6 is achieved through the use of active measures. Dredging, treatment, and upland disposal at an off-site, permitted Subtitle D facility are used for remediation of the ASB. Dredging and upland disposal in an off-site, permitted facility is used in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal. Dredging, upland disposal in an off-site, permitted facility and capping are used in the Inner Whatcom Waterway. The establishment of consistent depths and stable side-slopes in the Inner Whatcom Waterway reduces risks of recontamination from future construction activities or shoreline erosion. Contaminated sediments will remain in the Inner Waterway, but these areas will be contained with a cap designed to resist prop wash and to be stable under anticipated wind and wave conditions as well as seismic events. Areas outside the Waterway that exceed applicable standards will also be contained with a cap. Institutional controls and an institutional control plan will be tailored to protect the areas capped.

- **Permanence:** Alternative 6 removes the ASB sludges. These sediments will be treated to reduce their volume prior to disposal. Low-level buried contaminated sediments within the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal that may be disturbed through future dredging and navigation activities will be completely removed and disposed at a permitted upland facility. Low-level buried contaminated sediments in the Inner Whatcom Waterway that have a low potential for disturbance will be partially removed, then contained using a thick cap to ensure long-term protection of aquatic organisms. Contaminated sediments outside of the Whatcom Waterway will also be contained using a cap.

- **Remedy Costs:** The probable costs of Alternative 6 are $44 million. The higher costs are associated with the greater use of dredging and upland disposal for sediment management.

- **Long-Term Effectiveness:** Alternative 6 uses a hybrid remedy with a full range of remedial technologies. Those technologies include reuse, treatment, upland disposal, containment, natural recovery, and institutional controls. All sediment areas that do not currently meet cleanup standards and the navigation areas are remediated using active measures. Residual sediments not removed from the Waterway are contained by a thick sediment cap, providing a barrier against sediment contaminant resuspension, upward migration of contaminants and aquatic organism exposure. Alternative 6 also provides for reuse of clean berm materials from the ASB for capping and habitat enhancement activities. Alternative 6 will require appropriate institutional controls, which will be tailored to protect the integrity of the capped areas.

- **Short-Term Risk Management:** The additional dredging of the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal under Alternative 6 slightly increases the degree of short-term risk associated with the cleanup alternative. However, the incremental risks can be managed through appropriate design and construction practices and design of the cleanup to accommodate geotechnical and structural integrity limitations at the Bellingham Shipping Terminal.

- **Implementability:** From a technical and administrative standpoint, Alternative 6 is fully implementable. Alternative 6 is consistent with area land use planning for the Whatcom Waterway and for the ASB. The additional dredging of the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal slightly increases the technical complexity of the project, but facilitates long-term management of the deep draft Waterway areas.

- **Consideration of Public Concerns:** Public concerns were provided to Ecology through public review of the RI/FS and the DSEIS. Potential public concerns relevant to this alternative are mainly associated with the maximizing the use of dredging and upland disposal, and minimizing the use of containment (capping) for management of contaminated sediments. Removal of contaminated material from the ASB accommodates land-owner plans for aquatic reuse of this area. Alternative 6 also provides additional contaminated sediment removal in the vicinity of the Bellingham Shipping terminal in comparison to Alternative 5.

5.3.3 Alternative 7

Alternative 7 uses the same technologies as Alternatives 5 and 6 to comply with cleanup standards. These include institutional controls, monitored natural recovery, containment, removal and disposal, treatment and reuse. Unlike Alternatives 5 and 6, Alternative 7 dredges and caps contaminated subsurface sediments from the Inner Whatcom Waterway in accordance with the historic 1960s industrial navigation channel configuration. Alternative 7 is shown in Figure 4-7.

MTCA Threshold Requirements

A comparison of Alternative 7 against applicable MTCA criteria is provided below. This information is also summarized in Table 5-1. Alternative 7 complies with MTCA threshold criteria.

- **Protection of Human Health and the Environment:** Alternative 7 protects human health and the environment by complying with applicable cleanup standards, as discussed below. Although this alternative relies to a minor degree on containment via sediment capping, institutional controls and an institutional control plan (application and enforcement of restrictions on use of the waterway) will be tailored appropriately to protect the integrity of the capped areas.

- **Compliance with Cleanup Standards:** Alternative 7 complies with the cleanup standards as described in Section 3.1 of the RI/FS. Cleanup standards are achieved using removal, treatment, and upland disposal, combined with active containment measures including thick sediment capping. Alternative 7 does not rely on monitored natural recovery to meet cleanup standards. However, monitored natural recovery and institutional controls are applied in areas that already comply with cleanup standards for surface sediments, to ensure continued compliance in the long-term.

- **Compliance with Applicable State & Federal Laws:** By requiring appropriate project design and permitting, this alternative will comply with applicable state and federal laws.

- **Provisions for Compliance Monitoring:** Alternative 7 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 7 will be determined by both the start-date of construction and the sequence and duration of construction activities. The project will involve significant design and permitting issues, and will require coordination between the cleanup activities and the development of shoreline infrastructure improvements along the Inner Whatcom Waterway required resulting from the physical impacts of minimizing current shoreline slopes. The period required for design and permitting is estimated at between 3 to 5 years, including the integrated infrastructure planning. Construction activities are estimated to require 4 years to complete. The project construction activities would be completed in three phases, similar to Alternative 6, but in-water work activities would be required in all three construction phases, not just during the first and third. The additional in-water construction period is required to provide for dredging and shipment of the incremental sediment volume under Alternative 7. The total restoration time-frame for Alternative 7 is therefore estimated at between 7 and 9 years. This restoration time-frame pertains to the time required to meet cleanup standards. For areas of the site that currently comply with cleanup standards but have remaining buried low-level sediment contamination, long-term monitoring in the range of 30 years is anticipated to be performed to ensure continued compliance with cleanup standards (monitored natural recovery).

Evaluation of Disproportionate Cost Analysis Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 5-1.

- **Overall Protectiveness:** The protectiveness of Alternative 7 is achieved through the use of active measures. Dredging, treatment and upland disposal in an off-site, permitted Subtitle D facility are used for remediation of the ASB. Dredging and upland disposal in an off-site, permitted facility is used in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal. Dredging, upland disposal in an off-site, permitted facility and some capping are used in the Inner Whatcom Waterway in accordance with the historic 1960s industrial navigation channel. This dredging removes additional buried low-level contaminated sediments and caps residual sediments at elevations 5 feet below the historical channel depths. Areas outside the Waterway that exceed applicable cleanup standards will be contained with a cap. Institutional controls and an institutional control plan will be tailored to protect the areas capped.

- **Permanence:** Alternative 7 provides additional permanence by reducing the total volume of subsurface sediments remaining within the site. However, the additional materials removed under the alternative are relatively low in contaminant concentrations. This alternative provides no significant reductions in site areas that are subject to capping, monitoring, or institutional control requirements.

- **Remedy Costs:** The probable costs of Alternative 7 are $75 million. The higher costs of Alternative 7 are associated with the additional volume of contaminated sediment managed by dredging and upland disposal. These remedy costs do not include the additional costs associated with development of shoreline infrastructure in the Inner Whatcom Waterway (bulkheads, wharves and hardened shorelines) in order to access berth-area contamination and utilize water depths. If development project funding for these work elements is not available in parallel with the cleanup work, then the cleanup costs for this alternative would be increased as necessary to accomplish measures required to complete the cleanup action.

- **Long-Term Effectiveness:** Alternative 7 uses a greater degree of upland disposal than the preceding alternatives. However, the remedy still relies on the use of institutional controls, monitored natural recovery, and containment to achieve cleanup standards. The overall footprint of the containment and institutional control areas is similar to the preceding alternatives. The long-term effectiveness of Alternative 7 will also be affected by the coordinated matching of shoreline infrastructure to dredging patterns in the Waterway. If these actions are not coordinated, then the side-slopes of the Waterway will not be stable or usable for navigation, and the potential of waterway recontamination occurring will be greater. Institutional controls will be applied to any areas capped and will be tailored to protect the integrity of these areas.

- **Short-Term Risk Management:** The additional dredging under Alternative 7 increases the duration of in-water construction activities required for the cleanup. A third in-water construction season will be required which increases the level of short-term risks that must be managed under the alternative. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. Dredging activities in the Inner and Outer Whatcom Waterway will need to use appropriate environmental dredge methods to minimize water quality impacts adjacent to dredging, and at sediment offloading locations. Stormwater controls will need to be applied for upland sediment staging areas. The use of rail for shipment of sediments to the disposal location will minimize traffic impacts and associated risks. The phasing of all in-water construction activities will be timed to during the appropriate "fish windows" to avoid impacts to juvenile salmonids and other aquatic organisms.

- **Implementability:** The implementability of Alternative 7 will depend primarily on the ability to coordinate cleanup dredging with upgrades to shoreline infrastructure in the Inner Whatcom Waterway. Given the transition in area land uses from industrial to mixed-uses and the planned habitat enhancements along the Inner Whatcom Waterway, it is unlikely that the infrastructure investment and use limitations required to dredge and maintain the 1960s federal channel will be forthcoming. This issue is discussed further as part of the DSEIS.

- **Consideration of Public Concerns:** Public concerns were provided to Ecology through public review of the RI/FS and the DSEIS. Potential public concerns relevant to this alternative include: 1) desires by some commenters to increase the use of dredging and upland disposal beyond that used in Alternative 6, 2) desire to further minimize the use of capping, 3) concerns about conflicts between planned area land uses and the proposed dredging patterns and infrastructure requirements for the Inner Whatcom Waterway, and 4) concerns about destruction of emergent shallow-water habitat at the head and along the sides of the Inner Whatcom Waterway.

5.3.4 Alternative 8

Alternative 8 manages cleanup areas through sediment removal and upland disposal except where this is not technically feasible. The alternative uses the same range of technologies evaluated for Alternatives 5, 6 and 7 to comply with SMS cleanup standards. However, the extent of dredging and upland disposal is expanded under Alternative 8 relative to the preceding alternatives. Alternative 8 conducts removal and upland disposal for ASB sludges, and for sediments dredged from the Inner and Outer Whatcom Waterway. In addition, Alternative 8 removes additional sediments located outside of the Whatcom Waterway Alternative 8 is shown in Figure 4-8.

MTCA Threshold Requirements

A comparison of Alternative 8 against applicable MTCA criteria is provided below. This information is summarized in Table 5-1. Alternative 8 complies with MTCA threshold criteria.

- **Protection of Human Health and the Environment:** Alternative 8 protects human health and the environment by complying with applicable cleanup standards, as discussed below. Although this alternative may rely to a very minor degree on containment via sediment capping, where dredging is technical infeasible, institutional controls and an institutional control plan (application and enforcement of restrictions on use of the waterway) will be tailored appropriately to protect the integrity of the capped areas.

- **Compliance with Cleanup Standards:** Alternative 8 complies with the cleanup standards as described in Section 3.1 of the RI/FS, primarily through the use of dredging and upland disposal. The use of capping and institutional controls is limited to management of residual contamination in areas where removal of all contaminated sediment is not technically feasible. The use of monitored natural recovery is minimized compared to other alternatives, and is applied only to the outer portions of the site (i.e., Unit 9).

- **Compliance with Applicable State & Federal Laws:** By requiring appropriate project design and permitting requirements, this alternative will comply with applicable state and federal laws.

- **Provisions for Compliance Monitoring:** Alternative 8 provides for compliance monitoring in monitored natural recovery areas and areas where removal of all contaminated sediment is not feasible, and capping of residual sediments is likely to be required.

Restoration Time-Frame

The restoration time-frame for Alternative 8 is relatively long due to the extensive design and permitting, and due to the anticipated duration of site construction activities. It is likely that the restoration time-frame will exceed the SMS preference for a restoration time-frame less than 10 years. The total restoration time-frame is estimated to be between 8 and 13 years.

Evaluation of Disproportionate Cost Analysis Criteria

The MTCA disproportionate cost analysis includes a comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 5-1.

- **Overall Protectiveness:** The protectiveness of Alternative 8 is achieved primarily through the use of dredging and upland disposal in a permitted upland facility. Alternate measures are used only in limited areas. This remedy represents the most permanent remedy evaluated, and is the remedy against which other alternatives are compared in the disproportionate cost analysis (Section 5.3). The majority of the additional sediments removed under Alternative 8 (relative to preceding alternatives) are obtained from areas outside the Whatcom Waterway that currently comply with cleanup standards for surface sediments. These areas contain low-level contaminated sediment beneath clean surface sediments. The use of institutional controls and containment is still required under this alternative, but are limited compared to the other alternatives. Institutional controls would be tailored to protect any areas capped.

- **Permanence:** Alternative 8 provides the greatest reduction in the total volume of subsurface contaminated sediments remaining within the site, and makes the greatest use of permanent solutions of any alternatives evaluated. Since Alternative 8 is the most permanent remedy evaluated, it is the basis for evaluation of the relative costs and benefits of the other alternatives in the analysis of disproportionate costs (Section 5.3).

- **Remedy Costs:** The probable costs of Alternative 8 are $146 million. The higher costs of Alternative 8 are associated with the additional volume of contaminated sediment managed by dredging and upland disposal. The costs of Alternative 8 exclude the costs of providing additional shoreline infrastructure in the Inner Whatcom Waterway (bulkheads, wharves, and hardened shorelines) in order to access berth-area contamination and utilize water depths, because these are not direct cleanup costs. If development project funding for these work elements is not available in parallel with the cleanup work, then the cleanup costs for this alternative would be increased as necessary to accomplish measures required to complete the cleanup action.

- **Long-Term Effectiveness:** Alternative 8 uses the greatest degree of dredging and upland disposal of all of the evaluated alternatives. The alternative also provides the smallest areas requiring containment and institutional controls. The long-term effectiveness of Alternative 8 depends in part on the matching of shoreline infrastructure in the Inner Whatcom Waterway to dredging patterns. If these actions are not coordinated, then the side-slopes of the Waterway will not be stable or usable for navigation, and the potential for waterway recontamination to occur will be greater. Institutional controls will be applied to any areas capped and will be tailored to protect the long–term integrity of these areas.

- **Short-Term Risk Management:** Alternative 8 involves the greatest in-water construction and the greatest level of short-term risks requiring management. Work activities will take place over the course of 5 to 7 construction seasons, with in-water construction during each of those seasons. Project design and permitting for this alternative will have the greatest challenge to control construction risks throughout the project life-cycle both temporally and spatially.

- **Implementability:** The implementability of Alternative 8 will depend primarily on the ability to coordinate cleanup dredging with upgrades to shoreline infrastructure in the Inner Whatcom Waterway. Given the transition in area land uses from industrial to mixed-uses, and the planned habitat enhancements along the Inner Whatcom Waterway, it is unlikely that the infrastructure investment and use limitations required to dredge and maintain the 1960s federal channel will be forthcoming. This issue is discussed further as part of the DSEIS. The very high cost and the significant duration of the project also create concerns regarding the ability to fully implement this alternative.

- **Consideration of Public Concerns:** Public concerns were provided to Ecology through public review of the RI/FS and the DSEIS. Potential public concerns relevant to this alternative include: 1) concerns about conflicts between planned area land uses and the proposed dredging patterns and infrastructure requirements for the Inner Whatcom Waterway, and 2) concerns about destruction of emergent shallow-water habitat at the head and along the sides of the Inner Whatcom Waterway. Conversely, Alternative 8 is likely to appeal to commenters who desire the maximum use of removal and upland disposal, and minimal use of capping technologies as part of the site cleanup, and for whom costs and land use conflicts are less of a concern.

5.4 MTCA Disproportionate Cost Analysis

As discussed in Section 5.1.3, the MTCA analysis of disproportionate costs is used to determine which cleanup alternative that otherwise meets cleanup requirements is permanent to the maximum extent practicable.

The analysis of disproportionate costs is performed below, using the information from Section 5.3 and Table 5-1. First, the alternatives are compared to the most permanent remedial alternative evaluated (Alternative 8), and the benefits of each alternative are ranked under the six non-cost criteria. Then in Section 5.3.2 the overall benefits and costs of the alternatives are compared. This analysis then defines which alternatives represent the most permanent, practicable alternatives under MTCA.

5.4.1 Criteria Ranking

Key to interpreting the final rankings of the alternatives is in understanding how these rankings were calculated. Table 5-2 contains the two critical elements used for the ranking calculations; the *weighting factors* assigned to each criterion (e.g. Protectiveness, Permanence etc) and the *relative ranking* within that category for each alternative based upon a numerical (1-10) rank. (The selection of weighting factors was previously discussed in Section 5.1.3). These two factors are multiplied together for each alternative within each category and then summed resulting in a final numerical rank for that alternative. When relative percentage (%) rankings are discussed below, the devisor is the highest rank for any alternative within that category. In other words if an alternative was ranked a 7 in a particular category and the highest ranking alternative in that category was ranked a 9, the relative percentage ranking would be 7 divided by 9 or 77.7%.

5.4.2 Comparison of Alternatives by Criteria

The evaluation of disproportionate cost is based on a comparative analysis of costs against the six other criteria. Relative rankings of each alternative for these six criteria are summarized in Table 5-2. These rankings are described below.

Protectiveness

The protectiveness rankings for Alternatives 5 and 6 and 7 compared with Alternative 8 are lower. The ranking order of overall protectiveness from highest to lowest is 8, 7, 6, and 5. It is important to understand however that the relative ranking values assigned to help shape the overall alternatives selection process are important. In other words, while Alternative 8 ranks highest, Alternative 7 rates as 87.5% in overall protectiveness compared with Alternative 8. Similarly, 5 and 6 rate 62.5% and 75% respectively. The protectiveness of Alternative 6 is slightly higher than Alternative 5, because removal and upland disposal is expanded in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal.

The protectiveness of Alternative 7 is slightly higher than both 5 and 6, because it removes additional contaminated sediments and does not rely as much on temporal cap stability. The alternative makes use of active remediation and off-site disposal. Dredging in the Inner Whatcom Waterway is expanded under the alternative to dredging of the 1960s industrial navigation channel. This additional removal provides additional risk reduction, because the deep sediment is not capped with the potential risk of re-exposure. On the other hand the contamination levels are relatively low in the additional materials removed under Alternative 7. Some residual sediment would remain under Alternative 7, as with Alternatives 5 and 6 and therefore require greater reliance on capping and institutional controls for protectiveness. Under Alternative 7, the dredging of the 1960s industrial navigation channel requires integration of shoreline infrastructure improvements in order to ensure the stability of resulting shoreline side-slopes. The benefits of additional contaminant removal are also partially offset by the increased levels of short-term risk due to the additional dredging activity although short-term risks are included in short-term risk rankings.

Alternative 8 receives the highest ranking for protectiveness. Alternative 8 makes the greatest use of dredging and upland disposal. Other technologies are used only sparingly. The benefits of further reductions in residual sediment concentrations and volumes are offset slightly by the increase in short-term risks associated with the construction of the remedy; thus, Alternative 8 receives a rank of 9 rather than 10. This alternative would require between 5 and 7 in-water construction seasons to complete dredging. Because the additional subsurface sediments removed under Alternative 8 have the lowest constituent concentrations of all site materials, the incremental removal activities of this alternative result in negligible significant improvement in overall protectiveness over Alternative 7. The use of institutional controls and containment is still required under this alternative, although to a lesser degree.

Permanence

Alternative 8 is ranked an 8 for the parameter of permanence, because it makes the greatest use of dredging and upland disposal of any of the evaluated remedial alternatives. The majority of material removed under Alternative 8 comes from areas outside the Whatcom Waterway that currently comply with cleanup standards for surface sediments. These areas contain low-level contaminated sediment beneath clean surface sediments. The removal of this high-volume, low-concentration material is not expected to affect residual surface sediment concentrations in the near-term after completion of the remedy, and the removal is not required to prevent exposure of buried contaminated sediments due to navigation or land use conflicts. Further, the removal of these materials provides the least incremental benefit in terms of the mass of contaminant removal achieved, due to the low average concentration of contaminants in these materials. However, because Alternative 8 makes the greatest use of high-preference removal technologies, it receives the highest ranking for remedy permanence.

Alternatives 5, 6 and 7 are ranked 5, 6, and 7 respectively for permanence. Permanence of these alternatives is similar to the rankings for overall protectiveness for similar reasons as stated above. These alternatives do not carry the removal of contaminated sediments to the extreme of Alternative 8, which removes the greatest volume of contaminated sediments and sludge of any of the evaluated alternatives. Therefore, the permanence of these alternatives is ranked based upon the extent to which they remove contaminated sediment. Alternative 6 removes additional contaminated material from the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal relative to Alternative 5. Alternative 7 removes additional material from the Inner Whatcom Waterway relative to Alternative 6.

Long-Term Effectiveness

Alternatives 5 through 8 are organized in Table 5-2 in order of increasing use of high-preference technologies and overall long-term effectiveness. Alternatives 7 and 8 each earned a ranking of 9 because each removes significant volumes of contaminated sediment for disposal into a permitted upland disposal facility and each uses treatment and reuse technologies. Alternatives 5 and 6 remove lesser volumes for disposal upland, however each receives no less than a 77% long-term effectiveness ranking compared with Alternative 8.

Short-Term Risk Management

Inverse to the ranking discussed in the categories above, the lowest ranking for short-term risk management are earned by Alternative 8. This ranking value is established at 4. While this alternative has the highest permanence ranking, the same actions that produce this high ranking for permanence trigger short-term risks that must be managed during project implementation. Specifically, this alternative makes the greatest use of dredging, which carries with it a significant risk of water quality and recontamination impacts. Alternative 8 is estimated to require between 5 and 7 construction seasons to complete in-water dredging. This alternative also involves dredging to the 1960s industrial navigation channel configuration within the Inner Whatcom Waterway which must be integrated with shoreline infrastructure upgrades in order to maintain stability of project area shorelines.

Alternative 5, 6, and 7 receive rankings of 8, 7, and 6 respectively due to a progressively greater use of dredging and its related increasing risk of recontamination. As a result, Alternative 7 will use between two and four construction seasons for in-water dredging and construction, while Alternatives 5 and 6 are expected to involve two in-water construction seasons. Fewer construction seasons reduces temporal risk.

Most ASB remediation activities under these Alternatives will take place prior to opening of the ASB berm, reducing the potential for water quality or recontamination impacts.

Implementability

All of the alternatives are complex and require significant actions during design, permitting, and construction to achieve a successful project. Yet all alternatives are sufficiently implementable to pass the threshold criteria under MTCA. The following rankings express the relative implementation challenges associated with each of the evaluated alternatives.

The lowest score for implementability applies to Alternative 8, which received a score of 3. The low implementability ranking for Alternative 8 is associated with the logistical complexity of the project, the need for extensive multi-year dredging windows, and shoreline stabilization requirements. In addition, the dredge plan conflicts with planned land uses.

The Implementability scoring for Alternative 7 is 4, slightly greater than Alternatives 8 due to their similarity, but much lower than the score of Alternative 6. Alternative 7 is technically implementable, but the reliance of both Alternatives and 7 and 8 on dredging the historic 1960s industrial navigation channel is inconsistent with land use plans for the Waterway and adjacent upland properties. The alternatives would also require substantial investments in new shoreline infrastructure that conflict with land owner objectives and land use plans. As with Alternative 8, Alternative 7 also requires multi-year dredging activity and permitting.

The implementability scores applied to both Alternatives 5 and 6 was an 8. Like the other alternatives, these actions will involve complex construction activities and will require the development of appropriate permits and institutional controls. However, the construction methods used all rely on available technologies for which experienced contractors are available within the region. The administrative implementability of these alternatives is relatively high, because these alternatives are consistent with identified land use, navigation, and habitat enhancement plans for the Inner Whatcom Waterway and the ASB. The habitat restored as a consequence of these cleanup alternatives also improves the permitting implementability relative to other project alternatives. There is an insignificant difference in implementability between these two alternatives.

Consideration of Public Concerns

Public comment received on the RI/FS and the DSEIS has identified public concerns related to cleanup of the site.

The calculated rankings listed in Table 5-2 represent an attempt to summarize the potential for each alternative to address public concerns and interests that have been raised during public involvement activities for the site. Given the range of opinions offered, including conflicting opinions from different groups, no one alternative can be 100% compliant with all public input. The rankings provided in Table 5-2 are intended to reflect on balance, how well the alternatives address the cross-section of public comments received. As discussed in section 5.1 of this evaluation, comments related to environmental protection and human health were included in and considered for more appropriate categories such as Long-Term Effectiveness and Protectiveness. Only those issues not falling into the above-reviewed categories were considered here.

Alternative 5 is relatively responsive to community concerns that have been raised and receives a moderately high ranking score of 7. The alternative generally makes significant use of removal, treatment, and upland disposal technologies for management of contaminated sludges and sediments. The alternative is consistent with land-owner objectives and land use plans for the Whatcom Waterway, ASB, and adjacent uplands. Alternative 5 also preserves the flexibility for continued deep draft navigation uses at the Bellingham Shipping Terminal. Some commenters have stated a greater desire for additional removal and upland disposal of contaminated sediments, beyond that conducted in Alternative 5. These were considered but are included in other categories above such as Permanence and Protectiveness.

Like Alternative 5, Alternative 6 is highly responsive to public concerns that have been raised during public involvement activities for the site and receives a ranking score of 8. Alternative 6 receives a higher ranking than Alternative 5 and the highest overall score in this category, because it allows for greater deep draft shipping in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal. For this reason, Alternative 6 is considered likely to address public concerns better than the other alternatives. As with Alternative 5, some commenters have stated a desire for additional removal and upland disposal of contaminated sediments, beyond that conducted in Alternative 6. These were considered in other categories above as well.

Alternative 7 receives a lower ranking (a score of 5) for consideration of public concerns than either 5 or 6. Although the alternative conducts a greater degree of dredging and upland disposal than does Alternative 5 or Alternative 6, non-cleanup related factors result in other identified conflicts. Alternative 7 supports aquatic reuse of the ASB, consistent with local land use planning. However, the alternative received unfavorable comments relating to 1) the destruction of habitat at the head and along the sides of the Inner Whatcom Waterway, and 2) concerns about the conflicts between the shoreline infrastructure requirements of this alternative and the planned land uses, navigation patterns and habitat enhancement objectives in the Inner Whatcom Waterway. Concerns about the high costs of the alternative were not included here since they are captured in the cost portion of the overall evaluation. Based on these considerations, this alternative received a score of 5 for this category.

Alternative 8 is ranked lowest (a score of 4) for consideration of public concerns. Alternative 8 received favorable comments from commenters who desire the site cleanup to maximize the use of dredging and upland disposal and minimize the use of other technologies, and who are less concerned about costs, land use impacts, short-term environmental affects or habitat impacts of the alternative. However, as stated each of these issues except habitat and land-use preferences were considered in the other categories above. The alternative received unfavorable comments relating to 1) the destruction of habitat at the head and along the sides of the Inner Whatcom Waterway as well as other shoreline areas throughout the site, 2) concerns about the conflicts between the shoreline infrastructure requirements of this alternative and the planned land uses, navigation patterns and habitat enhancement objectives in the Inner Whatcom Waterway. Concerns about the high costs of the alternative were not included here since they are captured in the cost portion of the overall evaluation.

5.4.3 Overall Comparison of Alternatives: Remedy Costs and Benefits

Figure 5-1 and Table 5-2 summarize for each alternative the remedy cost, as well as the remedy benefits discussed in Section 5.4.1. Appendices A and B of the RI/FS contain a detailed cost breakdown for each alternative. Updated costs for Alternatives 5 through 8 are presented in Appendix B of this CAP. Excluding project contingencies, the probable costs of the Alternatives ranged from a low value of $42 million to a high value of $146 million. These costs are expressed in 2005 dollars without adjustments for future cost inflation and without present value discounting of future costs. Actual project costs are expected to vary within a range of +/- 30% around these probable estimates, as shown in Figure 5-1 and Table 5-2.

Table 5-2 summarizes the overall benefits associated with each alternative using a composite benefit ranking. The calculated benefits using the categorical weighting factors are shown in Section 3 of Table 5-2. The calculated benefits integrate the rankings for individual evaluation criteria discussed in Section 5.4.1 multiplied by the weighting within that category and summed to reach the benefits total.

Consistent with MTCA requirements, the relative benefits and costs of each alternative are compared to Alternative 8. Alternative 8 makes the greatest use of high-preference remedial technologies, and represents the most permanent remedial alternative evaluated. It therefore provides the benchmark against which the relationship between incremental remedy benefits and incremental costs are evaluated.

Alternative 8 receives an overall benefit score of 6.9. Because the alternative uses the greatest degree of dredging and upland disposal, the remedy is considered to provide high benefit rankings under overall protectiveness, permanence, and long-term effectiveness. However, the alternative has low rankings for short-term risk management, implementability, and consideration of public concerns. The calculated ranking of 6.9 is slightly higher than that for Alternative 7, though Alternative 8 is almost twice the cost of Alternative 7. Because the costs of Alternative 8 are substantially higher than those of Alternative 7, whereas the benefit level is slightly greater, the incremental costs of Alternative 8 are considered disproportionate.

Alternative 7 receives a calculated benefit score of 6.8. The alternative has a high score for Long-Term Effectiveness. The alternative also has relatively high rankings for overall protectiveness and permanence although generally lower than Alternative 8, and relatively moderate rankings for short-term risk management, implementability, and consideration of public concerns. The costs of Alternative 7 are approximately $30 million greater than those of Alternative 6, though the level of overall benefits achieved is slightly lower than those of Alternative 6. Because the costs of Alternative 7 are substantially higher than those of Alternative 6, whereas the level of benefits is lower, the incremental costs of Alternative 7 are also considered disproportionate.

The calculated ranking of Alternatives 6 is equal to that of Alternative 8 which scored a 6.9. Both Alternative 5 and 6 ranked moderate to moderately high for overall protectiveness, and permanence, while they ranked high for long-term effectiveness, short-term risk management, implementability and consideration of public concerns. The alternatives have lower rankings for permanence relative to Alternative 8, because they do not carry the use of dredging and disposal to the logical extreme as in Alternative 8. Costs of Alternatives 5 and 6 are $42 million and $44 million respectively. Alternative 6 provides a relatively high level of benefits as measured against MTCA criteria. The incremental costs of Alternatives 5 and 6 are not considered disproportionate.

Figure 5-1 provides a graphical comparison between remedy costs and benefits for each of the alternatives. Remedy benefits are plotted in red using the calculated rankings from Table 5-2. Probable costs are plotted on the figure in blue. The relative costs divided by benefits are graphically represented by the line. The substantial increase in costs between Alternatives 5 and 6 and those of Alternatives 7 and 8 is readily apparent from the graph of remedy costs. Because the increases in costs are not accompanied by a corresponding increase in remedy benefits, MTCA specifies that Alternatives 7 and 8 are impracticable, and that the lower cost alternatives should be selected. Because the incremental costs of Alternatives 5 and 6 are proportionate to increases in remedy benefits, these incremental costs are not considered disproportionate. Alternatives 5 and 6 are not considered impracticable. Because Alternative 6 has a greater degree of overall benefit than Alternative 5, this alternative is considered “permanent to the maximum extent practicable” under MTCA.

5.5 Conclusions

The conclusions of the disproportionate cost analysis are summarized in the top row of Table 5-2. This analysis is central to the MTCA selection of a preferred alternative.

Alternative 6 is identified as the preferred alternative, based on the MTCA analysis of disproportionate costs. This alternative makes the greatest use of high-preference technologies and provides the greatest calculated ranking score while remaining practicable. The high-cost dredging and removal actions performed under this alternative are appropriately targeted at the materials that 1) have the highest constituent levels, 2) that conflict with land use and navigation needs and are likely to be disturbed in the future, 3) that can be removed safely without an excessive level of short-term risk, and 4) that consider community concerns raised during public involvement activities for the site. Alternative 6 is permanent to the maximum extent practicable under MTCA, and is identified as the preferred alternative.

Alternatives 7 and 8 both receive high benefit rankings, but as clearly identified in Figure 5-1, the proportion of costs compared with the benefits gained is obviously significantly greater and is therefore considered impracticable. The additional removal activities conducted in Alternatives 7 and 8 expand the use of high-preference technologies, but apply these additional efforts only to subsurface sediments with low contaminant levels that are safely managed using other technologies in the preceding alternatives. Figure 5-1 shows that the incremental costs of these alternatives are substantial and disproportionate relative to the additional degree of contaminant removal achieved and to the incremental remedy benefits achieved. Based on the environmental protections present in the other alternatives, there is only slightly greater reduction in residual risk in Alternatives 7 and 8, despite a doubling or tripling of cleanup costs. Alternatives 7 and 8 are therefore not identified as preferred remedial alternatives, but rather are considered impracticable.

6 Description of the Proposed Cleanup Action

This section describes the cleanup action proposed by Ecology for the site. Information summarized in this section includes the following:

- Description of the proposed cleanup action, including which technologies are applied in the different Sediment Site Units (Section 6.1)

- Summary of the types and quantities of hazardous substances to be managed on-site as part of the cleanup action (Section 6.2)

- Discussion of the compliance monitoring to be performed during and after construction of the cleanup action (Section 6.3)

- Presentation of the institutional controls to be applied as part of the cleanup action (Section 6.4).

6.1 Cleanup Actions by Site Area

Figure 4-6 illustrates the elements of the proposed cleanup action Technologies used as part of the cleanup include removal with subtitle D disposal, treatment, reuse, containment, monitored natural recovery, and institutional controls.

6.1.1 Outer Whatcom Waterway (Unit 1)

Low-level buried contaminated sediments within Unit 1C that may be disturbed through future dredging and navigation activities will be removed by dredging to the extent technically feasible. The depth of dredge cuts is expected to range from 35 feet to 41 feet below MLLW in Unit 1C. The dredging will need to address geotechnical and structural integrity limitations associated with existing piers and structures in the Bellingham Shipping Terminal area. It is expected that most portions of Unit 1C will be remediated by removal.

A stable side-slope will be established in between Unit 1-C and the sediments in the adjacent Inner Whatcom Waterway (Unit 2-C). The design of that side-slope will be addressed as part of remedial design, and will anticipate future navigation maintenance dredging within the channel and the effects of vessel prop wash and seismic effects on sediment stability.

Sediments removed during dredging will be barged to an offload facility and transferred to rail cars or trucks for transportation to a Subtitle D landfill facility. Post-dredging residual sediment contamination will be considered as part of design and permitting and will include the use of best practices.

Surface sediments in the outer portion of the Whatcom Waterway (Units 1A and 1B) comply with applicable cleanup standards. They are also anticipated to comply with criteria applicable to PSDDA disposal and beneficial reuse, and may need to be removed in order to accommodate future deep draft navigation uses in the Outer Whatcom Waterway. Alternative 6 assumes that dredging of these sediments is required to support navigation uses and that these sediments will be dredged and managed by PSDDA disposal, subject to an updated characterization and suitability determination. Potential beneficial reuse options for these materials will be evaluated as part of project design and permitting.

No institutional controls are anticipated for this area of the site.

6.1.2 Inner Whatcom Waterway (Units 2 and 3)

Low-level buried contaminated sediments in the Inner Whatcom Waterway that have a low potential for disturbance, given the site use plans discussed in Section 6.4.1, will be partially removed then contained using a thick cap. Sediments removed during dredging will be barged to an offload facility, and transferred to rail cars or trucks for transportation to a Subtitle D landfill facility. The emergent tideflat at the head of the waterway will be preserved, and shallow-water habitat areas along the sides of the waterway will be preserved and enhanced.

The design concept assumes that the majority of the Inner Whatcom Waterway will be managed to achieve an effective water depth of between 18 feet and 22 feet below MLLW. This

As shown in Figure 4-6, navigation areas of the Waterway will be dredged to depths 5 feet below the planned effective water depth. Where this dredging does not remove all of the contaminated sediments, a sediment cap will be applied with the cap grading from an anticipated thickness of 3 feet near the head of the Waterway, to an anticipated thickness of 6 feet in areas near the Log Pond and Bellingham Shipping Terminal.

Where sediment caps are placed in navigation areas, the final cap surface elevation will be at least two feet below the planned effective water depth. This difference allows for future navigation dredging to be performed without disturbing the cap surface.

During design and permitting, cap design details will be finalized including the cap thickness and material type, and the side-slopes. Analyses of prop wash, wave erosion, and other potential cap disturbances will be conducted during remedial design, and appropriate measures will be included in design of the cap to protect against cap erosion or instability. Seismic stability and adjacent upland uses will be considered in the stabilization of channel side-slopes. In most areas of the Inner Waterway, average side-slopes (as measured from the base of the channel to the top of bank) are expected to be 3H:1V or flatter. Slopes may be graduated or stepped, with flatter slopes present in intertidal and shallow subtidal areas exposed to wind waves and vessel wakes. Using flatter slopes in the intertidal and shallow subtidal areas also preserves and enhances shallow-water nearshore habitat usable by juvenile salmonids.

The emergent tide-flat at the head of the Whatcom Waterway (Unit 3-A) will be managed by monitored natural recovery subject to additional sampling and sediment stability evaluations to be performed during remedial design. A stable side-slope will be established in between Units 3-A and 3-B, and the design of that side-slope will anticipate future navigation maintenance dredging in Unit 3-B.

Institutional controls will be required for this area of the site to ensure the long term integrity of the remedial action (Section 6.4).

6.1.3 Log Pond (Unit 4)

The Log Pond area was previously remediated as part of an Interim Action implemented in 2000. Results of multi-year monitoring have confirmed that the majority of the cap is meeting performance objectives; however some erosion has occurred at the shoreline edges where the cap was the thinnest, exposing mercury contaminated sediment. As part of the final cleanup of the site, contingency actions will be taken to contain exposed contaminants and to prevent cap erosion.

As shown in Appendix A, contingency actions in this area will include modifications to the shoreline edges of the cap, to ensure long-term stability. These modifications include the addition of stone groins in three areas to enhance shoreline geometry, maximize sediment stability, and minimize wave reflection. Sideslopes within the southern, western, and central shorelines will be modified, with placement of cap materials (appropriate grades of sand and gravel) that will be stable under anticipated wind and wave conditions. A coarser stone material will likely be required in the central shoreline area due to higher wave energies occurring in this area. See Appendix D of the RI/FS for additional details.

Design and permitting will include assessment of habitat changes associated with the shoreline modifications within the Log Pond, including any potentially required mitigation measures. These analyses will also ensure that the final design for this area is stable under planned land uses.

Continued institutional controls will be required for this area of the site to ensure the long term integrity of the remedial action (Section 6.4).

6.1.4 Areas Offshore of ASB (Unit 5)

Exceedances of site-specific cleanup goals within Unit 5-B will be remediated by capping. The design is expected to include the use of sand materials below -12 ft MLLW and in cap sub-grades. An offshore submerged wave break will be constructed using clean material from the ASB berm. The wave break will be placed in water depths of approximately -8 feet and will extend to approximately -3 feet MLLW. The wave break will be exposed only in extreme low tides. The cap thickness will be at least 3 feet. Institutional controls will be required for this area of the site to ensure the long term integrity of the remedial action (Section 6.4).

The RI/FS included a preliminary evaluation of wind and wave forces affecting the Unit 5-B area. Additional evaluations will be conducted during remedial design and permitting prior to finalizing the cap design details. To minimize wave energies affecting the cap during storm events, the cap surface elevation will be established at an elevation deeper than -4 feet MLLW. Some dredging in shallow-water areas of Unit 5-B will be required prior to cap placement to maintain minimum cap thicknesses. This dredging volume is estimated at less than 2,500 cubic yards, assuming a maximum final cap elevation between -4 and -6 feet MLLW.

The remaining areas of Unit 5 comply with site-specific cleanup goals. These areas will be addressed using Monitored Natural Recovery. No sediment capping or dredging is proposed for these areas at this time. Additional evaluations of sediment stability will be conducted as part of remedial design. These areas will be monitored to ensure continued compliance with cleanup standards. Institutional controls will be required for these areas of the site to ensure the long term integrity of the natural cap (Section 6.4).

6.1.5 Areas near Bellingham Shipping Terminal (Unit 6)

The areas south of the barge docks at the Bellingham Shipping Terminal (Units 6-B and 6-C) contain exceedances of cleanup standards. These areas will be remediated using a cap. Final water depths in this area will be greater than -18 feet MLLW in most areas, consistent with current shoreline infrastructure and existing and planned navigation uses. The cap will be constructed of coarse granular materials and will be designed to resist potential prop-wash erosion effects. These effects will be assessed and final cap design details will be defined during remedial design. Institutional controls will be required for these areas of the site to ensure the long term integrity of the natural cap (Section 6.4).

Unit 6A complies with site-specific cleanup standards. These areas will be addressed using Monitored Natural Recovery. No sediment capping or dredging is proposed for these areas. These areas will be monitored to ensure continued compliance. Institutional controls will be required for these areas of the site to ensure the long term integrity of the natural cap (Section 6.4).

6.1.6 Starr Rock (Unit 7)

Sediments in the Starr Rock area currently comply with site-specific cleanup goals. These areas will be addressed using Monitored Natural Recovery. No sediment capping or dredging is proposed for this area at this time. Additional evaluations of sediment stability will be conducted as part of remedial design. This area will be monitored to ensure continued compliance. Institutional controls will be required for this area of the site to ensure the long term integrity of the natural cap (Section 6.4).

6.1.7 ASB (Unit 8)

Under the proposed cleanup action, contaminated ASB sludges and impacted sediments immediately underlying the sludges (transition sediments) will be dredged and managed by upland disposal. Some clean ASB berm sediments and stone materials will also be removed for use in other cleanup actions at the site.

The design concept for cleanup of Unit 8 is based on a five-step process. The steps are outlined below, although some aspects of this process may change in remedial design. First, the water level in the ASB will be lowered and the connection between the ASB and the outfall plugged.

Second, the water treatment equipment (aerators, weirs, etc.) will be removed, and the tops of the berms removed. These berm materials consist of clean sand and stone materials used to construct the ASB and can be reused within other portions of the project area. The exterior of the berm will be reduced in elevation between 14 and 18 feet above MLLW. The interior of the berm will be removed to elevations approximately 10 feet above MLLW. Sheet piling may be driven along the berm to allow for subsequent dewatering of the interior of the ASB.

Third, the majority of the ASB sludges will be removed, likely by hydraulic dredging. The hydraulic dredge slurry will be treated to enhance separation of sludge solids from the entrained waters. Solids separated from the dredge slurry will be shipped by rail for upland disposal. Produced waters from dredging and materials handling will be returned to the ASB in a closed-loop system, to minimize the overall generation of contaminated waters. The use of hydraulic dredging and maintenance of a water layer overlying the sludges during removal was identified in the RI/FS as a method for minimizing odors and potential wildlife exposures during sludge removal.

During the fourth step, the impacted waters from the ASB will be pumped out, treated to remove suspended and dissolved contaminants, and then discharged to the sanitary sewer. If sewer capacity is limited, the treated waters will be managed using a permitted temporary surface water discharge.

Finally, the residual solids within the dewatered ASB will be removed by land-based excavation equipment. By conducting this final phase of removal without overlying water, the result will maximize sludge removal and minimize residual contamination. These five steps will be revisited as part of remedial design and permitting, and may be modified as necessary to optimize cleanup performance.

Following cleanout of the sludges, any installed sheet-piling may be removed from the ASB, the ASB filled to appropriate elevations with surface water, and the berm opened. Some additional impacted sediment will be generated for upland disposal at the time the new access channel to the ASB (Unit 2-B) is created.

No institutional controls are anticipated for this area of the site.

6.1.8 Remaining Area of the Site (Unit 9)

Surface sediments in the Remaining Area of the site currently comply with applicable cleanup standards. This area will be addressed using Monitored Natural Recovery to ensure continued compliance. Institutional controls will be required to ensure the long term integrity of the natural cap (Section 6.4). The boundaries of Unit 9 shown in Figure 4-6 are estimated and will be refined as part of remedial design.

6.2 Types, Levels and Amounts of Contamination Remaining On Site

The information presented in the RI/FS documents conditions at the site prior to the cleanup action. As described in the RI/FS, the principal sediment contaminants at the site include mercury, 4-methylphenol, and phenol.

Most surface sediments at the site comply with applicable cleanup standards as measured using chemical and biological testing, and also comply with the site-specific bioaccumulation screening level developed using Human Health Risk assessment procedures. The proposed remedy addresses the few areas of surface sediment contamination through dredging and/or capping. Subsurface sediment contamination will be addressed using a range of technologies, with capping and removal used to address unstable sediments, and monitored natural recovery used to address sediments that are safely buried.

The proposed cleanup action will remove contaminated subsurface sediments from the Outer Whatcom Waterway (Unit 1) adjacent to the Bellingham Shipping Terminal and from the ASB (Unit 8). In other site areas, hazardous substances will remain in stable, subsurface sediments. These sediments will be managed by capping and monitored natural recovery. Monitoring and institutional controls will be used to ensure the long-term stability of these subsurface sediments. These measures are described in Sections 6.3 and 6.4 of this CAP respectively.

Figures 6-1 through 6-3 summarize the RI/FS subsurface sediment data for areas of the site where contaminated subsurface sediments will be managed on-site using monitored natural recovery or capping. Subsurface sediment conditions vary according to site unit. Figures 6-1 and 6-2 provide a summary of the average subsurface sediment quality, expressed as the average sediment quality at depths 0.4 feet to 4 feet below the sediment mud-line. In order to provide the reader with a better overall sense of subsurface contaminant distribution throughout the site prior to initiation of remedial efforts, the Log Pond area is shown prior to completion of the Interim Remedial Action. Figure 6-3 summarizes discrete sampling data for subsurface mercury within the Whatcom Waterway. The estimated dredge and cap elevations are shown on the cross-section, subject to final remedial design and permitting.

6.3 Compliance Monitoring and Contingency Responses

Compliance monitoring and contingency responses (as needed) will be implemented in accordance with WAC 173-340-410, Compliance Monitoring Requirements. Detailed requirements will be described in the site Construction Quality Assurance Project Plan (CQAP) and the Compliance Monitoring and Contingency Response Plan (CMCRP) to be prepared as a part of remedial design. The objective of these plans is to confirm that cleanup standards have been achieved, and also to confirm the long-term effectiveness of cleanup actions at the site. The plans will contain discussions on duration and frequency of monitoring; the trigger for contingency response actions; and the rationale for terminating monitoring. The plans will be subject to public review as part of a draft Engineering Design Report. The three types of compliance monitoring to be conducted include:

1) **Protection Monitoring:** This type of monitoring is used to confirm that human health and the environment are adequately protected during the construction period of the cleanup action;

2) **Performance Monitoring:** Performance monitoring is used to confirm that the cleanup action has attained cleanup standards and other performance standards; and,

3) **Confirmation Monitoring:** Used to confirm the long-term effectiveness of the cleanup action once performance standards have been attained.

Cleanup standards and associated points of compliance for the remedial action are described in Section 3.

A general overview of the monitoring and contingency response actions anticipated for the site under each of the above categories follows.

6.3.1 Cleanup Action Monitoring Requirements

The cleanup action incorporates monitoring to determine whether cleanup standards have been achieved during and after remedial action. Five broad categories of compliance monitoring will be undertaken at the site as follows:

- **Physical Integrity (Performance and Confirmation Monitoring):** Monitoring will be conducted during the remedial action to guide construction activities. Following completion of construction, long-term physical monitoring of cap surfaces and naturally recovered areas will be performed to verify that they are not substantially eroded over time by natural and anthropogenic forces. Engineering cap thickness and natural recovery thickness will be periodically assessed and compared with the minimum required thickness determined during remedial design to ensure integrity of the engineered caps and successful development of the natural recovery caps to protect human health and the environment. This monitoring will incorporate bathymetric surveys, sediment cores, and direct inspections of intertidal and shoreline areas.

- **Water Quality (Protection Monitoring):** During remedial action, various construction controls will be implemented as feasible to ensure water quality protection within the site area. Protection will be verified through a combination of intensive monitoring (e.g., once per construction shift) and routine monitoring (e.g., once weekly). Protection monitoring will identify the need for further controls as appropriate.

- **Sediment Quality in Removal and Cap Areas (Performance Monitoring):** The effectiveness of sediment removal during and following construction will be verified in a two-step sequence. First, physical surveys (as outlined above) will be performed to verify that dredging has achieved required dredge depths, to be developed during remedial design. In capping areas, physical surveys will be used to ensure that desired cap thicknesses and sideslopes are achieved. In the second step, post-construction (Year 0) surface sediment samples (0 to 12 cm) will be collected and analyzed for priority contaminants (mercury, phenol, and 4-methylphenol) as part of performance monitoring.

- **Sediment Quality in Cap and Natural Recovery Areas (Confirmation Monitoring):** Sediment quality in all cap and natural recovery areas will be documented during long-term confirmation monitoring. If enhanced natural recovery is used as part of management of dredge residuals, then these areas will also be included within the scope of confirmation monitoring. Sediment quality monitoring events are anticipated to be conducted during years 1, 3, 5, 10, 20 and 30 after completion of the remedial action. Additional monitoring events may be required and/or the term extended in the event that sediment areas are shown during physical and chemical monitoring to be unstable or to exhibit recontamination. Chemical and/or confirmatory biological monitoring of surface sediments will be performed to verify that these areas achieve and maintain compliance with site cleanup standards as described in Section 3 of this CAP.

- **Tissue Monitoring (Confirmation Monitoring):** As discussed in the RI/FS, bioaccumulation monitoring has been performed at the site. The tissue data exhibiting the strongest correlation to site sediment mercury concentrations and the most relevance to potential human health exposures is that for adult male Dungeness crab muscle. Tissue monitoring is anticipated to be performed as part of confirmation monitoring during the Year 3, 5, and 10 monitoring events. Additional monitoring events may be required and/or the term extended in the event that sediment areas and/or associated tissues are shown during monitoring to exhibit recontamination or exceed effects levels.

Additional details regarding the anticipated monitoring requirements are provided below. Final specific monitoring requirements (i.e., sample locations, monitoring parameters) will be defined as part of remedial design and permitting. The following parameters are provided to clarify Ecology expectations as part of the CAP.

Water Quality Monitoring Expectations

Water quality will be monitored during dredging of sediments, following procedures to be detailed in the CQAP. Water quality samples will be obtained and analyzed to monitor and control short-term water quality impacts from dredging activities, and to invoke corrective actions or modify dredging procedures, if necessary, to bring construction activities into compliance with water quality standards.

The purpose of the water quality monitoring is to provide ongoing assessment of the water quality impacts of dredging of site sediments. Final water quality procedures will be specified in the CQAP. General requirements of the monitoring program for open-water dredge and cap areas are as follows:

- Characterize baseline water quality conditions prior to construction
- Ensure dissolved oxygen remains above prescribed minimums

- Ensure turbidity remains below prescribed maximums (compliance with turbidity criteria also ensures protection from dredging-related mercury releases)

- Allow for appropriate adjustment of construction activities in a manner that ensures protection of human health and the environment

- Document the results of the water quality performance monitoring.

Water quality monitoring will include documentation of baseline water quality monitoring within or near dredging and capping operation areas to establish ambient water quality conditions. Determination of baseline water quality will be presented in a baseline water quality monitoring report.

Dissolved oxygen and turbidity can fluctuate greatly in Inner Bellingham Bay due to silt distribution from the Nooksack River and turnover effects that can bring water with lower dissolved oxygen to the surface. Therefore, in addition to pre-construction monitoring/sampling of the ambient water quality locations, at least two of the locations shall be monitored daily during those periods of construction activity which also require intensive water quality monitoring, to check for unusual departures of ambient conditions from normal levels. The selection of daily ambient monitoring locations shall be rotated to best complement current dredging and disposal operations. Ambient threshold criteria will be recalculated periodically to incorporate these additional background measurements.

During construction, water quality monitoring will be performed in the vicinity of dredging and capping operations when the activity is in progress. The compliance boundary for the zone of disturbance will be established at a maximum distance of 300 feet from the point of dredging or cap placement, and the boundary will move with equipment operation. Two monitoring stations will be established downstream of the dredge or cap placement location along the predominant direction of tidal flow (flood or ebb). The exact monitoring locations may move laterally along the compliance boundary and the midpoint. Monitoring locations will be positioned to intercept any visible turbidity plumes released from construction activities. At each monitoring location, water quality will be monitored at two depths: shallow (within 3 feet of the water surface), and deep (within 6 feet of the sediment surface).

Ongoing dredging and capping activities require rapid feedback from the monitoring program to ensure that corrective actions are implemented in a timely manner. The CQAP will specify the appropriate balance between rapid turn-around results and maintenance of an appropriate level of quality control.

Sediment Monitoring Expectations

Performance monitoring will be conducted for surface sediments in dredge and cap areas at Year 0, and confirmational monitoring of surface sediments is anticipated to be conducted in cap and natural recovery areas during years 1, 3, 5, 10, 20 and 30 following completion of the remedial action with potential modifications in the schedule depending upon prior sampling results. This may include decrease or increase in frequency and/or intensity of sampling efforts.

Performance and confirmational surface grab samples (upper 12 cm of sediment) will be collected along a systematic grid. Sample collection procedures will be specified in the CQAP. Data quality objectives and procedures used in performance monitoring sample collection, analysis, and data validation shall correspond to those used in the RI/FS, and will also correspond with then-current PSEP protocols. The number of confirmational monitoring locations is expected to be between 20 and 30 locations for the cap and natural recovery areas. Additional sampling locations will be established in removal areas within the ASB (Unit 8) and Bellingham Shipping Terminal (Unit 1) areas for performance monitoring. Final monitoring locations and number will be determined during remedial design. Monitoring priorities will include the following;

- **Target Sampling Areas:** The sampling locations will be sufficient to monitor surface and subsurface sediment quality throughout the active and passive remedial action areas. This will include but not be limited to dredged, capped, and natural recovery areas. The sampling will generally follow a grid pattern, but the sample density may vary depending on the type of remedial action (e.g., thick cap versus monitored natural recovery area) and the relative concentrations of underlying or adjacent subsurface sediments (i.e., sample density may be greater in areas with higher subsurface mercury levels).

- **Different Elevations and Slopes:** Monitoring points will be placed to ensure representative monitoring of different slopes or elevations through the cap and natural recovery areas.

- **Stormwater Discharges:** Sampling locations may be targeted to ensure monitoring of areas of the site subject to stormwater discharges or other discharges that could potentially affect surface sediment quality.

Tissue Monitoring Expectations

Tissue monitoring locations are anticipated to include a minimum of three collection areas within the site, and two clean reference areas. Adult male Dungeness crab will be collected from test and reference areas for tissue analysis of total mercury levels. Compositing, will only be performed if necessary to obtain sufficient tissue for analysis.

Tissue monitoring is anticipated to be performed at years 3, 5 and 10 following completion of the remedial action. Additional monitoring events may be required and/or the term extended in the event that sediment areas and/or associated tissues are shown during monitoring to exhibit recontamination or exceed effects levels. Data analysis will include statistical comparisons of test and reference areas, analysis of time trends in tissue concentrations, and evaluation of tissue concentrations against the target tissue concentrations developed as part of the mercury Bioaccumulation Screening Level.

6.3.2 Contingency Response Actions

Detailed contingency response actions will be described in the site CQAP and the CMCRP to be prepared as a part of remedial design. The objective of these plans is to confirm that cleanup standards have been achieved, and also to confirm the long-term effectiveness of cleanup actions at the site. Along with the information on monitoring; these plans will discuss the types of contingency actions that could potentially be required in response to monitoring observations, and will discuss triggers for different types of contingency response actions. The plans will be subject to public review as part of a draft Engineering Design Report. Examples of different types of contingency response actions are discussed below to clarify Ecology expectations for the types of information to be developed as part of the CQAP and CMCRP:

Construction Contingencies

The Engineering Design Report will define specific performance standards for the cleanup action. During construction of the cleanup action, contingency response actions could be triggered by a number of types of events. The following types of contingencies shall be addressed in the CQAP:

- **Achievement of Physical Performance Standards:** Construction contingencies shall address compliance with physical performance standards such as dredging depth or cap elevation. Contingencies could be triggered by the presence of unanticipated field conditions, and generally can be addressed through modifications of equipment selection, dredging/capping methods, or production rate.

- **Dredging Residuals Management:** Ecology expects that the CQAP will consider potential management options and contingencies for dredge residuals. These contingencies shall address potential contingencies such as limited redredging and/or use of monitored natural recovery or enhanced natural recovery. These contingencies are most relevant in dredge areas where subsequent capping is not included in the proposed cleanup action.

- **Water Quality Impacts:** Construction contingencies shall be considered in the event that water quality performance standards are not met during dredging or capping. These contingencies may include actions such as temporary cessation of operations, assessment of the cause of the water quality problem, definition appropriate measures to correct the problem, and appropriate notifications and reporting to Ecology relating to the water quality problem and the measures taken to correct the problem.

Post-Construction Contingencies

The Engineering Design Report will also discuss contingencies applicable to the period following completion of construction. The following types of contingencies shall be addressed in the CMCRP:

- **Recontamination of Cap or Natural Recovery Areas:** The potential for sediment recontamination will be monitored as part of long-term sediment monitoring. The CMCRP will discuss triggers and potential contingency responses including response timelines if recontamination is observed. Generally these responses will include collection of appropriate data to define the source and extent of recontamination, assessment of control options for the source of the recontamination (e.g., implementation of enhanced stormwater source control and/or treatment), and implementation of appropriate corrective measures for the area of recontamination (e.g., monitoring, capping or dredging as appropriate to the location, extent and stability of the affected area).

- **Stability of Sediment Caps:** The sediment caps to be placed as part of the proposed cleanup are intended to be stable under site conditions and anticipated land and navigation uses. The physical integrity of the caps will be monitored to ensure that this stability is achieved. If significant erosion is observed in cap areas, then contingency response measures will be implemented in a timely manner to correct the problem and restore stability. Generally these responses will include collection of appropriate data to define the source and extent of the cap erosion, assessment of potential control options, and implementation of appropriate corrective measures for the affected area. These corrective measures could include placement of additional cap material, construction of protective groins or armoring, or modifications to cap elevation through dredging and new material placement.

- **Tissue Quality Concerns:** The CMCRP will discuss measures to be taken in the event that elevated or elevating trends in tissue mercury concentrations are observed during monitoring. Such observations could occur following the period of cleanup construction when sediment disturbances will be greatest or following sediment disturbance events caused by sediment recontamination or cap erosion. Generally Ecology expects that these measures will include collection of appropriate data to assess the nature and extent of tissue quality concerns, assess the source of the tissue quality problem, and define options for correction of the problem. The CMCRP shall also discuss protocols for communication of tissue quality issues with other regulatory agencies and potentially affected stakeholders.

6.4 Institutional Controls

In conjunction with compliance monitoring, institutional controls will be applied to limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances. Institutional controls will include multiple actions as described below. Restrictive covenants will be recorded for all sediment cap areas. Institutional controls and restrictive covenants currently in effect at the Log Pond area will remain in effect and will be amended if necessary to reference the contingency actions in this area.

6.4.1 Use Assumptions

The remedial actions and institutional controls for the site have been developed to ensure protection under anticipated land and navigation use assumptions. The Port has provided Ecology with the attached Figure 6-4 which depicts anticipated land and navigation uses within the site (refer to the RI/FS and the DSEIS for additional information on area land and navigation uses). They include the following:

- **Outer Whatcom Waterway:** Continued deep draft navigation uses are anticipated for the Outer Whatcom Waterway (Site Unit 1). These uses include continued operation and maintenance of the federal navigation channel in this area.

- **Inner Whatcom Waterway (Site Units 2 & 3):** The Inner Whatcom Waterway is to be operated as a locally-managed, multi-purpose channel. The former industrial navigation uses of this area are to be discontinued, and the Port, DNR, and the USACE have initiated the deauthorization process for the federal navigation channel in this area. Operation of the multi-purpose channel will include periodic maintenance dredging by the Port (in conjunction with other property owners along the Waterway) to maintain water depths, but future deepening or widening of the channel is not anticipated. Channel dimensions are to be established during integrated design and permitting for cleanup, habitat restoration and related actions as described in Section 7. Land uses along the Inner Waterway are expected to consist of mixed-use redevelopment, consistent with planned property zoning. Emergent shallow-water habitat at the head of Whatcom Waterway (Unit 3A) and along the sides of the Inner Waterway will be maintained. Existing industrial bulkheads and over-water structures are anticipated to be replaced with updated infrastructure consistent with habitat restoration goals for this area.

- **Log Pond and ASB Offshore Areas (Units 4 & 5):** The areas within the Log Pond and the shallow-water areas located offshore of the ASB (Unit 5) are identified as priority habitat restoration areas. Navigation uses in these areas are not anticipated, with the exception of small boat access (i.e., kayaks, hand-carry boats). Public shoreline access enhancements are anticipated in portions of these areas. No deepening for navigation uses is anticipated for these areas. The offshore areas of Unit 5 are expected to continue in use for transient small-boat navigation, but dredging or the development of deep-water navigation uses in these areas is not anticipated.

- **Barge Dock Area (Unit 6):** The Barge Dock area is expected to continue in navigation uses associated with the Bellingham Shipping Terminal. Periodic maintenance dredging of this area may be performed to maintain water depths, but deepening of this area is not anticipated.

- **Starr Rock Area (Unit 7):** Starr Rock is a deep-water offshore area for which navigation uses are constrained by the presence of the natural Starr Rock obstruction. Future navigation uses of this area are not anticipated, other than transient small boat navigation uses, or possibly transient moorage buoy installation. Deepening of this area by navigation dredging, or the construction of docks, wharves or floats in this area are not anticipated due to wind and wave conditions in this area and due to the proximity of current (i.e., Boulevard Park) and anticipated (i.e., Cornwall area park) park developments by the City.

- **ASB (Unit 8):** The ASB will be opened to Bellingham Bay and developed into a Clean Ocean Marina, including public shoreline access and habitat enhancements. The existing industrial waste water treatment use is to be discontinued. Operation of the marina will include periodic maintenance dredging by the Port to maintain water depths.

- **Remaining Areas of the Site (Unit 9):** The Remaining Areas of the site will continue existing uses that range from transient small boat navigation to shipping uses in deep-water areas and in the I & J Waterway federal channel.

6.4.2 Restrictive Covenants

An Institutional Control (IC) Plan will be developed for the site, in consultation with the appropriate federal, state, and local agencies. It is intended that the IC Plan will address such matters as waterway signage on prohibited activities, vessel size and speed; signage regarding protection of capped areas; lease prohibitions or usage restrictions and notifications; as well as a plan for enforcing the waterway restrictions.

Restrictive Covenants will also be recorded with Whatcom County for all capped sediment areas within the site, and shall incorporate the provisions of the IC Plan to the fullest extent permitted by law.

The restrictive covenants document the nature and extent of contamination and the remedial action. They further limit uses of the capped areas to those that do not interfere with the remedial action, and prohibit the modification of the cap without the prior written approval of Ecology. The restrictive covenants shall further limit activity on the property to those activities which will not interfere with the integrity of the remedial action (e.g. cap). In addition, the restrictive covenants require owners of the property to notify all lessees or property purchasers of the restrictions on the use of the properties. Finally, the restrictive covenants require the Owners of the properties make provisions for continued monitoring and operation and maintenance of the remedial action prior to conveying title, easement, lease or other interest in the Property. The restrictive covenants will be subject to Ecology's approval before being recorded.

In addition, for state-owned properties, the restrictive covenants will be recorded in the Washington Department of Natural Resources (WDNRs) index plates and property files used to track ownership and use activities for state-owned aquatic lands.

6.4.3 Review Process for Navigation Dredging and Other Construction Activities

As discussed in Section 6.4.1, the remedial action anticipates future navigation uses, navigation maintenance dredging, and other activities in portions of the site following completion of the remedial action. Specific design considerations for each site area will be developed as part of remedial design and permitting for anticipated uses and maintenance activities. Such considerations will also be addressed in the IC Plan for the site.

Future in-water construction activities are subject to extensive project review under permitting authorities (e.g., Corps permit reviews, WDFW HPA permit reviews, and Ecology water quality certifications). Requirements for maintenance dredging activities that do not disrupt the cap surfaces will be addressed during these permit reviews. Consistent with the restrictive covenants, additional notifications will be conducted with the Department of Ecology for construction activities in capped areas where those activities may disrupt the cap. Ecology approval of the proposed construction methods will be required for these projects prior to implementation.

7 Implementation of the Cleanup Action

This section describes the manner in which the cleanup action will be implemented.

- Section 7.1 discusses other cleanup, source control, habitat restoration, and waterfront redevelopment actions that will be coordinated with the Whatcom Waterway cleanup action

- Section 7.2 describes the anticipated project schedule.

7.1 Coordination with Other Actions

Several cleanup, source control, restoration, and redevelopment actions on the Bellingham waterfront will be coordinated with the cleanup of the site. These actions are described below and illustrated in Figure 7-1. Coordination of waterfront activities is necessary to ensure effective cleanup of the site, prevent recontamination for other sources, and provide for comprehensive environmental review, efficient permitting and construction, and minimal disturbance to salmonids and sensitive aquatic receptors.

7.1.1 Central Waterfront Site Cleanup and Shoreline Restoration

The Central Waterfront site shares over 1,200 linear feet of shoreline with the site. The Central Waterfront site is approximately 55 acres, and is undergoing an RI/FS through a MTCA agreed order with Ecology.

Surface sediment contamination from historic upland boatyard activities along the southern shoreline of the Central Waterfront site includes copper, zinc and tributyl tin. Contaminated surface sediments from the Central Waterfront site overlay buried mercury contaminated sediment that comprise part of the site. These surface sediments will be remediated as a consequence of the cleanup selected for the site. Central Waterfront site activities are anticipated to include the following:

- Upland cleanup activities – to address areas of residual groundwater contamination

- Removal of obsolete creosote-treated pilings and dock structures

- Removal of obsolete concrete, timber and sheet-piling bulkheads

- Restoration of the shoreline to produce a stable sloping shoreline compatible with planned navigation, public access and habitat enhancements.

Renovation of shoreline structures at the adjacent property at 601 “C” Street will also be coordinated with the Central Waterfront cleanup and restoration effort. Renovation activities are expected to include removal of creosoted dock/piling structures, bulkhead removal, and installation of new navigation floats and non-creosoted dock structures.

7.1.2 I & J Waterway Site Cleanup

The I & J Waterway site is approximately 4 acres, and is undergoing an RI/FS through a MTCA agreed order with Ecology.

Surface sediment contamination from historic industrial activities along the southern shoreline of the I & J Waterway includes but is not limited to bis(2-ethylhexyl)phthalate and nickel. Contaminated surface sediments from the I & J Waterway site overlay buried contaminated sediment that comprise part of the site as shown in Figure 7-1. Surface and subsurface contaminated sediment will be remediated as part of the cleanup selected for the I & J Waterway site.

7.1.3 Cornwall Avenue Landfill Site Cleanup

The Cornwall Avenue Landfill site is approximately 8 acres, and is undergoing an RI/FS through a MTCA agreed order with Ecology.

Surface sediment contamination from historic municipal landfill activities along the shoreline at the south end of Cornwall Avenue includes but is not limited to solid waste. Contaminated surface sediments from the Cornwall Avenue Landfill site overlay buried contaminated sediment that comprise part of the site as shown in Figure 7-1. Surface and subsurface contaminated sediment will be remediated as part of the cleanup selected for the Cornwall Avenue Landfill site.

7.1.4 R.G. Haley Cleanup Site

The R.G. Haley site is approximately 8 acres, and is undergoing an RI/FS through a MTCA agreed order with Ecology.

Surface sediment contamination from historic wood treatment activities along the shoreline at the south end of Cornwall Avenue includes but is not limited to pentachlorophenol and dioxins. Contaminated surface sediments from the R.G. Haley site overlay buried contaminated sediment that comprise part of the site as shown in Figure 7-1. Surface and subsurface contaminated sediment will be addressed as part of the cleanup selected for the R.G. Haley site.

7.1.5 Removal of Creosote-Treated Pilings and Dock Structures

Removal of creosote-treated pilings and dock structures is expected to occur along the southern shoreline of the Whatcom Waterway, and along portions of the northern Waterway shoreline, as described above. These activities remove a potential source of PAH contamination from Bellingham Bay.

Where structures require replacement, these replacements will maximize the use of appropriate materials such as concrete that do not represent a potential source of water quality or sediment contamination. Permitting and construction phasing between the removal actions and the cleanup actions will be coordinated to avoid logistical conflicts and minimize unnecessary disturbance to fisheries resources.

7.1.6 ASB Marina and Waterfront Development

The Port plans to open the ASB to Bellingham Bay, and to develop within the basin a 28-acre Clean Ocean Marina. The Clean Ocean Marina will include public shoreline access and habitat enhancements.

The Port and City are jointly developing a Master Plan that includes restoration activities, creation of buffers and habitat restoration along the shoreline of the site. The Master Plan includes the marina and will incorporate Ecology's SEPA review of the site cleanup alternatives presented in the DSEIS by reference in order to ensure appropriate and necessary integration of MTCA site cleanup, habitat restoration, and marina and park development. The construction activities for the site cleanup and the construction activities for the development of the Clean Ocean Marina will be managed by the Port as multiple elements of a single Port project that encompasses cleanup, restoration, and redevelopment. The Port plans to integrate the design, permitting and associated environmental reviews for this work to ensure an opportunity for informed agency and stakeholder review of the project. Construction phasing between the projects will be coordinated to avoid logistical conflicts and minimize unnecessary disturbance to fisheries resources.

7.1.7 Former GP Mill Property Shoreline Restoration Activities

The former GP mill property located along the southern shoreline of the site includes extensive stretches of aging concrete, timber, and metal bulkheads. As part of redevelopment activities, the Port plans to conduct shoreline restoration activities in these shoreline areas, removing bulkheads and replacing them with more natural, sloping shorelines where practicable.

The restoration work will be conducted concurrent with creosoted-piling removal activities in the Whatcom Waterway and with cleanup of the

Whatcom Waterway sediments. The design, permitting and associated environmental reviews for this work will be integrated with that for the Whatcom Waterway cleanup to ensure an opportunity for informed agency and stakeholder review of the overall project. Concurrent project implementation will provide for efficient construction, and will minimize disturbance to fish and wildlife.

7.2 Anticipated Schedule for Design and Implementation

The design and implementation of the cleanup of the site will be implemented over a period of approximately six years, with a subsequent period of long-term monitoring. The anticipated schedule for design and implementation of the Whatcom Waterway cleanup is illustrated in Figure 7-2, and is described below.

- **Engineering Design and Permitting:** The project is significant in scope, and design and permitting are expected to require approximately 2 years to complete, though permitting time-frames are subject to the discretion of the regulatory agencies involved. Pre-design data collection activities will be necessary to document current conditions (e.g., current bathymetric data, supplemental coring data in planned dredge areas, sediment geotechnical data, current eel grass distribution) for design and permitting. It is anticipated that public review of the MTCA Engineering Design Report will be conducted jointly with the public review of the Corps permit submittals. The final compliance monitoring plans will be developed as part of the design process.

- **Phased Cleanup Construction:** Because the project involves more in-water construction activities than can be completed in a single construction season, multiple construction phases will be required. Cleanup construction will likely take place in three discrete phases. Timing of most in-water work activities will be limited by permit-specified “fish windows” to appropriate time-periods when those activities are least likely to affect migrating juvenile salmonids and other aquatic species. These time limitations will affect the amount of work that can be completed within a given construction season, and particularly affect the overall time required to complete dredging, capping and shoreline restoration activities. Other work does not require in-water activity (e.g., upland sediment staging/transport, ASB sludge removal prior to berm opening, etc.) but is subject to other logistical constraints. Cleanup construction is reasonably expected to require at least three construction phases, spanning a period of approximately 4 years. The initial construction phase is anticipated to include ASB preparation, completion of contaminated sediment dredging within the Waterway, and initial sediment capping and shoreline stabilization activities within the Waterway area. The second construction phase is anticipated to include ASB sludge removal, dewatering and final ASB cleanout. The final construction phase is anticipated to include opening of the ASB berm, and completion of final dredging and capping activities within the Waterway areas.

- **Recording of Institutional Controls:** Restrictive covenants will be recorded upon completion of the active cleanup measures required by the CAP. These controls will remain in place indefinitely unless removal is approved by Ecology.

- **Post-Construction Monitoring:** Post-construction monitoring will be performed as defined in the final Compliance Monitoring and Contingency Response Plan, to be prepared during final design and permitting. As described in Section 7, the monitoring framework anticipates completion of monitoring activities in years 1, 3, 5, 10, 20 and 30 following completion of construction.

The above-described schedule may be affected by the time required for permitting and to complete construction within permit-required "fish windows."

8 References Cited

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Tables

Table 2-1 Summary of Principal Contaminants and Sources

Principal Site Contaminants	Principal Source(s)	Source Control Status
Mercury	**Wastewater Discharges to Log Pond**	**Controlled**
		- Discharges terminated in the 1970s
	Groundwater Discharges to Log Pond	**Controlled**
		- Monitoring indicates no continuing discharges affecting Log Pond sediments or water quality
	Log Pond Sediments	**Partially Controlled**
		- Area capped as part of interim action
		- Contingency actions to be included in final site cleanup to address erosion of the shoreline edges of the cap.
	Historic Dredge Disposal	**Controlled**
		- Rigorous dredge material characterization and management protocols now required by regulation and permit for all dredging projects
	Chlor-Alkali Plant Discharges to ASB	**Controlled**
		- Chlor-alkali plant was closed and demolished in 1999.
Phenolic Compounds	**Historic Pulp Mill Discharges to Waterway**	**Controlled**
		- NPDES Wastewater improvements implemented in the 1970s, including primary & secondary treatment, and termination of waterway discharges.
		- Early remedial efforts completed in the Whatcom Waterway included sediment removal actions in 1974
	Pulp Mill Discharges to ASB	**Controlled**
		- Pulp mill and associated chemical plant were closed in 2001.
	Wood Waste from Log Rafting	**Controlled**
		- Cargo shipments of logs and wood products have been reduced, and additional regulatory and permit-required pollution controls apply to log/wood handling activities.
	Historic Sewer Outfalls	**Controlled**
		- Sewage treatment and discharge improvements implemented in the 1960s and 1970s.
	Stormwater Discharges	**Controlled**
		- Ongoing stormwater system upgrades to reduce/eliminate CSO events.
		- No evidence of ongoing sediment impact in intermittent CSO area
		- Enhanced stormwater management practices, permitting and monitoring.

Notes:
This table summarizes primary sources of sediment contamination. Secondary sources of sediment contamination (i.e.,impacted sufrace sediment at the site) will be addressed by the cleanup of the Site.
Section 2 of the RI contains an overall history of the Whatcom Waterway site.
Section 6.1 of the RI includes a detailed discussion of site source control activities.

Table 2-2 Principal Site Investigations and Findings

Site Study Area	Study Topics	Investigations	Quick Reference to Relevant RI Report Sections
Whatcom Waterway and Other Areas Outside the ASB	Assess current site lithology, including the impacts of historic dredging and shoreline development activities	Site lithology characterized through review of historic records, review of historic sediment borings, and completion of extensive subsurface physical and chemical testing	Section 3.1 includes a discussion of site lithology, with accompanying geologic cross-sections developed from subsurface explorations.
	Delineate the nature & extent of impacts to surface sediments	Surface sediment testing performed using chemical testing and whole-sediment bioassays	Section 5.2 figures, tables and text summarize the results of chemical and bioassay testing.
	Assess the natural recovery processess occurring at the Site.	Natural recovery processes studied with cores and sediment traps, modeled quantitatively and then verified through chemical testing	Section 6.2 describes the natural recovery process evaluation conducted at the Site. Changes in surface sediment conditions over time are documented in Section 5.2.
	Evaluate the nature & extent of subsurface sediment impacts	Core sampling used to directly assess the nature and extent of subsurface sediment impacts	Subsurface sediment quality summarized in Section 5.3. Refer also to the cross-sections and the lithology discussion in Section 3.1.
	Assess potential dredge disposal properties of waterway sediments	Dredge disposal suitability testing performed in support of the Feasibility Study	Previous dredge material evaluations summarized in Section 7, and in Appendix H.
Log Pond	Delineate surface & subsurface impacted sediments	RI activities included surface and subsurface testing prior to implementation of Log Pond Interim Action	Surface and subsurface sediment quality data are summarized in Section 5.2 and 5.3.
	Monitor effectiveness of Interim Action and assess the need for contingent actions	Effectiveness of Interim Action has been assessed through implementation of Year-1, Year-2 and Year-5 monitoring events	The Year-5 Log Pond Monitoring report is attached as Appendix I. Proposed contingency actions are discussed in Appendix D of the Site Feasibility Study.
	Assess the potential application of *in situ* treatment technologies at the Site	Electro-chemical reductive technology (ECRT) pilot test performed in support of the Feasibility Study	Results of ECRT pilot testing are summarized in Section 7.
ASB	Assess current site lithology, including the impacts of historic dredging and shoreline development activities	Site lithology characterized through review of historic records, review of historic sediment borings, and completion of extensive subsurface physical and chemical testing	Section 3.1 includes a discussion of site lithology, with accompanying geologic cross-sections developed from subsurface explorations.
	Assess the volume and thickness of the ASB sludges	Bathymetric and invasive physical testing used to quantify the volume of the ASB sludges	Bathymetric data are summarized in Section 3.1 and accompanying figures. Physical testing data are summarized in Appendix C and Appendix D to the RI.
	Assess the chemical properties of ASB Sludges	Core sampling used to document concentrations of mercury, phenolic compounds and other contaminants in ASB sludges.	Chemical properties of the ASB sludges are summarized in Section 5.3 and the accompanying figures and tables, and in Appendix C.
	Evaluate the characteristics of the ASB berm materials	Berm sand quality assessed through direct chemical and physical testing, to assess potential for reuse of these materials.	Chemical properties of the berm sands are summarized in Section 5.3 and the accompanying figures and tables, and in Appendix D.
	Quantify the characteristics of the sands underlying the ASB	Chemical and physical testing performed for the sands underlying the ASB sludges	Chemical properties of the berm sands are summarized in Section 5.3 and the accompanying figures and tables, and in Appendix C.
	Assess the physical properties of the sludges relevant to Site remedial decisions	Physical properties of the sludges assessed through physical and geotechnical testing, and during dewatering tests performed in support of the Feasibility Study.	Geotechnical properties of ASB materials are included in Appendix C. Dewatering test results are summarized in Section 7, and in Appendix D.
Starr Rock	Define the historic dredge disposal area	Area of dredge disposal defined through review of historic records, site bathymetric monitoring, and surface sediment testing	Disposal site location identified in Figure 3-1. Sediment quality data are summarized in Section 5.2 and in associated figures and tables.

Table 2-3 Exposure Pathways and Receptors

Receptor	Exposure Pathway	Basis for Evaluating Protectiveness
Benthic Organisms	Direct toxicity to benthic/epibenthic invertebrates	Screening for areas of potential impact using SMS numeric standards
		Verification using whole-sediment bioassays and SMS interpretive criteria
Human Health	Contaminant exposure through consumption of seafood containing bioaccumulated mercury and/or methylmercury	Development of a site-specific BSL as part of 2000 RI/FS activities to identify sediment concentrations that will prevent significant bioaccumulation impacts
		Conservative application of BSL in site decision-making to ensure a substantial additional degree of protectiveness
Ecological Health	Exposure of higher trophic level wildlife (e.g., whales) through consumption of benthic organisms	BSL assessed to verify its protectiveness of potential wildlife exposures
		Verification of BSL protectiveness through sediment bioaccumulation tests and seafood tissue monitoring
Other Considerations	Cross-media transfers (e.g., contaminant leaching) and subsequent exposure to human health or environmental receptors	Contaminant mobility studies conducted in support of Feasibility Study and Remedial Design efforts
	Direct contact of human health and ecological receptors at dredge disposal locations	Applicable regulatory standards for dredge disposal scenarios evaluated as part of Feasibility Study

Notes:

Section 4 of the RI Report contains a summary of exposure pathways and receptors, and a discussion of the screening levels used to evaluate the protectiveness of site conditions under these exposure conditions.

Table 4-1 Concise Summary of Remedial Alternatives & Technologies Applied

Alternative Number	Probable Cost ($million)	Institutional Controls	Monitored Natural Recovery	Containment	Removal & Disposal	Treatment	Reuse & Recycling
Alt. 1	$8	Yes	Yes	Yes	—	—	—
Alt. 2	$34	Yes	Yes	Yes	—	—	—
Alt. 3	$34	Yes	Yes	Yes	—	—	—
Alt. 4	$21	Yes	Yes	Yes	Yes	—	—
Alt. 5	$42	Yes	Yes	Yes	Yes	Yes	Yes
Alt. 6	$44	Yes	Yes	Yes	Yes	Yes	Yes
Alt. 7	$75	Yes	Yes	Yes	Yes	Yes	Yes
Alt. 8	$146	Yes	Yes	Yes	Yes	Yes	Yes

Table 5-1 Detailed MTCA Evaluation of Alternatives

Alternative Number	**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)	$42	$44	$75	$146
Design Concept	Figure 4-5	Figure 4-6	Figure 4-7	Figure 4-8
Alternative Description				
Areas Outside the ASB	Outer Waterway: Dredging and capping adjacent to the Bellingham Shipping Terminal; Inner Waterway: Dredging and capping of planned multi-purpose channel configuration; Areas Outside of Waterway: Capping and Monitored Natural Recovery (MNR). Dredged sediments will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Outer Waterway: Dredging adjacent to the Bellingham Shipping Terminal; Inner Waterway: Dredging and capping of planned multi-purpose channel configuration; Areas Outside of Waterway: Capping and MNR. Dredged sediments will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Outer Waterway: Dredging adjacent to the Bellingham Shipping Terminal; Inner Waterway: Dredging and capping of historic 1960s industrial channel configuration; Areas Outside the Waterway: Capping and MNR. Dredged sediments will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Outer Waterway: Dredging adjacent to the Bellingham Shipping Terminal; Inner Waterway: Dredging and capping of historic 1960s industrial channel configuration; Areas Outside the Waterway: Dredging. Dredged sediments will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.
Volume of Sediment Dredged With PSDDA Disposal and Reuse (yd^3)	124,399	124,399	124,399	124,399
Volume of Sediment Dredged and Disposed with Upland Disposal (yd^3)	86,331	133,099	529,799	1,385,339
Capped Area (acres)	43	32	36	23
ASB	Sludges removed and berm opened. Sludges dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.	Sludges removed and berm opened. Sludges dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.	Sludges removed and berm opened. Sludges dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.	Sludges removed and berm opened. Sludges dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.
Volume of Sludge Dredged and Disposed with Upland Disposal (yd^3)	416,444	416,444	416,444	416,444

Table 5-1 Detailed MTCA Evaluation of Alternatives

Alternative Number	Alt. 5	Alt. 6	Alt. 7	Alt. 8
Probable Cost ($Million)	$42	$44	$75	$146
Design Concept	Figure 4-5	Figure 4-6	Figure 4-7	Figure 4-8
Basis for Alternative Ranking Under MTCA & SMS (Cont'd)				
1 **Compliance with MTCA Threshold Criteria** [1] *(WAC 173-340-360(2)(a))*				
Protection of Human Health & Environment	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.
Compliance with Cleanup Standards	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.
Compliance with Applicable State & Federal Laws	Yes -- Alternative complies with applicable laws.	Yes -- Alternative complies with applicable laws.	Yes -- Alternative complies with applicable laws.	Yes -- Alternative complies with applicable laws.
Provision for Compliance Monitoring	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.
2 **Restoration Time-Frame** *(WAC 173-340-360(2)(b)(ii))*	Restoration time-frame is 5 to 6 years for design and construction.	Restoration time-frame is with 5 to 6 years for design and construction.	Restoration time-frame is 5 to 8 years for design and construction.	Restoration time-frame is 8 to 13 years for design and construction.
3 **Evaluation of Permanence Using MTCA Disproportionate Cost Analysis** *(WAC 173-340-360(2)(b)(i) & WAC 173-340-360(3)(f))*				
Overall Protectiveness	Alternative makes use of active remediation and off-site disposal. Establishment of consistent waterway depths and stable side-slopes reduces risk of recontamination and/or shoreline erosion.	Alternative makes greater use of active remediation and off-site disposal. Establishment of consistent waterway depths and stable side-slopes reduces risk of recontamination and/or shoreline erosion.	Alternative makes greater use of active remediation and off-site disposal. Alternative requires shoreline infrastructure improvements to prevent shoreline instability in Inner Waterway.	Alternative makes greatest use of active remediation and off-site disposal. Alternative requires shoreline infrastructure improvements to prevent shoreline instability in Inner Waterway.
Permanence	Alternative reduces the volume of impacted material by completely removing the ASB sludges and partially removing impacted subsurface sediments in the Waterway. Remaining impacted sediments are capped.	Alternative reduces the volume of impacted material by completely removing the ASB sludges and impacted subsurface sediment in the Outer Waterway adjacent to the Bellingham Shipping Terminal. Impacted subsurface sediments in the Inner Waterway are partially removed. Remaining impacted sediments are capped.	Alternative reduces the volume of impacted material by completely removing the ASB sludges and impacted subsurface sediment in the Outer Waterway adjacent to the Bellingham Shipping Terminal. A greater volume of impacted subsurface sediment is removed from the Inner Waterway. Remaining impacted sediments are capped.	Alternative reduces the volume of impacted material by completely removing, to greatest degree technically feasible, impacted surface and subsurface sediments throughout the Site. Remaining impacted sediments are capped.
Remedy Costs	$42 Million	$44 Million	$74 Million	$146 Million

Table 5-1 Detailed MTCA Evaluation of Alternatives

Alternative Number	**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)	$42	$44	$75	$146
Design Concept	Figure 4-5	Figure 4-6	Figure 4-7	Figure 4-8
Long-Term Effectiveness	Alternative makes least use of upland disposal and most use of containment. Dewatering treatment performed on ASB sludges. Clean ASB berm materials reused.	Alternative makes greater use of upland disposal. Dewatering treatment performed on ASB sludges. Clean ASB berm materials reused.	Alternative makes greater use of upland disposal. Dewatering treatment performed on ASB sludges. Clean ASB berm materials reused.	Alternative makes greatest use of upland disposal and the least use of containment. Dewatering treatment performed on ASB sludges. Clean ASB berm materials reused.
Short-Term Risk Management	Work in Waterway and harbor areas to be completed within two construction seasons. Most ASB remediation activities to take place prior to opening of ASB berm, reducing short-term risks to water quality.	Work in Waterway and harbor areas to be completed within two construction seasons. Most ASB remediation activities to take place prior to opening of ASB berm, reducing short-term risks to water quality.	Alternative requires three to four in-water construction seasons. Extensive off-site transportation of sediments and sludges required. Deep dredging within Inner Waterway will destabilize shorelines and must be coordinated with upgrades in shoreline infrastructure.	Alternative involves between five and seven construction seasons to complete in-water dredging and off-site sediment transport. Highest degree of water quality and safety risks of evaluated Alternatives. Deep dredging within Inner Waterway will destabilize shorelines and must be coordinated with upgrades in shoreline infrastructure.
Implementability	Construction activities are complex, but use only established technologies. Dredging plan for Inner Waterway consistent with land use, navigation, and habitat enhancement plans.	Construction activities are complex, but use only established technologies. Dredging plan for Inner Waterway consistent with land use, navigation, and habitat enhancement plans.	Alternative has greater complexity and short-term risks. Dredging plan for Inner Waterway conflicts with land use, navigation and habitat enhancement plans. Requires upgrades in waterfront infrastructure, that must be coordinated with Waterway dredging.	Alternative has greaterest complexity and short-term risks. Dredging plan for Inner Waterway conflicts with land use, navigation, and habitat enhancement plans. Requires upgrades in waterfront infrastructure, that must be coordinated with Waterway dredging.
Consideration of Public Concerns	Alternative is consistent with land use, navigation, and habitat enhancement plans. Alternative does not maximize removal and upland disposal.	Alternative is consistent with land use, navigation, and habitat enhancement plans. While a greater volume of impacted sediments are removed and disposed upland under this Alternative, more is needed.	Alternative conflicts with land use, navigation and habitat enhancement plans. While an even greater volume of impacted sediment is removed and disposed upland under this Alternative, more is needed.	Alternative conflicts with land use, navigation and habitat enhancement plans. Alternative maximizes removal and upland disposal.

Notes:

Refer to Section 4 for a detailed description of each alternative.

1: All evaluated alternatives comply with the MTCA threshold criteria, as required by regulation.

Table 5-2 Summary of MTCA Alternatives Evaluation and Ranking

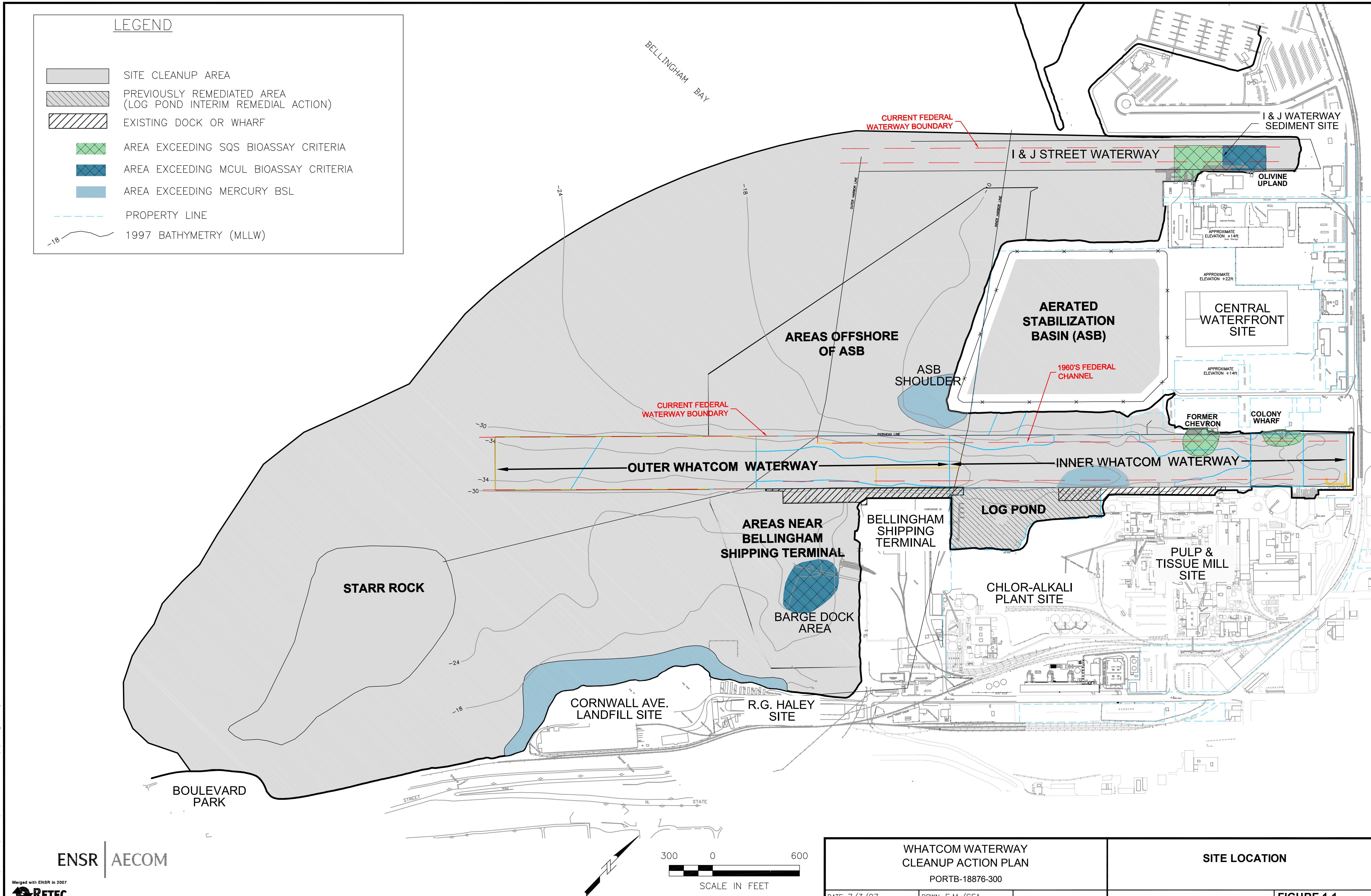
Alternative Number		**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)		$42	$44	$75	$146
Overall Alternative Ranking		**6.2**	**6.9**	**6.8**	**6.9**
Alternative Description					
Areas Outside the ASB					
Outer Waterway		Removal and disposal. Capping at BST	Removal and disposal	Removal and disposal	Removal and disposal
Inner Waterway		Removal, upland disposal and capping of planned multi-purpose channel	Removal, upland disposal and capping of planned multi-purpose channel	Removal, upland disposal and capping of historic industrial channel	Removal, upland disposal and capping of historic industrial channel
Areas Outside Waterway		Capping and MNR	Capping and MNR	Capping and MNR	Removal and upland disposal
ASB		Removal and upland disposal	Removal and upland disposal	Removal and upland disposal	Removal and upland disposal
Basis for Alternative Ranking Under MTCA & SMS					
1 **Compliance with MTCA Threshold Criteria** [1] *(WAC 173-340-360(2)(a))*		Yes	Yes	Yes	Yes
2 **Restoration Time-Frame** *(WAC 173-340-360(2)(b)(ii))*		5 to 6 yrs	5 to 6 yrs	5 to 8 yrs	8 to 13 yrs
3 **Relative Benefits Ranking for Disproportionate Cost Analysis** *(WAC 173-340-360(2)(b)(i) & WAC 173-340-360(3)(f))*	**Ecology Weighting Factor**				
Overall Protectiveness	**30%**	**5** Waterway addressed Sludges Removed Slopes Stabilized	**6** Waterway addressed Sludges Removed Slopes Stabilized	**7** Waterway addressed Sludges Removed Additional Removal	**8** Waterway addressed Sludges Removed Most Removal
Permanence	**20%**	**5** Medium Permanence	**6** Medium Permanence	**7** More Permanence	**8** Most Permanent
Long-Term Effectiveness	**20%**	**7** More Upland Disp. Also Capping & Monitored Natural Recovery	**8** More Upland Disp. Also Capping & Monitored Natural Recovery	**9** More Upland Disp. Also Capping & Monitored Natural Recovery	**9** Most Upland Disp. Also Capping & Monitored Natural Recovery
Short-Term Risk Management	**10%**	**8** Lower In-Water Work Slopes Stabilized	**7** Lower In-Water Work Slopes Stabilized	**6** More In-Water Work Slope Stability Concerns	**4** Most In-Water Work Slope Stability Concerns
Implementability	**10%**	**8** Most Implementable	**8** Most Implementable	**4** Shoreline Infrastructure	**3** Shoreline Infrastructure Overall Difficulty
Consideration of Public Concerns	**10%** (excluding above factors)	**7** Removal (+) Still too Much Hg (-) Consistent with use plans (+)	**8** More Removal (+) Still too Much Hg (-) Consistent with use plans (+)	**5** More Removal (+) Habitat Destruction (-) Conflicts with use plans (-)	**4** Most Removal (+) Habitat Destruction (-) Conflicts with use plans (-)

Notes:

Refer to Section 4 for additional description of the remedial alternatives, and to Table 5-1 for a description of the factors considered in evaluation of these alternatives under MTCA and SMS.

1: All evaluated alternatives comply with the MTCA threshold criteria, as required by regulation.

Figures



WHATCOM WATERWAY CLEANUP ACTION PLAN

PORTB-18876-300

DATE: 7/3/07 DRWN: E.M./SEA

SITE LOCATION

FIGURE 1-1

File: H:\18876\DCAP\18876DCAP011(D).dwg Layout: FIGURE 1-1 User: emarshall Plotted: Jul 03, 2007 - 3:03pm Xref's:

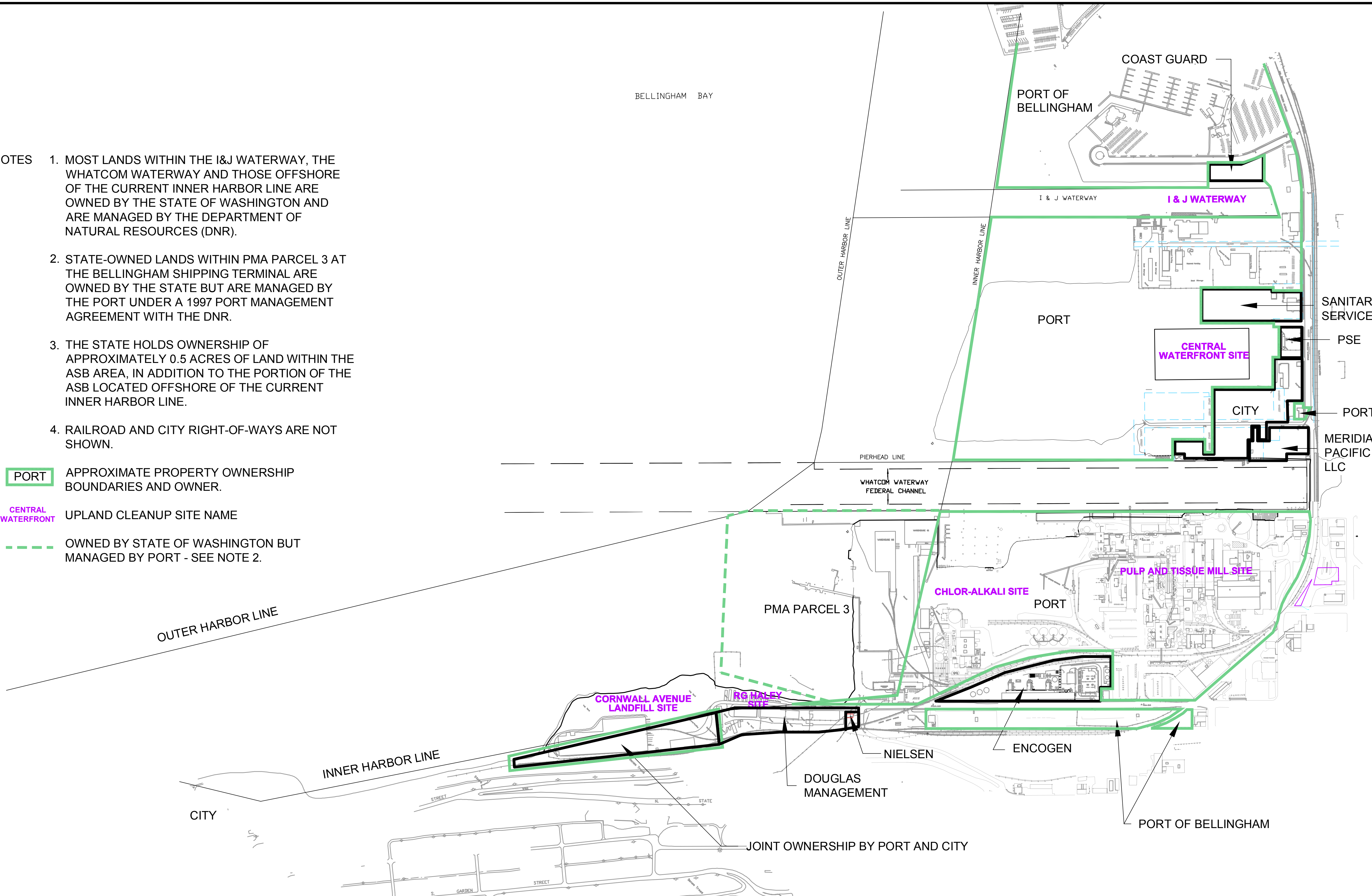
NOTES

1. MOST LANDS WITHIN THE I&J WATERWAY, THE WHATCOM WATERWAY AND THOSE OFFSHORE OF THE CURRENT INNER HARBOR LINE ARE OWNED BY THE STATE OF WASHINGTON AND ARE MANAGED BY THE DEPARTMENT OF NATURAL RESOURCES (DNR).
2. STATE-OWNED LANDS WITHIN PMA PARCEL 3 AT THE BELLINGHAM SHIPPING TERMINAL ARE OWNED BY THE STATE BUT ARE MANAGED BY THE PORT UNDER A 1997 PORT MANAGEMENT AGREEMENT WITH THE DNR.
3. THE STATE HOLDS OWNERSHIP OF APPROXIMATELY 0.5 ACRES OF LAND WITHIN THE ASB AREA, IN ADDITION TO THE PORTION OF THE ASB LOCATED OFFSHORE OF THE CURRENT INNER HARBOR LINE.
4. RAILROAD AND CITY RIGHT-OF-WAYS ARE NOT SHOWN.

PORT — APPROXIMATE PROPERTY OWNERSHIP BOUNDARIES AND OWNER.

CENTRAL WATERFRONT — UPLAND CLEANUP SITE NAME

OWNED BY STATE OF WASHINGTON BUT MANAGED BY PORT - SEE NOTE 2.



350 0 700

SCALE IN FEET

ENSR | AECOM

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WHATCOM WATERWAY CLEANUP ACTION PLAN	PROPERTY OWNERSHIP
DATE: 7/3/07 DRWN: E.M./SEA	FIGURE 1-2

File: H:\18876\DCAP\18876DCAP012.dwg Layout: FIGURE 1-2 User: emarshall Plotted: Jul 03, 2007 - 3:06pm Xref's:

Figure 2-1
Conceptual Site Model – Part 1 of 2
(Log Pond and Waterway Areas)

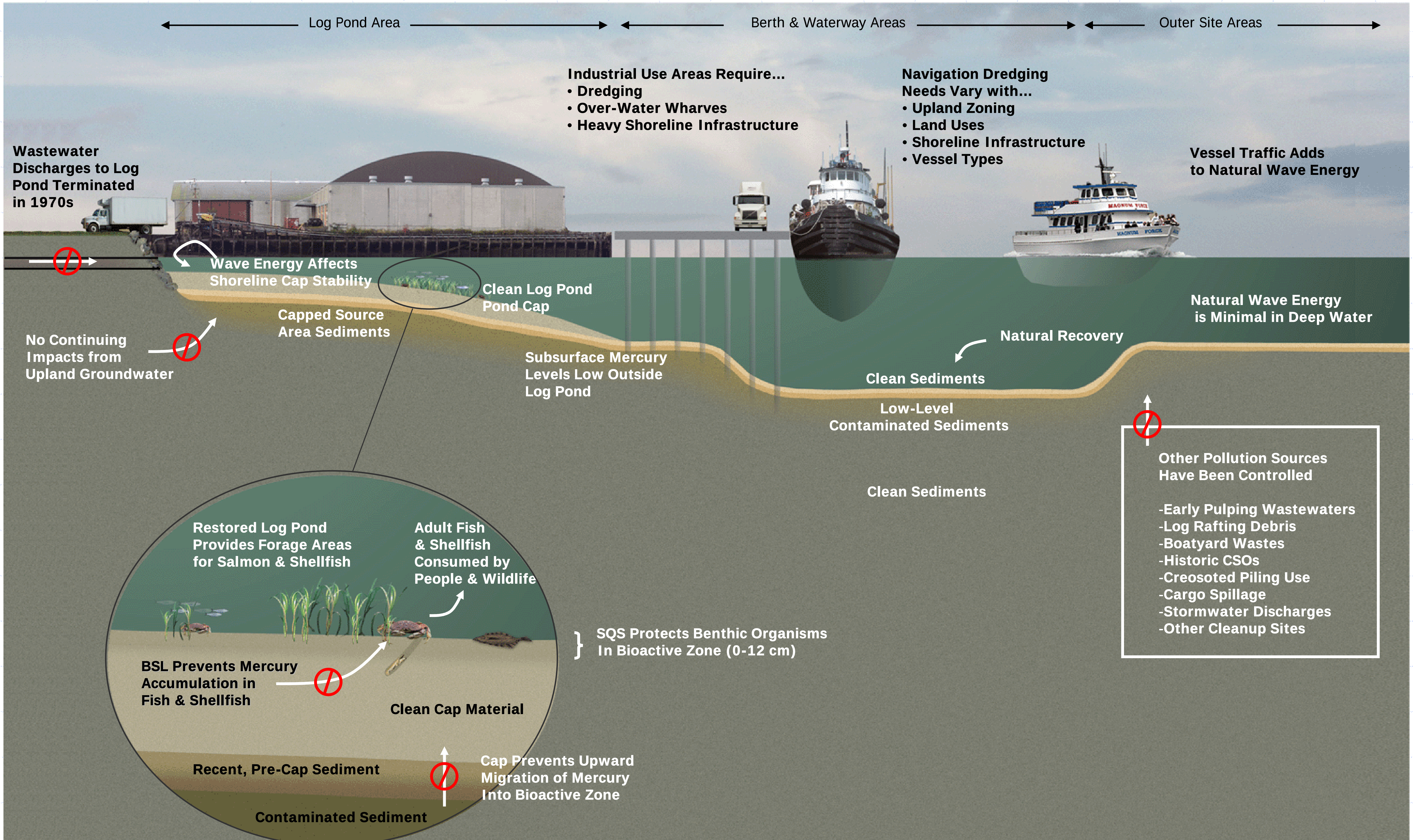
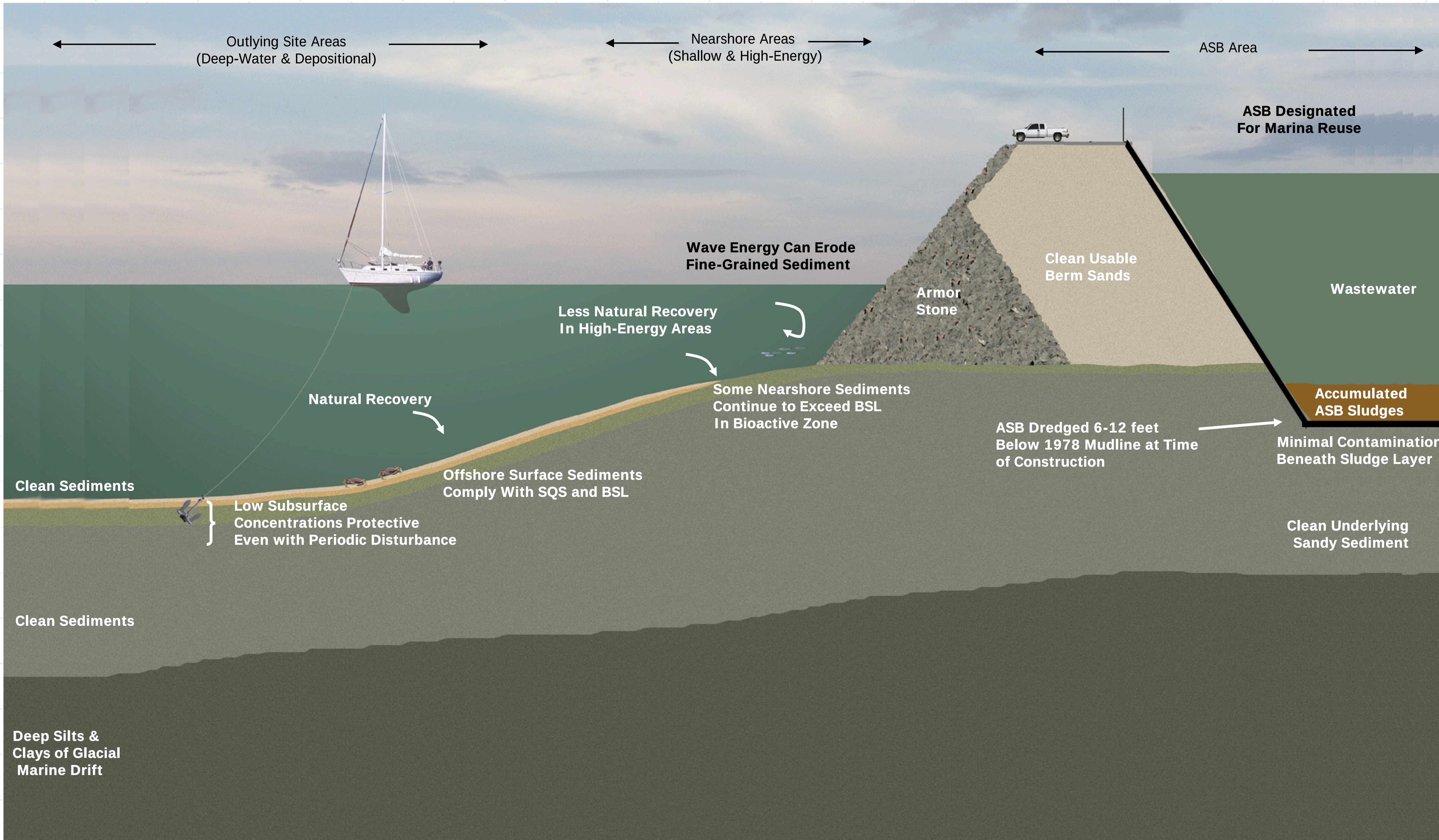
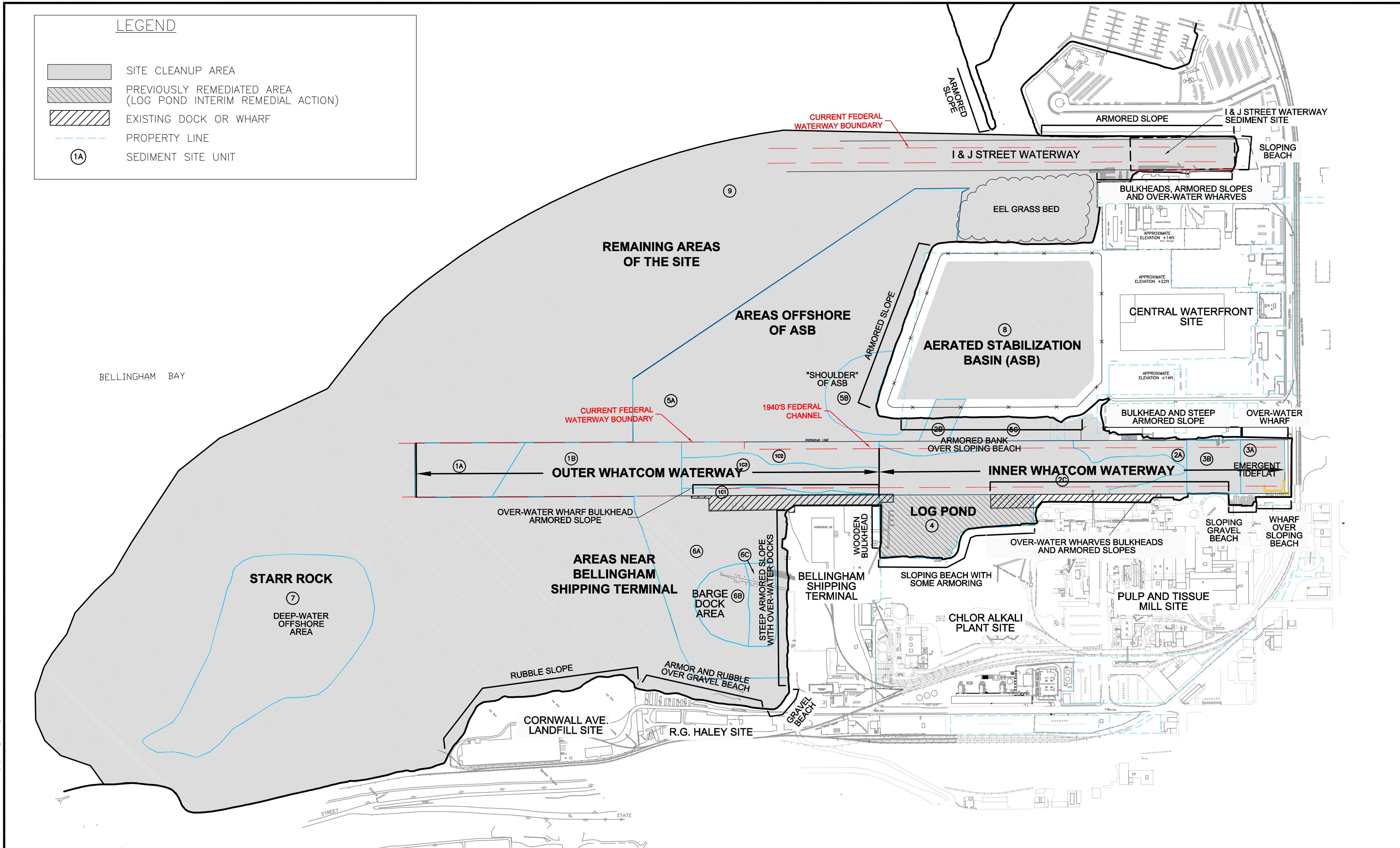


Figure 2-2
Conceptual Site Model – Part 2 of 2
(ASB and Outlying Site Areas)





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WHATCOM WATERWAY CLEANUP ACTION PLAN

PORTB-18876-300

WHATCOM WATERWAY SITE UNITS

DATE: 7/3/07 | DRWN: E.M./SEA

FIGURE 2-3

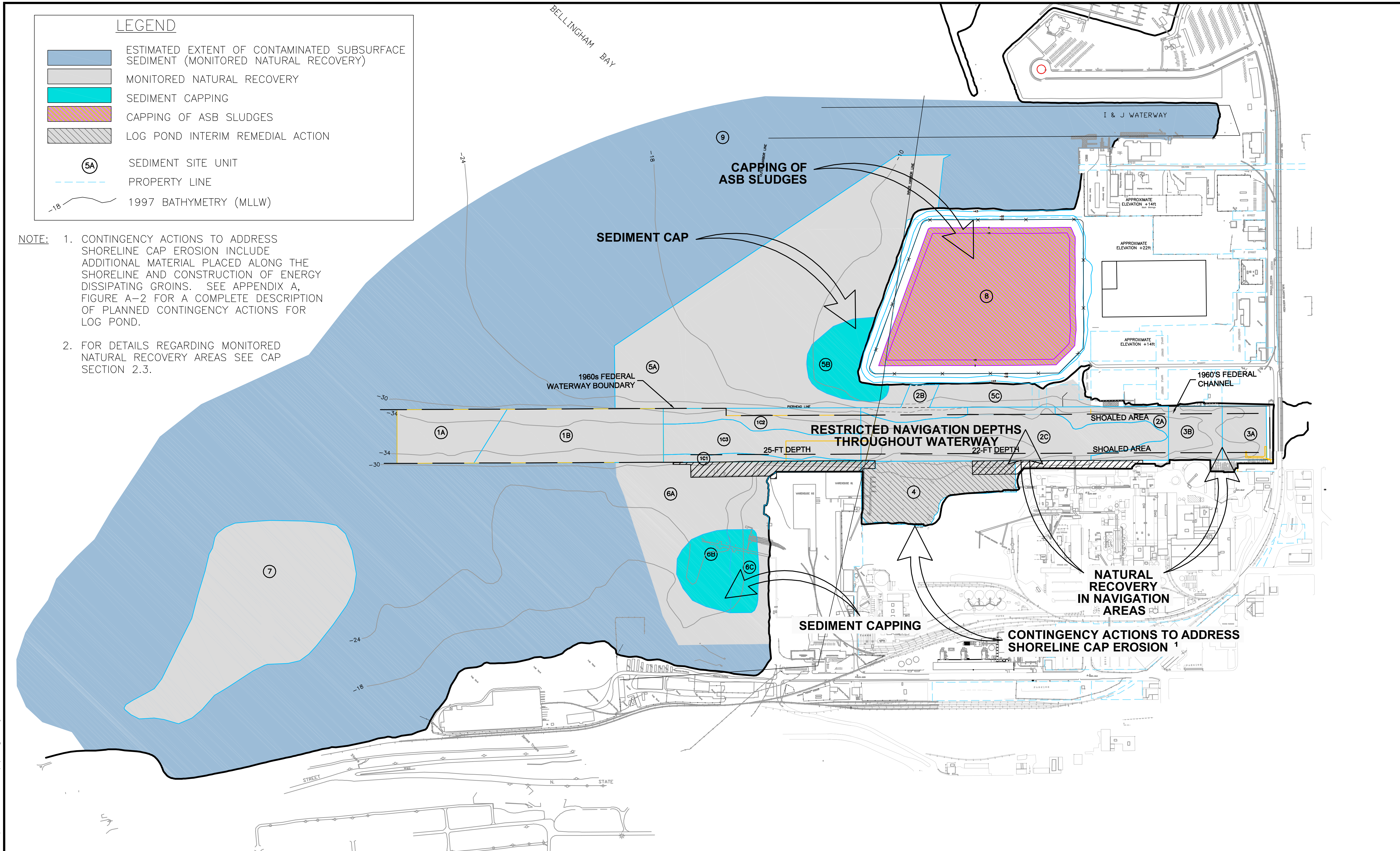
File: H:\18876\DCAP\18876DCAP013(b).dwg Layout: FIGURE 2-3 User: emarshall Plotted: Jul 03, 2007 - 3:31pm Xref's:

LEGEND

- ESTIMATED EXTENT OF CONTAMINATED SUBSURFACE SEDIMENT (MONITORED NATURAL RECOVERY)
- MONITORED NATURAL RECOVERY
- SEDIMENT CAPPING
- CAPPING OF ASB SLUDGES
- LOG POND INTERIM REMEDIAL ACTION
- (5A) SEDIMENT SITE UNIT
- PROPERTY LINE
- -18 1997 BATHYMETRY (MLLW)

NOTE:
1. CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION INCLUDE ADDITIONAL MATERIAL PLACED ALONG THE SHORELINE AND CONSTRUCTION OF ENERGY DISSIPATING GROINS. SEE APPENDIX A, FIGURE A-2 FOR A COMPLETE DESCRIPTION OF PLANNED CONTINGENCY ACTIONS FOR LOG POND.

2. FOR DETAILS REGARDING MONITORED NATURAL RECOVERY AREAS SEE CAP SECTION 2.3.



300 0 600
SCALE IN FEET

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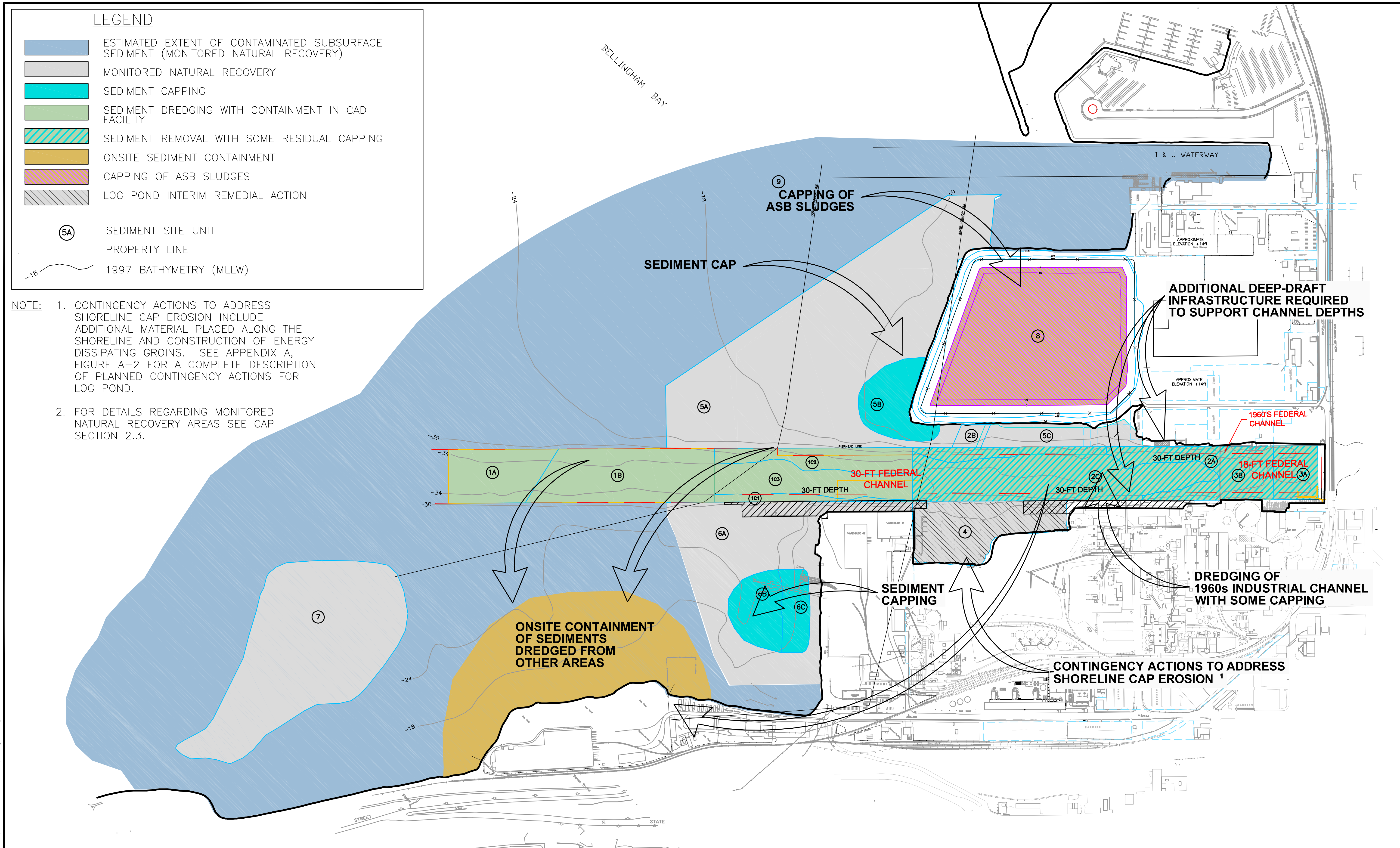
RETEC

WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	DESIGN CONCEPT ALTERNATIVE 1
DATE: 7/5/07 DRWN: E.M./SEA	FIGURE 4-1

File: H:\18876\DCAP\18876DCAP003(B).dwg Layout: FIGURE 4-1 User: emarshall Plotted: Jul 05, 2007 - 9:40am Xref's:



ENSR | AECOM

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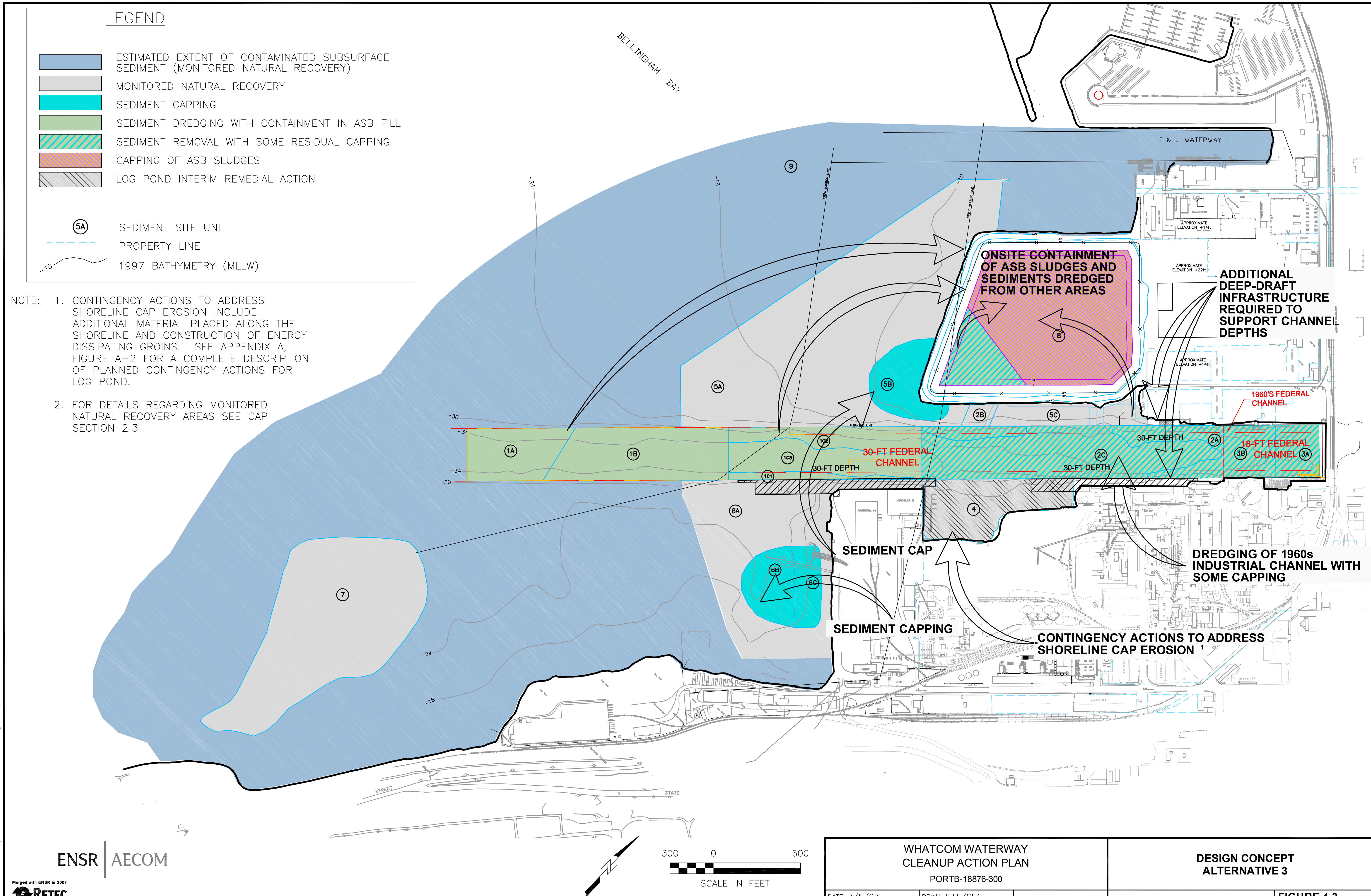
300 0 600

SCALE IN FEET

WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	DESIGN CONCEPT ALTERNATIVE 2
DATE: 7/5/07 DRWN: E.M./SEA	FIGURE 4-2

File: H:\18876\DCAP\18876DCAP004(B).dwg Layout: FIGURE 4-2 User: emarshall Plotted: Jul 05, 2007 - 9:42am Xref's:



LEGEND

- ESTIMATED EXTENT OF CONTAMINATED SUBSURFACE SEDIMENT (MONITORED NATURAL RECOVERY)
- MONITORED NATURAL RECOVERY
- SEDIMENT CAPPING
- SEDIMENT DREDGING WITH CONTAINMENT IN ASB FILL
- SEDIMENT REMOVAL WITH SOME RESIDUAL CAPPING
- CAPPING OF ASB SLUDGES
- LOG POND INTERIM REMEDIAL ACTION
- 5A SEDIMENT SITE UNIT
- PROPERTY LINE
- -18 1997 BATHYMETRY (MLLW)

NOTE:
1. CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION INCLUDE ADDITIONAL MATERIAL PLACED ALONG THE SHORELINE AND CONSTRUCTION OF ENERGY DISSIPATING GROINS. SEE APPENDIX A, FIGURE A-2 FOR A COMPLETE DESCRIPTION OF PLANNED CONTINGENCY ACTIONS FOR LOG POND.
2. FOR DETAILS REGARDING MONITORED NATURAL RECOVERY AREAS SEE CAP SECTION 2.3.

File: H:\18876\DCAP\18876DCAP005(B).dwg Layout: FIGURE 4-3 User: emarshall Plotted: Jul 05, 2007 - 9:43am Xref's:

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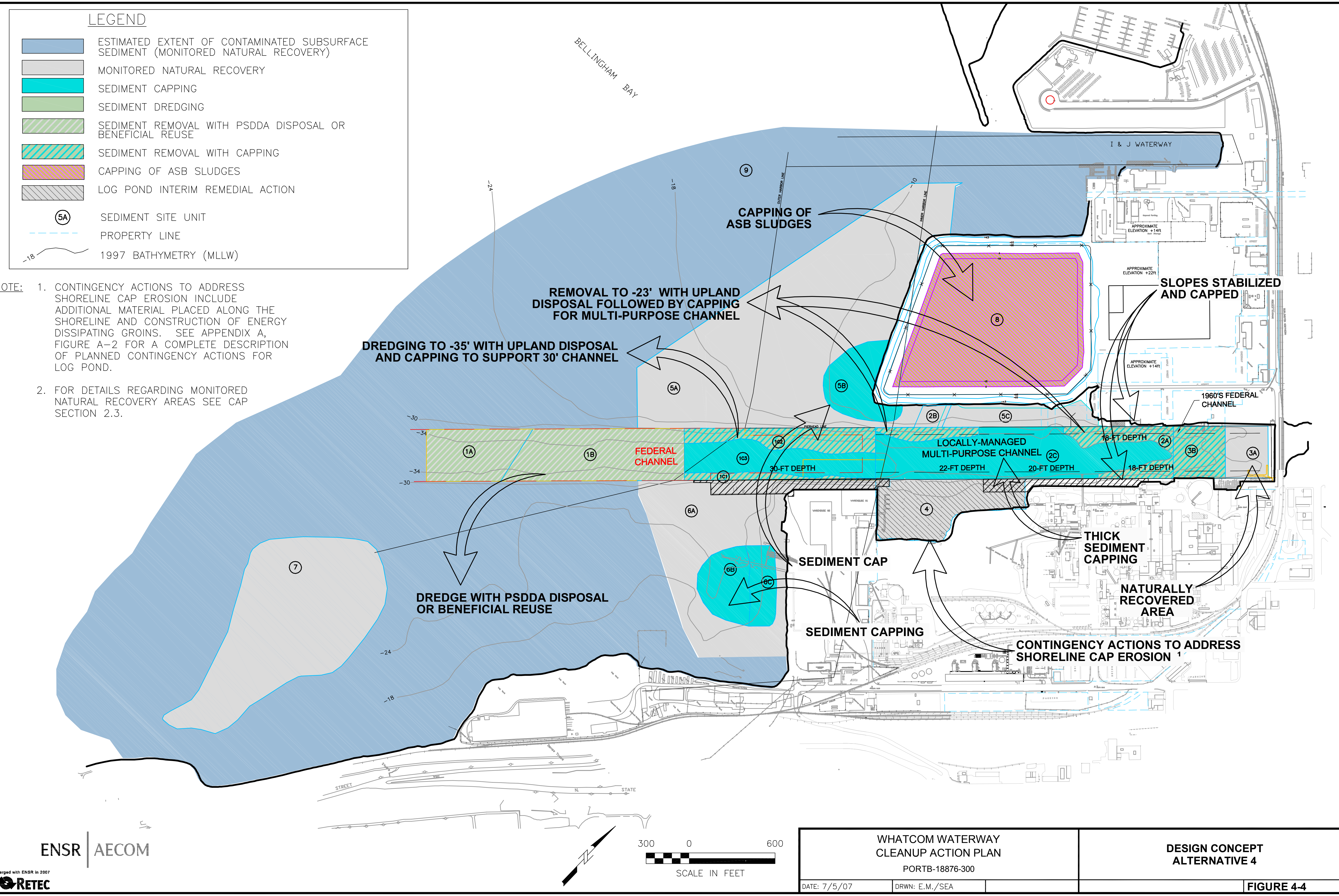
WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	DESIGN CONCEPT ALTERNATIVE 3
DATE: 7/5/07 DRWN: E.M./SEA	FIGURE 4-3



NOTE:

1. CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION INCLUDE ADDITIONAL MATERIAL PLACED ALONG THE SHORELINE AND CONSTRUCTION OF ENERGY DISSIPATING GROINS. SEE APPENDIX A, FIGURE A-2 FOR A COMPLETE DESCRIPTION OF PLANNED CONTINGENCY ACTIONS FOR LOG POND.
2. FOR DETAILS REGARDING MONITORED NATURAL RECOVERY AREAS SEE CAP SECTION 2.3.

File: H:\18876\DCAP\18876DCAP006(B).dwg Layout: FIGURE 4-4 User: emarshall Plotted: Jul 05, 2007 - 9:44am Xref's:

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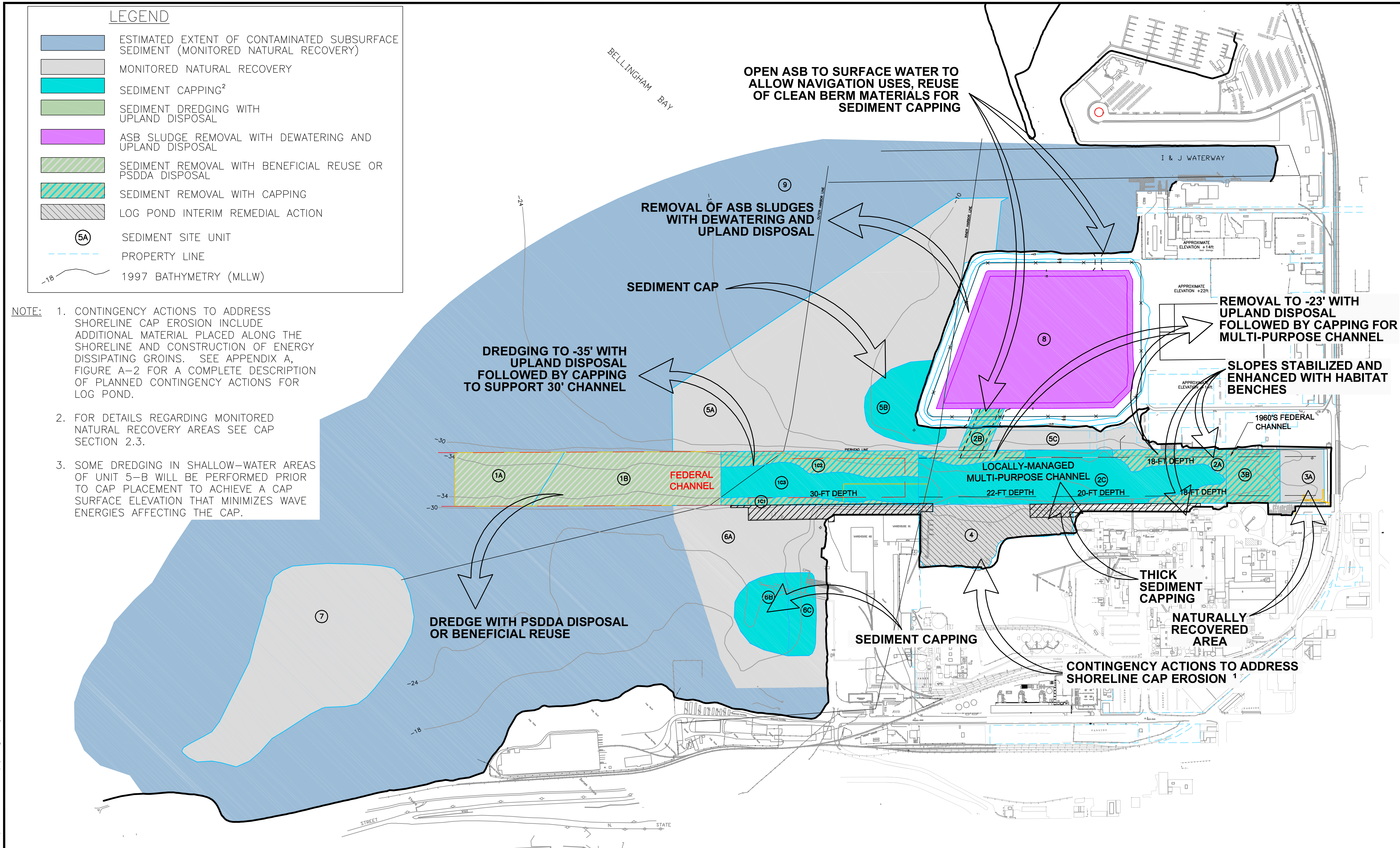
WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	DESIGN CONCEPT ALTERNATIVE 4
DATE: 7/5/07 DRWN: E.M./SEA	FIGURE 4-4



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WHATCOM WATERWAY CLEANUP ACTION PLAN

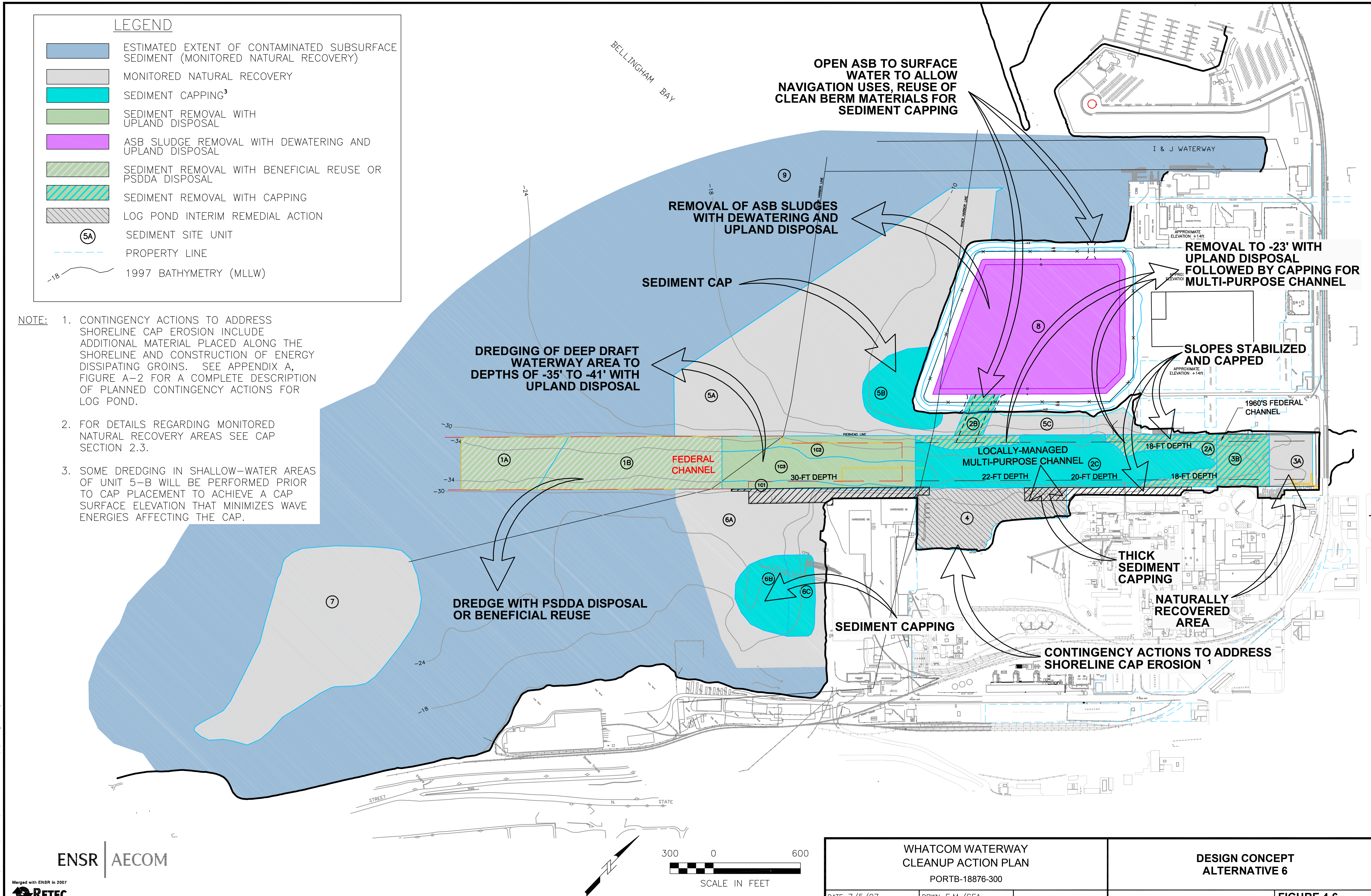
PORTB-18876-300

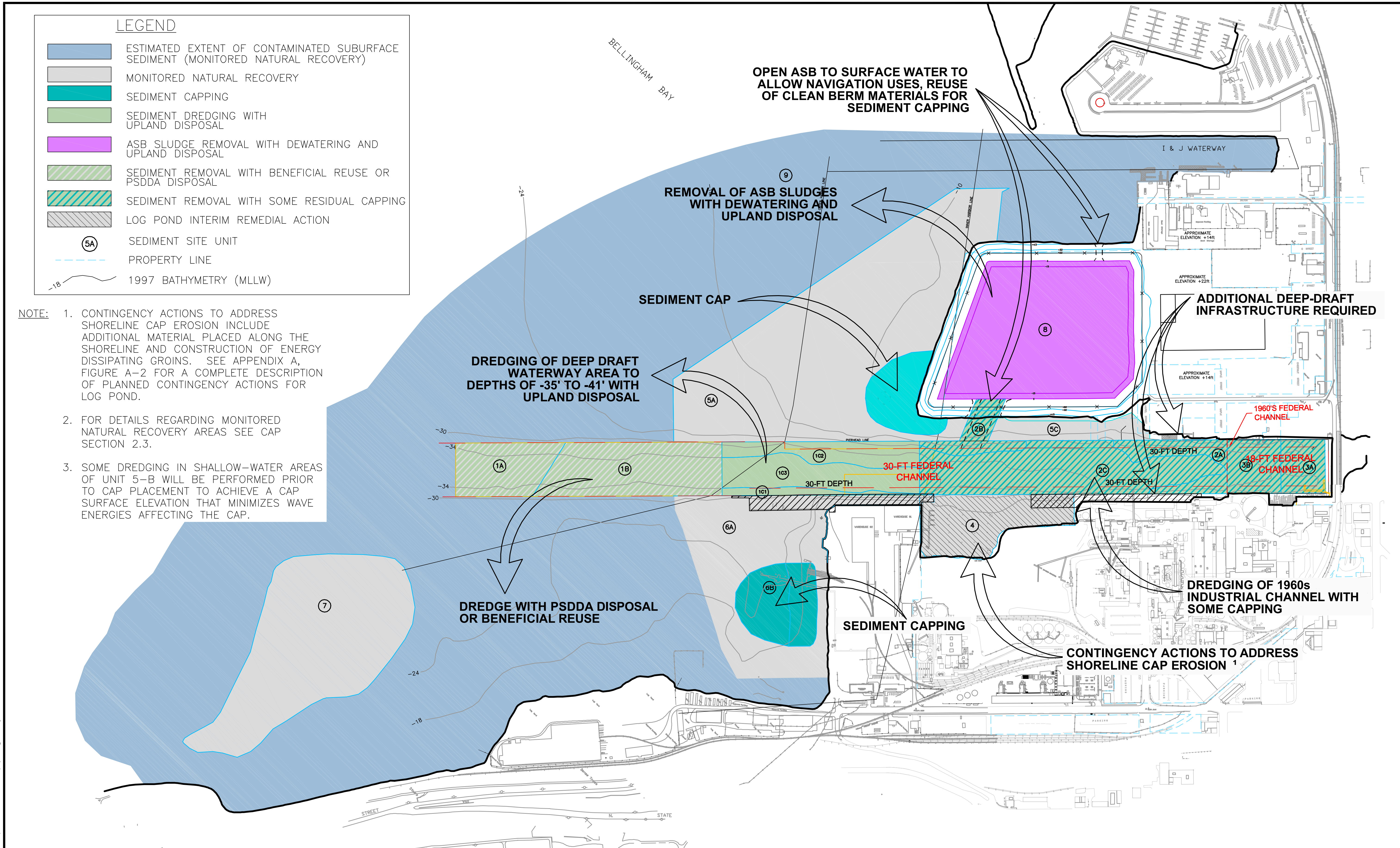
DATE: 7/5/07 DRWN: E.M./SEA

DESIGN CONCEPT ALTERNATIVE 5

FIGURE 4-5

File: H:\18876\DCAP\18876DCAP007(B).dwg Layout: FIGURE 4-5 User: emarshall Plotted: Jul 05, 2007 - 9:45am Xref's:


LEGEND
ESTIMATED EXTENT OF CONTAMINATED SUBSURFACE SEDIMENT (MONITORED NATURAL RECOVERY)
MONITORED NATURAL RECOVERY
SEDIMENT CAPPING[3]
SEDIMENT REMOVAL WITH UPLAND DISPOSAL
ASB SLUDGE REMOVAL WITH DEWATERING AND UPLAND DISPOSAL
SEDIMENT REMOVAL WITH BENEFICIAL REUSE OR PSDDA DISPOSAL
SEDIMENT REMOVAL WITH CAPPING
LOG POND INTERIM REMEDIAL ACTION
5A SEDIMENT SITE UNIT
PROPERTY LINE
-18 1997 BATHYMETRY (MLLW)
NOTE:
1. CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION INCLUDE ADDITIONAL MATERIAL PLACED ALONG THE SHORELINE AND CONSTRUCTION OF ENERGY DISSIPATING GROINS. SEE APPENDIX A, FIGURE A-2 FOR A COMPLETE DESCRIPTION OF PLANNED CONTINGENCY ACTIONS FOR LOG POND.
2. FOR DETAILS REGARDING MONITORED NATURAL RECOVERY AREAS SEE CAP SECTION 2.3.
3. SOME DREDGING IN SHALLOW-WATER AREAS OF UNIT 5-B WILL BE PERFORMED PRIOR TO CAP PLACEMENT TO ACHIEVE A CAP SURFACE ELEVATION THAT MINIMIZES WAVE ENERGIES AFFECTING THE CAP.
BELLINGHAM BAY
I & J WATERWAY
OPEN ASB TO SURFACE WATER TO ALLOW NAVIGATION USES, REUSE OF CLEAN BERM MATERIALS FOR SEDIMENT CAPPING
REMOVAL OF ASB SLUDGES WITH DEWATERING AND UPLAND DISPOSAL
SEDIMENT CAP
REMOVAL TO -23' WITH UPLAND DISPOSAL FOLLOWED BY CAPPING FOR MULTI-PURPOSE CHANNEL
SLOPES STABILIZED AND CAPPED
1960'S FEDERAL CHANNEL
DREDGING OF DEEP DRAFT WATERWAY AREA TO DEPTHS OF -35' TO -41' WITH UPLAND DISPOSAL
FEDERAL CHANNEL
30-FT DEPTH
LOCALLY-MANAGED MULTI-PURPOSE CHANNEL
22-FT DEPTH
20-FT DEPTH
18-FT DEPTH
18-FT DEPTH
DREDGE WITH PSDDA DISPOSAL OR BENEFICIAL REUSE
SEDIMENT CAPPING
THICK SEDIMENT CAPPING
NATURALLY RECOVERED AREA
CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION [1]
1A 1B 1C1 1C2 1C3 2A 2B 2C 3A 3B 4 5A 5B 5C 6A 6B 6C 7 8 9
300 0 600
SCALE IN FEET
ENSR AECOM
Merged with ENSR in 2007
RETEC
File: H:\18876\DCAP\18876DCAP008(C).dwg Layout: FIGURE 4-6 User: emarshall Plotted: Jul 05, 2007 - 10:40am Xref's:
WHATCOM WATERWAY CLEANUP ACTION PLAN
PORTB-18876-300
DATE: 7/5/07
DRWN: E.M./SEA
DESIGN CONCEPT ALTERNATIVE 6
FIGURE 4-6



NOTE:

1. CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION INCLUDE ADDITIONAL MATERIAL PLACED ALONG THE SHORELINE AND CONSTRUCTION OF ENERGY DISSIPATING GROINS. SEE APPENDIX A, FIGURE A-2 FOR A COMPLETE DESCRIPTION OF PLANNED CONTINGENCY ACTIONS FOR LOG POND.
2. FOR DETAILS REGARDING MONITORED NATURAL RECOVERY AREAS SEE CAP SECTION 2.3.
3. SOME DREDGING IN SHALLOW-WATER AREAS OF UNIT 5-B WILL BE PERFORMED PRIOR TO CAP PLACEMENT TO ACHIEVE A CAP SURFACE ELEVATION THAT MINIMIZES WAVE ENERGIES AFFECTING THE CAP.

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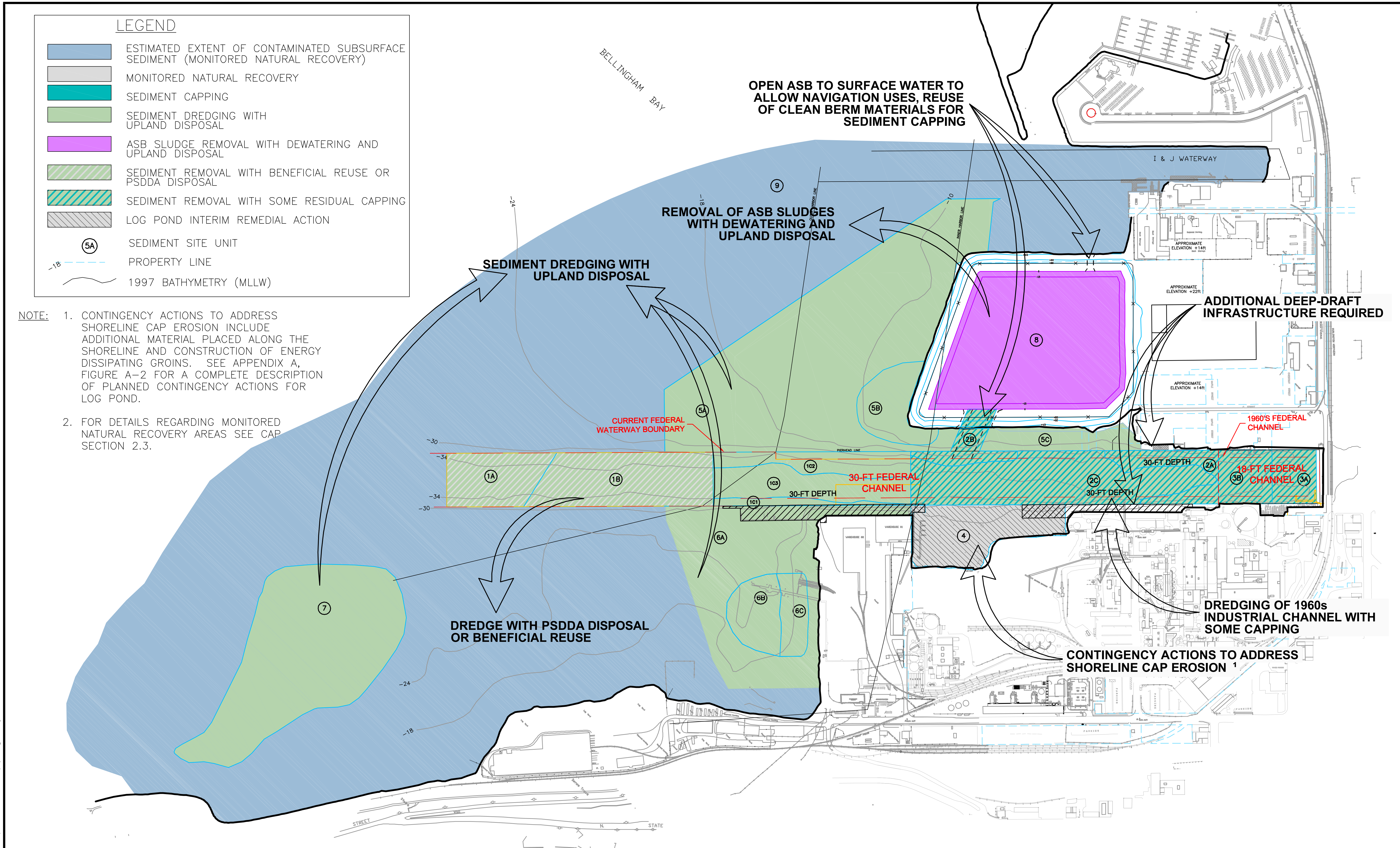
WHATCOM WATERWAY
CLEANUP ACTION PLAN
PORTB-18876-300

DATE: 7/5/07 DRWN: E.M./SEA

DESIGN CONCEPT
ALTERNATIVE 7

FIGURE 4-7

File: H:\18876\DCAP\18876DCAP009(B).dwg Layout: FIGURE 4-7 User: emarshall Plotted: Jul 05, 2007 - 10:44am Xref's:



NOTE:
1. CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION INCLUDE ADDITIONAL MATERIAL PLACED ALONG THE SHORELINE AND CONSTRUCTION OF ENERGY DISSIPATING GROINS. SEE APPENDIX A, FIGURE A-2 FOR A COMPLETE DESCRIPTION OF PLANNED CONTINGENCY ACTIONS FOR LOG POND.
2. FOR DETAILS REGARDING MONITORED NATURAL RECOVERY AREAS SEE CAP SECTION 2.3.

File: H:\18876\DCAP\18876DCAP010(B).dwg Layout: FIGURE 4-8 User: emarshall Plotted: Jul 05, 2007 - 10:42am Xref's:

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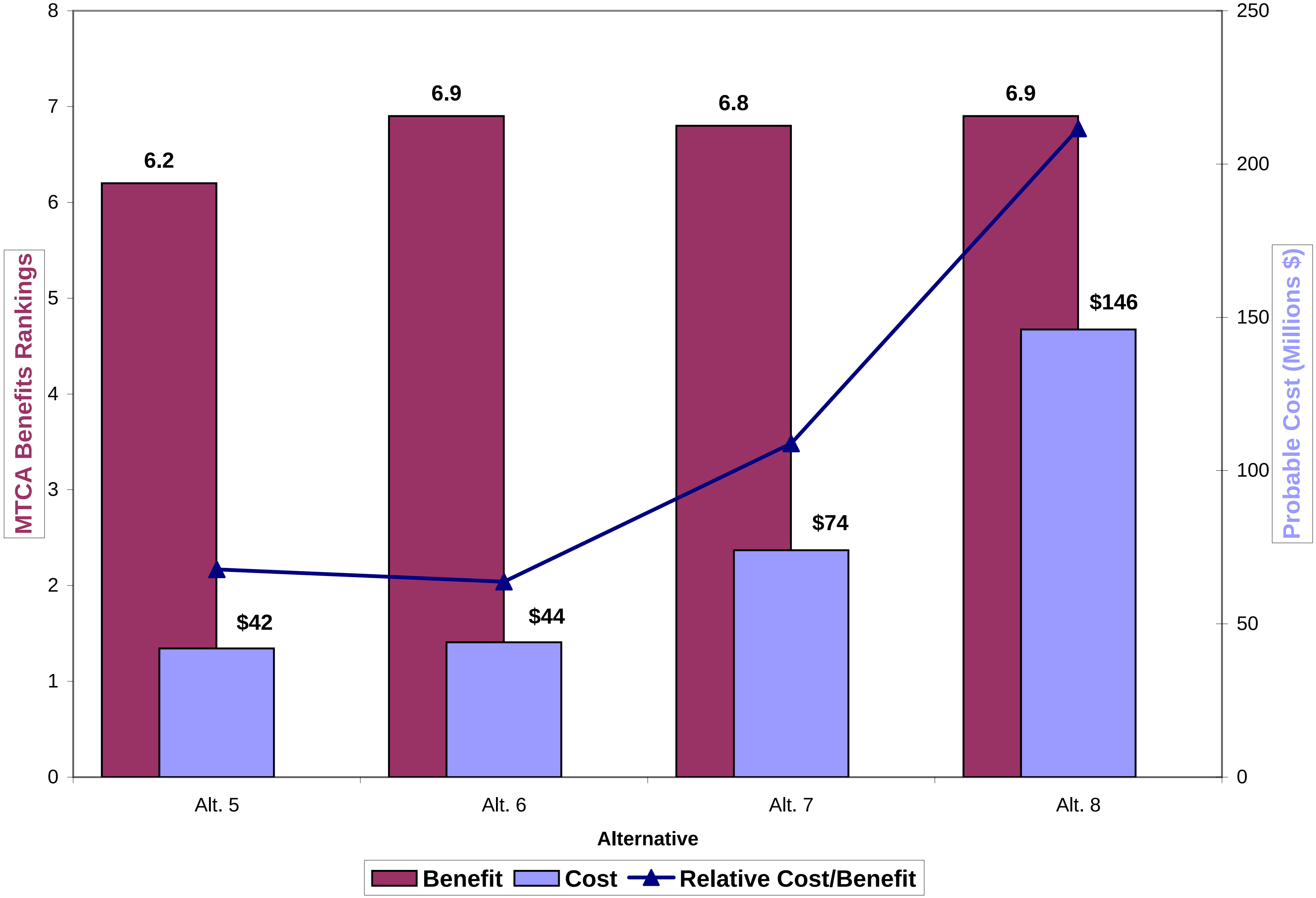
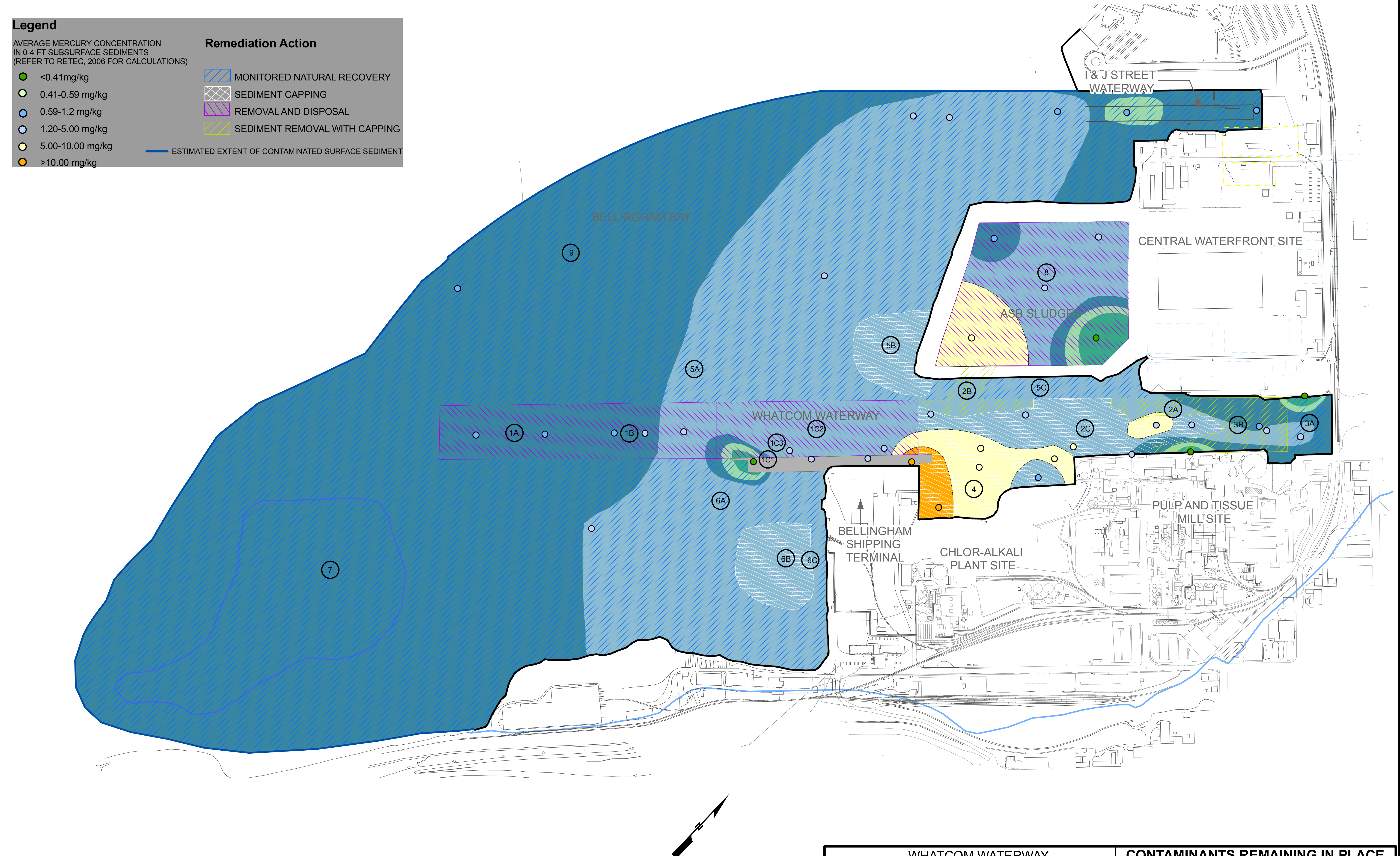
WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	DESIGN CONCEPT ALTERNATIVE 8
DATE: 7/5/07 DRWN: E.M./SEA	FIGURE 4-8

Figure 5-1 Disproportional Cost Analysis Rankings

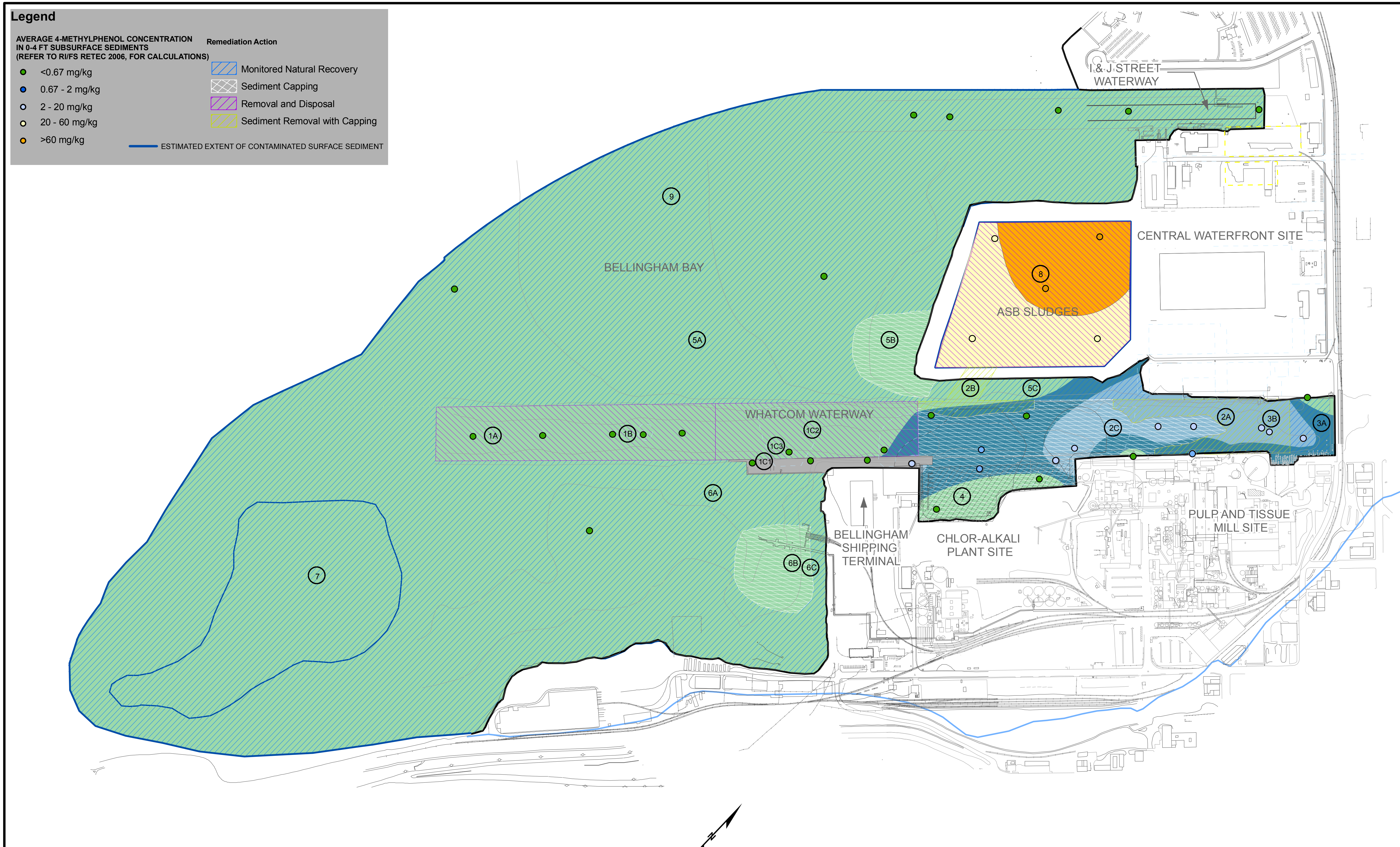




ENSR | AECOM

Merged with ENSR in 2007
RETEC

WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-240	CONTAMINANTS REMAINING IN PLACE BELOW CAP & NATURAL RECOVERY (MERCURY)
DATE: 4/02/07 DWN. BY: MVI/sea FILE: T:/POB_WHATCOM/PROJECTS/erhg_HC2.MXD	FIGURE: 6-1



ENSR | AECOM

Merged with ENSR in 2007 RETEC

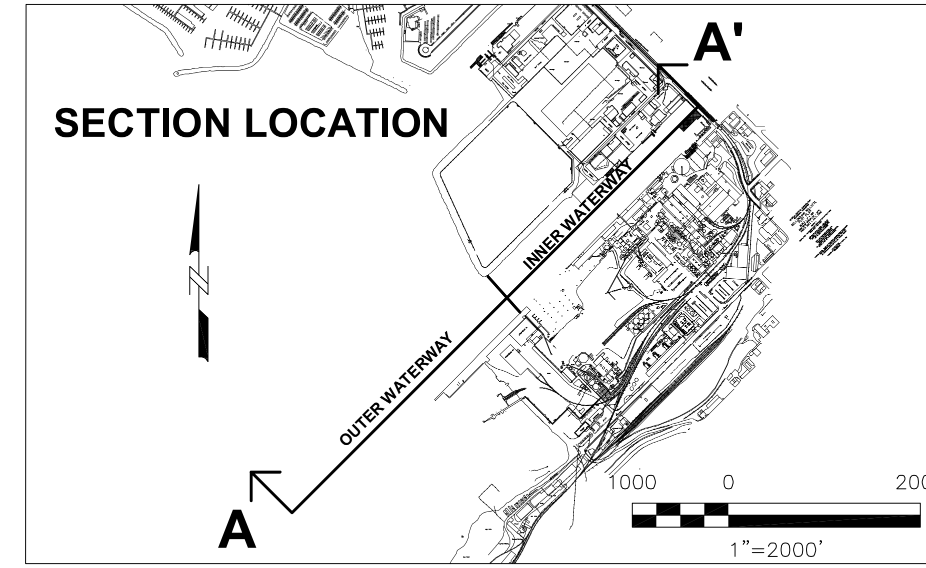
WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-240	CONTAMINANTS REMAINING IN PLACE BELOW CAP & NATURAL RECOVERY (4-METHYLPHENOL)
DATE: 4/02/07 · DWN. BY: MVI/sea · FILE: T:/POB_WHATCOM/PROJECTS/CER_HC2.MXD	FIGURE: 6-2

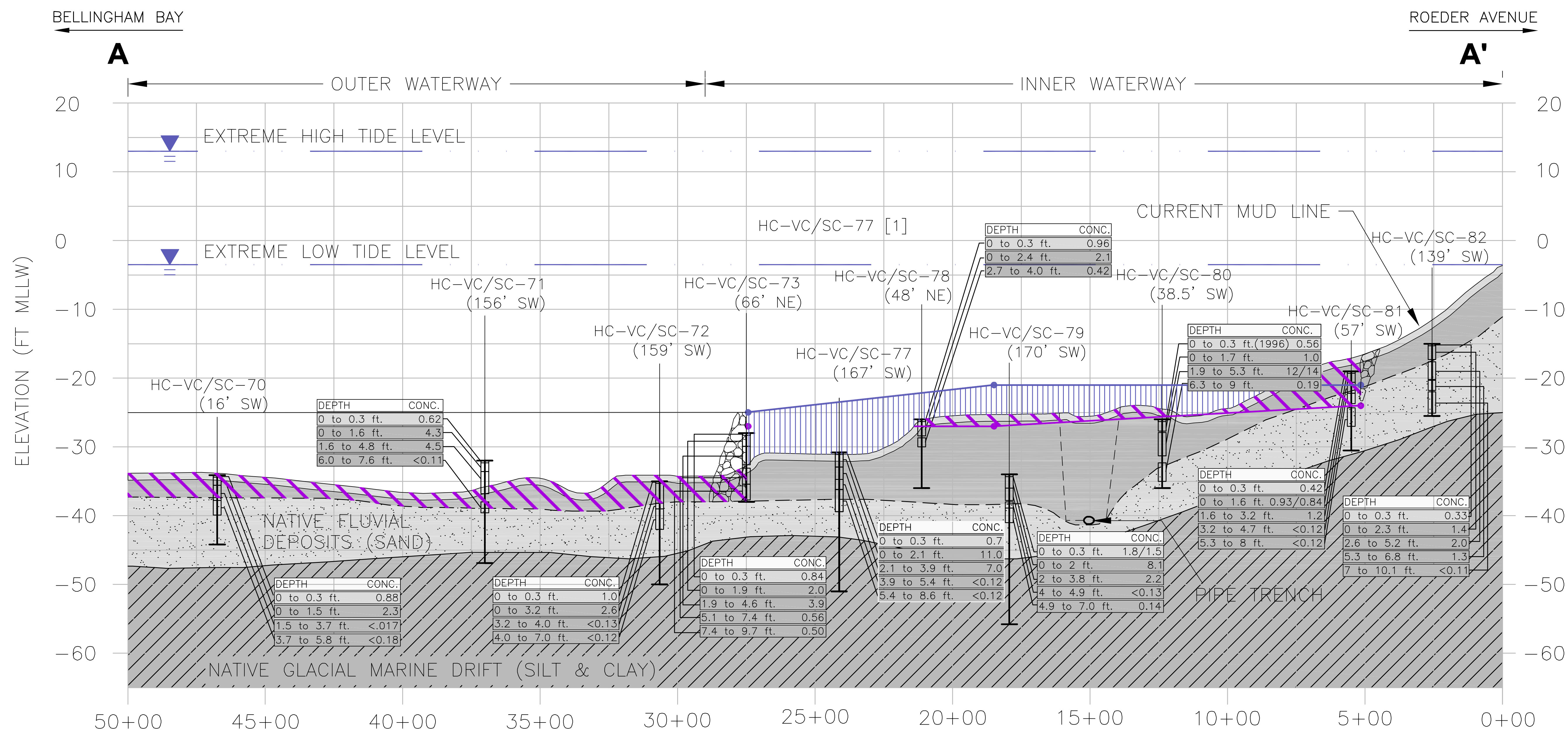
LEGEND

- SURFACE SEDIMENT
- SUBSURFACE SEDIMENT CONTAINING ELEVATED MERCURY LEVELS
- SAND
- SILT AND CLAY
- SEDIMENT REMOVED DURING DREDGING
- CAP
- SEDIMENT CAP SURFACE
- VERTICAL LIMIT OF DREDGING IN THE INNER WATERWAY
- CURRENT BATHYMETRY ALONG SECTION AXIS (COE & BWE, 1996)
- DEEPEST REPORTED HISTORICAL BATHYMETRY ALONG SECTION AXIS
- SAMPLE DEPTH AND MERCURY CONCENTRATION FROM 1996 CORE SAMPLING AND ASSOCIATED GRAB SAMPLING

DEPTH	CONC.
0 to 0.3 ft.	0.96

- STONE



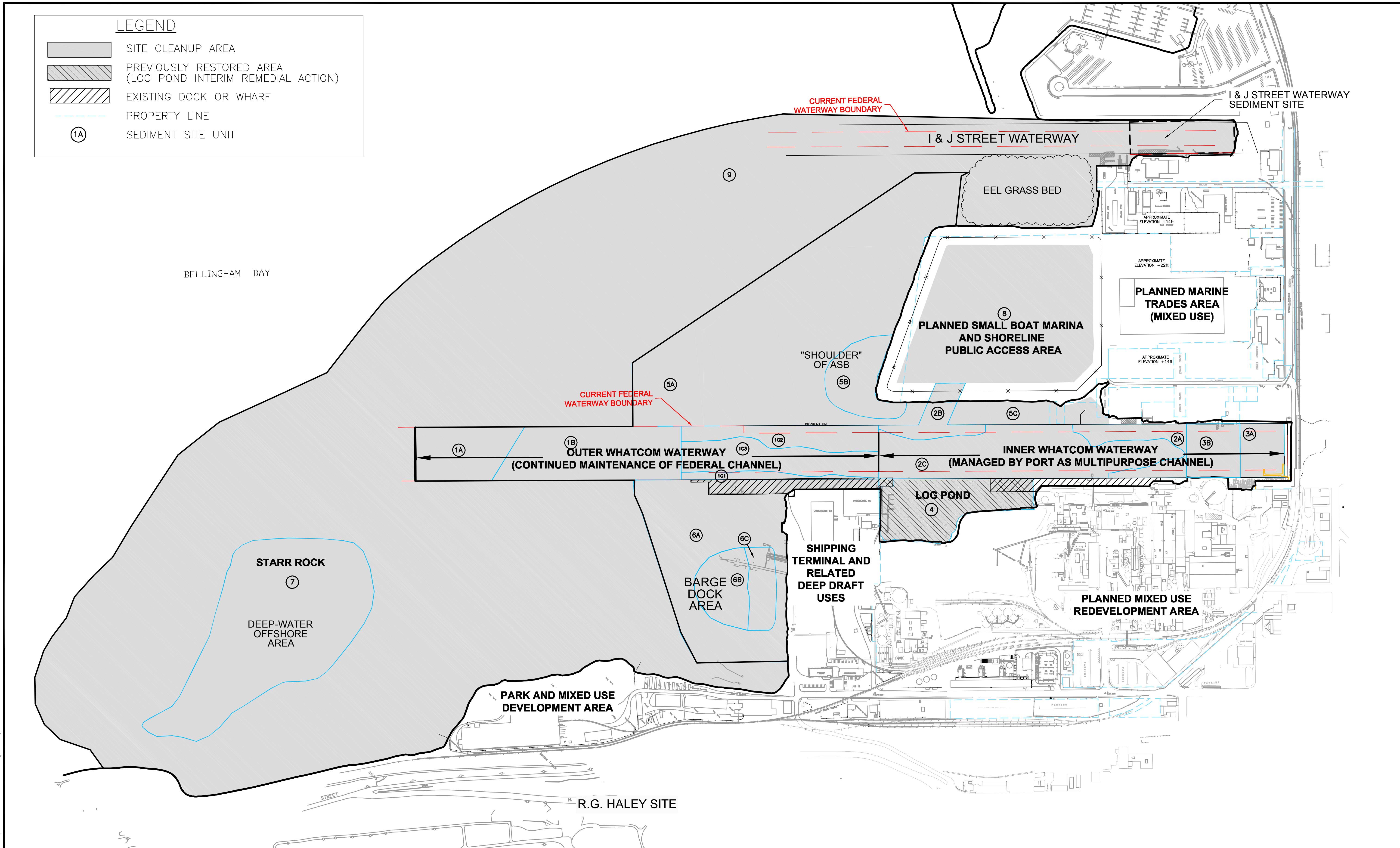


200 0 400
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 8:1

ENSR | AECOM
Merged with ENSR in 2007
RETEC

WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	CROSS SECTION A-A'
DATE: 05/30/07 DRWN: E.M./SEA	FIGURE 6-3

File: H:\18876\DCAP\18876DCAP014.dwg Layout: FIG 6-3 User: emarshall Plotted: May 30, 2007 - 11:05am Xref's:



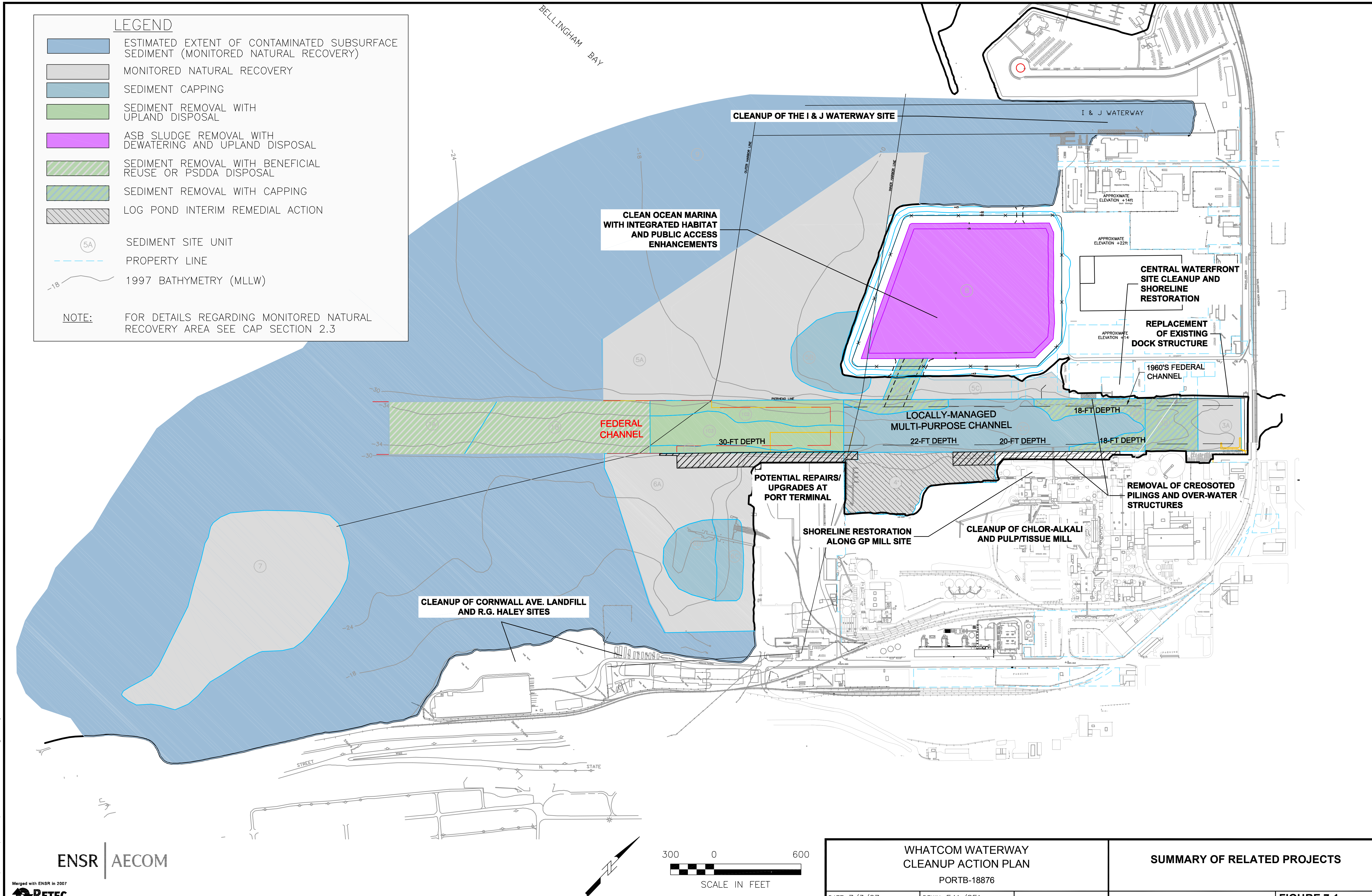
ENSR | AECOM

Merged with ENSR in 2007

RETEC

WHATCOM WATERWAY CLEANUP ACTION PLAN PORTB-18876-300	SITE USE PLAN WHATCOM WATERWAY AND NEW PORT MARINA
DATE: 07/05/07 DRWN: E.M./SEA	FIGURE 6-4

File: H:\18876\DCAP\18876DCAP016.dwg Layout: FIGURE 6-4 User: emarshall Plotted: Jul 05, 2007 - 10:07am Xref's:



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WHATCOM WATERWAY CLEANUP ACTION PLAN

PORTB-18876

SUMMARY OF RELATED PROJECTS

DATE: 7/3/07 DRWN: E.M./SEA

FIGURE 7-1

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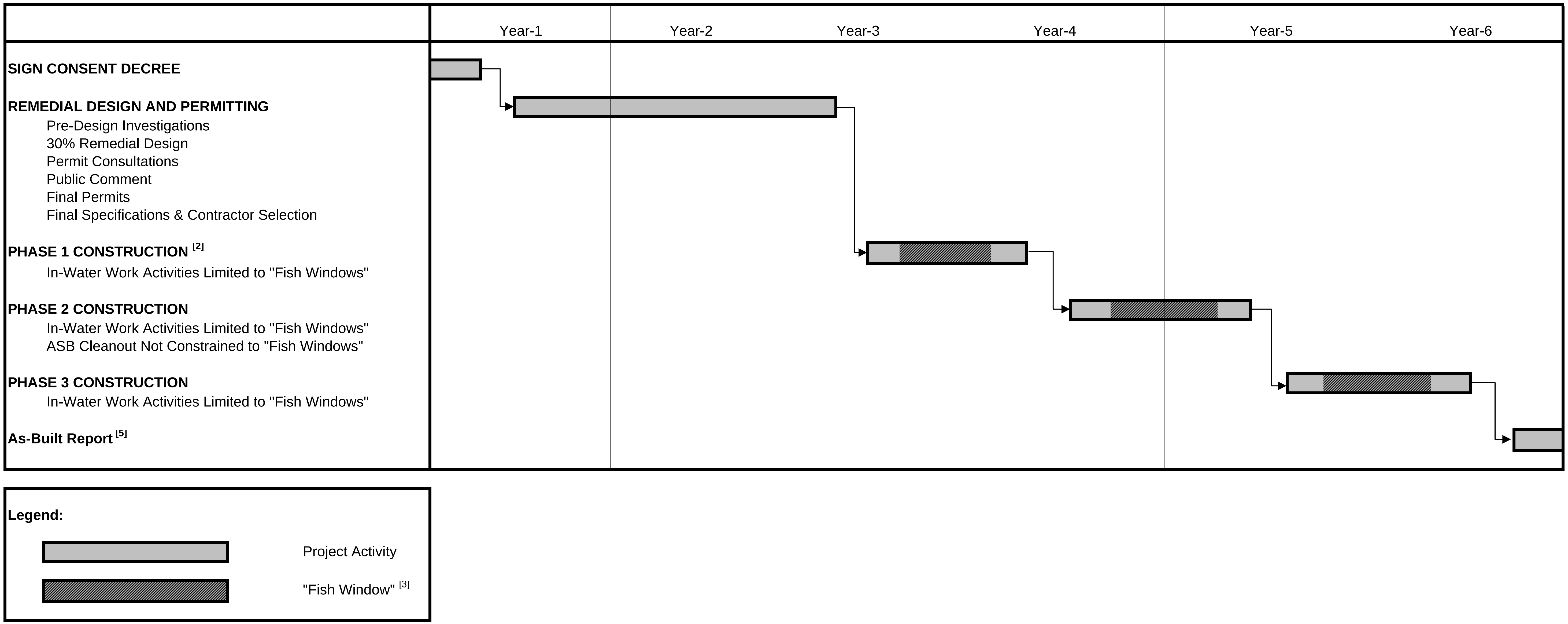
Figure 7-2 Anticipated Implementation Schedule [1]



Notes:

1. This figure illustrates anticipated schedule for design, permitting and construction activities. Actual duration is subject to change based on time required for permitting, and construction sequence specified in project permits.
2. Three-phase construction sequence is described in Section 4 of the cleanup action plan. Final phasing is subject to change based on permit requirements and final design.
3. Construction activities within Bellingham Bay surface waters are expected to be limited to appropriate seasonal "fish windows" specified in project permits, to avoid impacts to juvenile salmonids.
4. Long-term monitoring activities are not shown. As described in Section 6, these are expected to include monitoring events 1, 3, 5, 10, 20 and 30 years after completion of construction.
5. Restrictive Covenants to be filed prior to Ecology approval of the completion report.

Appendix A
Log Pond Cap Contingency Actions

An Interim Remedial Action was conducted in the Log Pond area of the Whatcom Waterway site (site) in late 2000 and early 2001. A sediment cap was placed within the Log Pond by the Georgia-Pacific Corporation in accordance with an Agreed Order (00TCPNR-1418) with the Department of Ecology. The project was also authorized under Clean Water Act Permit No. 2002-2-00424 administered by the US Army Corps of Engineers (Corps). The sediment cap included containment measures to remediate sediment impacts while also enhancing and restoring inter-tidal and shallow sub-tidal aquatic habitat.

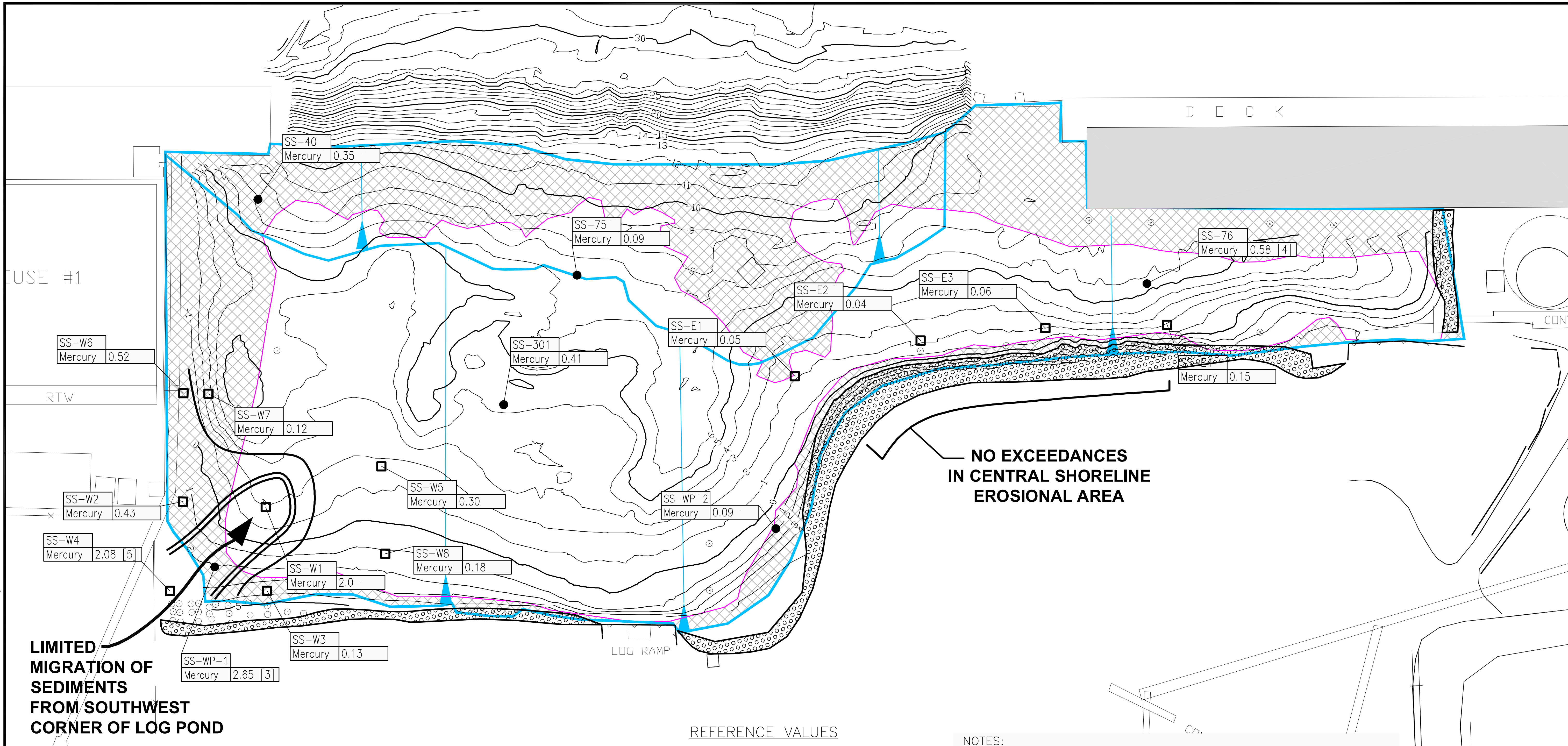
Monitoring of the Log Pond Interim Action was performed in Year 1, Year 2, and Year 5 (Anchor, 2001b, 2002c, and RETEC 2006a: Appendix I). Results of monitoring have confirmed that the majority of the cap is meeting performance objectives; however, some erosion has occurred at the shoreline edges where the cap was the thinnest, exposing mercury contaminated sediment. As part of the final cleanup of the site, a contingent remedy will be implemented that corrects the area of recontamination, thickens the shoreline cap edges, and enhances shoreline stability to prevent recurrence of shoreline erosion.

The figures in this appendix summarize the Log Pond Cap Contingency Actions that will be implemented as part of the final cleanup of the site. Additional detailed information regarding the Log Pond conditions and the engineering basis for these actions may be found in Appendix C of the *Supplemental Remedial Investigation Report* (RETEC, 2006a) and Appendix D of the *Supplemental Feasibility Study* (RETEC, 2006b).

Figure A-1 shows the existing conditions in the Log Pond area. Localized erosional areas were noted along the Central shoreline and in the southern corner of the Log Pond. The figure also shows the area of localized recontamination identified in the southern corner of the Log Pond. Elevated mercury concentrations were detected at four locations adjacent to station SS-WP-1 (the sample from Year 5 monitoring that contained elevated mercury levels). These samples included SS-W1, SS-W2, SS-W4 and SS-W6. One of these locations (SS-W4) was located outside of the area initially capped as part of the Log Pond Interim Action. The remaining samples were located within the designed cap limits.

Results from supplemental testing indicate that the surface detections of mercury at SS-WP-1 were caused by the resuspension of impacted sediments in the extreme southwestern corner of the Log Pond (the area represented by station SS-W4). The current distribution of mercury exceedances is very limited in extent. No evidence of similar edge effects were noted in the Central shoreline area, though limited erosion that has been observed in that area.

Figure A-2 shows the proposed contingency actions to be implemented at the Log Pond as part of the final cleanup of the site. Shoreline cap materials of different particle sizes will be placed in the central and southern portions of the Log Pond. Stone groins will be placed in three locations to dampen wave energies and provide a more stable shoreline geometry that enhances sediment retention within the Log Pond. The changes will result in a cap thickness of at least 3 feet in all shoreline areas, and will address anticipated wave erosion potential as discussed in Appendix C of the *Remedial Investigation Report* (RETEC, 2006a). Further refinement of these proposed contingency actions will be performed as part of remedial design and permitting. Estimated costs are included in Appendix B.



LEGEND

- APPROXIMATE AREAS OF ARMORED SLOPES
- PHASE I AND II CAP LIMITS FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- THIN LAYER CAPPING AREA (0.5' TO 3') FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- OCTOBER 2005 MUD-LINE ELEVATION (FT.MLLW)
- YEAR 5 SURFACE SAMPLE LOCATION
- SUPPLEMENTAL SAMPLING LOCATION

REFERENCE VALUES

SMS	SQS	CSL	BSL
Mercury–mg/kg	0.41	0.59	1.2

40 0 80
SCALE IN FEET

NOTES:

1. MERCURY SEDIMENT CONCENTRATIONS ARE REPORTED AS mg/kg DRY WEIGHT.
2. BATHYMETRY SHOWN FROM OCTOBER 12, 2005 SURVEY. (FT. MLLW)
3. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 2.7 AND 2.6 mg/kg.
4. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 0.55 AND 0.60 mg/kg. SAMPLE WAS SUBMITTED FOR AND PASSED ALL CONFIRMATIONAL BIOASSAYS.
5. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 2.7 AND 1.45 mg/kg.

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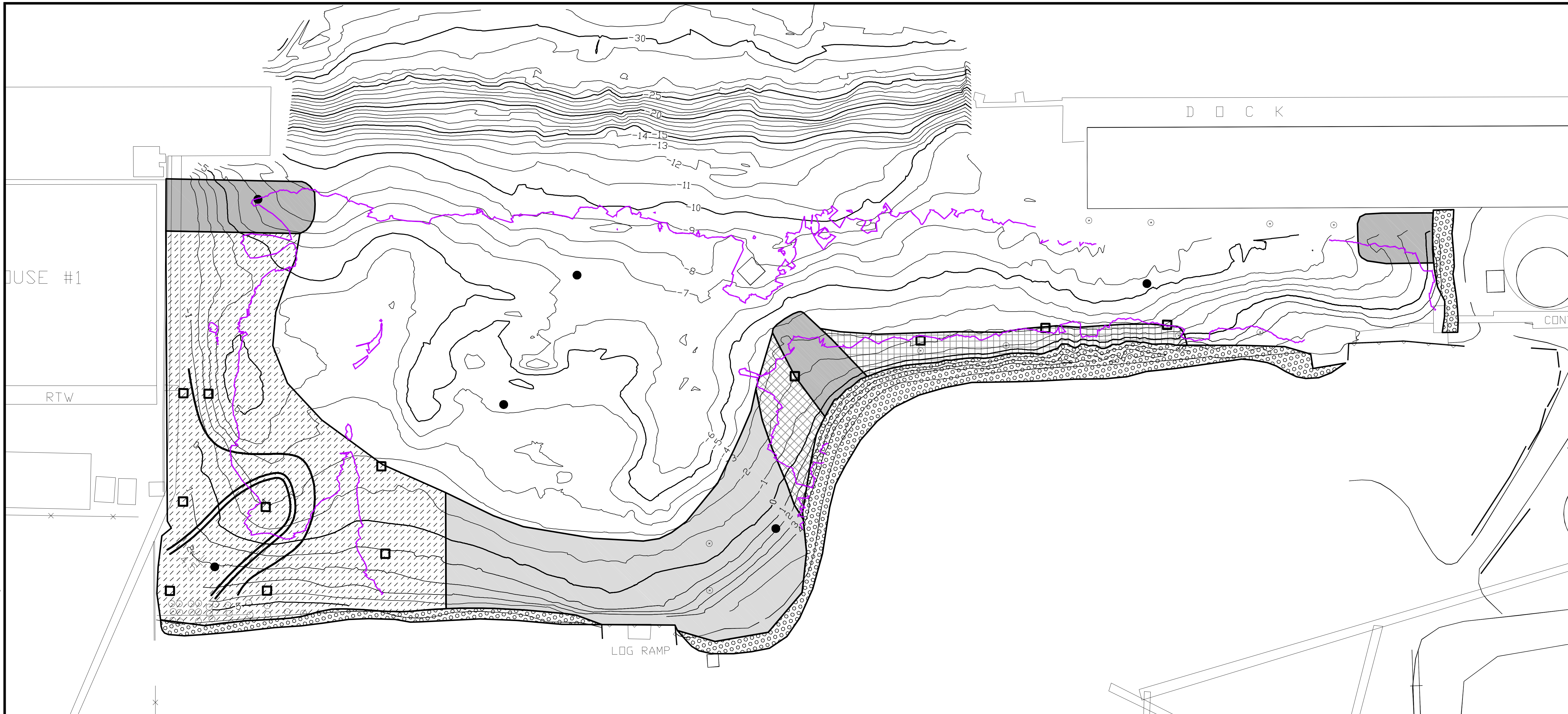
WHATCOM WATERWAY
CLEANUP ACTION PLAN - APPENDIX A
PORTB-18876-300

EXISTING CONDITIONS

DATE: 05/22/07 DRWN: E.M./SEA

FIGURE A-1



LEGEND

- CURRENT ESTIMATED LIMITS OF THICK CAP (3FT)*
- YEAR 5 SURFACE SAMPLE LOCATION
- SUPPLEMENTAL SAMPLING LOCATION

KEY

- TYPE 1 MATERIAL
- TYPE 2 MATERIAL
- TYPE 3 MATERIAL
- NEW GROIN
- EXISTING ARMORED SLOPE

40 0 80
SCALE IN FEET

NOTES:

1. BATHYMETRY SHOWN FROM OCTOBER 12, 2005 SURVEY. (FT. MLLW)

* BASED ON NOMINAL THICKNESS CONTOUR OF 2.5 FEET AS SHOWN IN FIGURE 4. THE NOMINAL THICKNESS DOES NOT ACCOUNT FOR CAP CONSOLIDATION.

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WHATCOM WATERWAY CLEANUP ACTION PLAN - APPENDIX A PORTB-18876-300	PLANNED CONTINGENCY ACTIONS TO ADDRESS SHORELINE CAP EROSION
DATE: 05/22/07 DRWN: E.M./SEA	FIGURE A-2

File: H:\18876\DCAP\18876DCAP001.dwg Layout: FIGURE A-2 User: emarshall Plotted: May 22, 2007 - 11:50am Xref's:

Appendix B
Estimated Remedial Costs

Summary of Costs - Whatcom Waterway Site

Work Performed	Probable Cost	Construction Contingency	Upper Probable Cost
Alternative 5			
Phase 1	$ 11,541,000	$ 2,463,000	$ 14,005,000
Phase 2	$ 26,780,000	$ 6,481,000	$ 33,261,000
Phase 3	$ 4,029,000	$ 949,000	$ 4,978,000
Alternative 5 Total Costs	**$ 42,350,000**	**$ 9,893,000**	**$ 52,244,000**
Alternative 6			
Phase 1	$ 14,572,000	$ 3,205,000	$ 17,777,000
Phase 2	$ 26,780,000	$ 6,481,000	$ 33,261,000
Phase 3	$ 3,072,000	$ 723,000	$ 3,795,000
Alternative 6 Total Costs	**$ 44,424,000**	**$ 10,409,000**	**$ 54,833,000**
Alternative 7			
Phase 1 (multi-yr)	$ 37,280,000	$ 8,759,000	$ 46,039,000
Phase 2	$ 26,780,000	$ 6,481,000	$ 33,261,000
Phase 3 (multi-yr)	$ 10,889,000	$ 2,626,000	$ 13,515,000
Alternative 7 Total Costs	**$ 74,949,000**	**$ 17,866,000**	**$ 92,815,000**
Alternative 8			
Phase 1 (multi-yr)	$ 40,086,000	$ 9,234,000	$ 49,320,000
Phase 2 (multi-yr)	$ 50,222,000	$ 11,826,000	$ 62,048,000
Phase 3	$ 26,852,000	$ 6,323,000	$ 33,175,000
Phase 4a & 4b:	$ 29,417,000	$ 7,102,000	$ 36,519,000
Alternative 8 Total Costs	**$ 146,577,000**	**$ 34,485,000**	**$ 181,062,000**

Assumptions Used in Cost Estimates -- Depths, Volumes & Production Rates

Alternative Unit	Area (sf)		Assumed Overdredge (ft) or Production Rate (cyd/hr)	5	6	7	8
1A	229,254	Neat Line (and overdredge) Elevation		(38)	(38)	(38)	(38)
		Neat Line Volume		38,851	38,851	38,851	38,851
		Overdredge Depth	2				
		Overdredge Volume					
		Cap Volume (3 ft thickness)					
1B	424,112	Neat Line (and overdredge) Elevation		(38)	(38)	(38)	(38)
		Neat Line Volume		74,239	74,239	74,239	74,239
		Overdredge Depth	2				
		Overdredge Volume					
		Cap Volume (3 ft thickness)					
1C1	50,684	Neat Line Elevation		(35)	-38/-41	-38/-41	-38/-41
		Neat Line Volume		5,298	10,116	10,116	10,116
		Overdredge Depth	1	(36)			
		Overdredge Volume		1,877	1,877	1,877	1,877
		Cap Volume (3 ft thickness)		5,632			
1C2	179,540	Neat Line Elevation		(35)	(38)	(38)	(38)
		Neat Line Volume		33,717	26,944	26,944	26,944
		Overdredge Depth	1	(36)			
		Overdredge Volume		6,650	6,650	6,650	6,650
		Cap Volume (3 ft thickness)		19,949			
1C3	254,190	Neat Line Elevation		No Dredge	-38/-41	-38/-41	-38/-41
		Neat Line Volume			35,055	35,055	35,055
		Overdredge Depth	1				
		Overdredge Volume			9,414	9,414	9,414
		Cap Volume (3 ft thickness)					
2A	69,851	Neat Line Elevation		(23)	(23)	(35)	(35)
capping	133,587	Neat Line Volume		4,232	4,232	81,293	81,293
		Overdredge Depth	1	(24)	(24)	(36)	(36)
		Overdredge Volume		2,585	2,587	4,948	4,948
		Cap Volume (3 ft thickness)		14,843	14,843	14,843	14,843
2B-1	40,410	Neat Line Elevation		(23)	(23)	(23)	(23)
Alt area (7,8)	30,625	Neat Line Volume		5,987	5,987	5,987	5,987
	40,410	Overdredge Depth	1	(24)	(24)	(24)	(24)
		Overdredge Volume		1,497	1,497	1,497	1,497
		Cap Volume (3 ft thickness)					
2B-2	54,504	Neat Line Elevation		(23)	(23)	(35)	(35)
capping	54,504	Neat Line Volume		633	633	30,670	30,670
		Overdredge Depth	1	(24)	(24)	(36)	(36)
		Overdredge Volume		713	713	2,019	2,019
		Cap Volume (3 ft thickness)		6,056	6,056	6,056	6,056
2C	566,756	Neat Line Elevation		No Dredge	No Dredge	(35)	(35)
		Neat Line Volume				146,234	146,234
		Overdredge Depth	1			(36)	(36)
		Overdredge Volume				20,991	20,991
		Cap Volume (3 to 6 ft) *		83,964	83,964	62,973	62,973
3A	144,814	Neat Line Elevation		No Dredge	No Dredge	(23)	(23)
		Neat Line Volume				77,282	77,282
		Overdredge Depth	1			(24)	(24)
		Overdredge Volume				5,363	5,363
		Cap Volume (3 ft thickness)				16,090	16,090
3B	69,226	Neat Line Elevation		(23)	(23)	(23)	(23)
cap area	95,597	Neat Line Volume		10,231	10,231	10,231	10,231
		Overdredge Depth	1	(24)	(24)	(24)	(24)
		Overdredge Volume		2,564	2,564	2,564	2,564
		Cap Volume (3 ft thickness)		10,622	10,622	10,622	10,622
4		Neat Line Elevation		No Dredge	No Dredge	No Dredge	No Dredge
		Neat Line Volume					
		Overdredge Depth	1				
		Overdredge Volume					
		Cap Volume (3 ft thickness)					
5A	1,773,099	Neat Line Elevation		No Dredge	No Dredge	No Dredge	3 foot cut
		Neat Line Volume					197,011
		Overdredge Depth	1				
		Overdredge Volume					65,670
		Cap Volume (3 ft thickness)					
5B	248,199	Neat Line Elevation		(8)	(8)	(8)	3 foot cut
		Neat Line Volume		1,500	1,500	1,500	27,578
		Overdredge Depth	1	1	1	1	
		Overdredge Volume		1,000	1,000	1,000	9,193
		Cap Volume (3 ft thickness)		27,578	27,578	27,578	
5C	157,156	Neat Line Elevation		No Dredge	No Dredge	No Dredge	3 foot cut
alt area	212,271	Neat Line Volume					23,586
		Overdredge Depth	1				
		Overdredge Volume					7,862
		Cap Volume (3 ft thickness)					
6A	782,764	Neat Line Elevation		No Dredge	No Dredge	No Dredge	3 foot cut
		Neat Line Volume					86,974
		Overdredge Depth	1				
		Overdredge Volume					28,991
		Cap Volume (3 ft thickness)					
6B	158,500	Neat Line Elevation		No Dredge	No Dredge	No Dredge	3 foot cut
		Neat Line Volume					17,611
		Overdredge Depth	1				
		Overdredge Volume					5,870
		Cap Volume (3 ft thickness)		17,611	17,611	17,611	
6C	146,497	Neat Line Elevation		No Dredge	No Dredge	No Dredge	3 foot cut
		Neat Line Volume					13,479
		Overdredge Depth	1				
		Overdredge Volume					5,426
		Cap Volume (3 ft thickness)		16,277	16,277	16,277	
7	121,311	Neat Line Elevation		No Dredge	No Dredge	No Dredge	Dredge to clean bottom (varies). Est. volume 300,000 cyd.
		Neat Line Volume					300,000
		Overdredge Depth	1				
		Overdredge Volume					
		Cap Volume					
8	1,306,679	Neat Line Elevation		(15)	(15)	(15)	(15)
		Neat Line Volume		377,977	377,977	377,977	377,977
		Overdredge Depth	1	(16)	(16)	(16)	(16)
		Overdredge Volume		34,074	34,074	34,074	34,074
		Cap Volume					
TOTALS		1A/1B Dredging (include Overdredge)		113,090	113,090	113,090	113,090
		Contaminated Dredging (excluding ASB)		61,598	94,697	425,312	1,090,050
		Contaminated Overdredge (excluding ASB)		16,885	26,302	56,323	178,335
		Capping		202,531	176,951	172,050	110,584
		Capping Excluding ASB		202,531	176,951	172,050	110,584

WORK BREAKOUT SYSTEM
FISH WINDOW IS 22 WEEKS

Assumptions Used in Cost Estimates -- Depths, Volumes & Production Rates

Alternative Unit Area (sf)	Assumed Overdredge (ft) or Production Rate (cyd/hr)	5	6	7	8
ALL INCLUSIVE - STRAIGHT DREDGING RATES (WKS)					
Dredge Timing					
Production Pass - Environmental Bucket	cy/hr				
1 dredge - 10 hour days	170.0	17.1	20.4	52.8	118.0
1 dredge - 20 hour days	170.0	8.6	10.2	26.4	59.0
2 dredges - 20 hour days	340.0	4.3	5.1	13.2	29.5
Finish Pass (overdredge) - Articulated Bucket					
1 dredge - 10 hour days	70.0	4.0	6.3	13.4	42.5
1 dredge - 20 hour days	70.0	2.0	3.1	6.7	21.2
Hydraulic Dredging					
TOTAL CAPPING					
Cap Timing - 10 hour days					
1 unit - Low Production Rate	60.0	56.3	49.2	47.8	30.7
1 unit - High Production Rate	130.0	26.0	22.7	22.1	14.2
2 units - Low Production Rate	120.0	28.1	24.6	23.9	15.4
2 units - high production Rate	260.0	13.0	11.3	11.0	7.1
Cap Timing - 20 hour days					
1 unit - Low Production Rate	60.0	28.1	24.6	23.9	15.4
1 unit - High Production Rate	130.0	13.0	11.3	11.0	7.1
2 units - Low Production Rate	120.0	14.1	12.3	11.9	7.7
2 units - high production Rate	260.0	6.5	5.7	5.5	3.5
CAPPING EXCLUDING ASB					
Cap Timing - 10 hour days					
1 unit - Low Production Rate	60.0	56.3	49.2	47.8	30.7
1 unit - High Production Rate	130.0	26.0	22.7	22.1	14.2
2 units - Low Production Rate	120.0	28.1	24.6	23.9	15.4
2 units - high production Rate	260.0	13.0	11.3	11.0	7.1
Cap Timing - 20 hour days					
1 unit - Low Production Rate	60.0	28.1	24.6	23.9	15.4
1 unit - High Production Rate	130.0	13.0	11.3	11.0	7.1
2 units - Low Production Rate	120.0	14.1	12.3	11.9	7.7
2 units - high production Rate	260.0	6.5	5.7	5.5	3.5
ALTERNATIVE SPECIFIC RATES					
Unit 3A, 3B, 2A, 2B, 2C					
Production Pass - Environmental Bucket		21,082.5	21,082.7	351,696.8	351,696.8
1 dredge - 20 hour days	170.0	1.0	1.0	17.2	17.2
2 dredges - 20 hour days	340.0	0.5	0.5	8.6	8.6
Finish Pass (overdredge) - Articulated Bucket		7,358.5	7,360.5	37,381.5	37,381.5
1 dredge - 20 hour days	70.0	0.9	0.9	4.5	4.5
Capping - 20 hour days		115,484.7	115,484.7	110,584.2	110,584.2
1 unit - low production rate	60.0	16.0	16.0	15.4	15.4
1 unit - high production rate	130.0	7.4	7.4	7.1	7.1
Unit 1C					
Production Pass - Environmental Bucket		39,015.2	72,114.8	72,114.8	72,114.8
1 dredge - 20 hour days	170.0	1.9	3.5	3.5	3.5
2 dredges - 20 hour days	340.0	1.0	1.8	1.8	1.8
Finish Pass (overdredge) - Articulated Bucket		8,526.8	17,941.2	17,941.2	17,941.2
1 dredge - 20 hour days	70.0	1.0	2.1	2.1	2.1
Capping - 20 hour days		25,580.4	-	-	-
1 unit - low production rate	60.0	3.6	-	-	-
1 unit - high production rate	130.0	1.6	-	-	-
Unit 1A/1B					
Production Pass - Environmental Bucket		113,090.1	113,090.1	113,090.1	113,090.1
1 dredge - 20 hour days	170.0	5.5	5.5	5.5	5.5
2 dredges - 20 hour days	340.0	2.8	2.8	2.8	2.8
Unit 5B, 6B, 6C					
Capping - 20 hour days		61,466.2	61,466.2	61,466.2	
1 unit - low production rate	60.0	8.5	8.5	8.5	
1 unit - high production rate	130.0	3.9	3.9	3.9	
Unit 5A/5B					
Production Pass - Environmental Bucket					224,588.6
1 dredge - 20 hour days	170.0				11.0
2 dredges - 20 hour days	340.0				5.5
Fninish Pass (assume 1/3 Production Pass) - Articulated Bucket					74,862.9
1 dredge - 20 hour days	70.0				8.9
Production Dredge - Articulated Bucket					248,174.3
1 dredge - 20 hour days	70.0				29.5
Unit 6					
Production Pass - Environmental Bucket					104,584.9
1 dredge - 20 hour days	170.0				5.1
2 dredges - 20 hour days	340.0				2.6
Finish Pass (assume 1/3 production pass) - Articulated Bucket					34,861.6
1 dredge - 20 hour days	70.0				4.2
Production Dredge - Articulated Bucket					104,584.9
1 dredge - 20 hour days	70.0				12.5
Unit 7					
Production Pass - Environmental Bucket					300,000.0
1 dredge - 20 hour days	150.0				16.7
2 dredges - 20 hour days	300.0				8.3
Finish Pass (assume 1/3 production pass) - Articulated Bucket					26,712.4
1 dredge - 20 hour days	50.0				4.5
Production Dredge - Articulated Bucket					300,000.0
1 dredge - 20 hour days	50.0				50.0

Notes:

* Capping thickness in Unit 2C will vary between 3 and 6 feet under Alternatives 5 and 6, as described in Section 4 of the DCAP.

WHATCOM WATERWAY REMEDIATION -- UNIT COST USED FOR COST ESTIMATION

	Alt 5	Alt 6	Alt 7	Alt 8
Uncontaminated Sediment Volume, cy :	113,090	113,090	113,090	113,090
Uncontaminated Overdredge Volume, cy :	0	0	0	0
Contaminated Sediment Volume, cy :	61,598	94,697	425,312	1,090,050
Contaminated Overdredge Volume, cy:	16,885	26,302	56,323	178,335
Dredge Volume (excluding ASB)	174,688	207,788	538,402	1,203,140
Total Overdredge Volume (excluding ASB)	16,885	26,302	56,323	178,335
Capping Volume, cy (includes ASB):	202,531	176,951	172,050	110,584
Capping Volume, cy (ASB):				
Clean Importr Sand Volume for CAD:				
ASB Sludge Removal (Exc.. Overdredge):	377,977	377,977	377,977	377,977

Equipment Rates:

	Mob	Setup	Rental	Operation	Teardown	Demob	Production Rate	Source	
Loader, front-end, wheel, 130-hp, 3-cy bucket	$100/ea/Seattle-Barge	NA	$350/ea/day	$16/ea/hr	NA	$100/ea/Barge-Seattle	200 cy/hr	01590-200-4710	RS Means 2005
Dredge, barge-mounted derrick crane, 100-ton, 7-cy clamshell	$4,800/ea/Seattle-Bellingham	NA	$2,225/ea/day	$350/ea/hr	NA	$4,800/ea/Bellingham-Seattle	200 cy/hr	American & General Constr.	1500 cy
Dredge, barge-mounted derrick crane, 40-ton, 4-cy clamshell	$3,000/ea/Seattle-Bellingham	NA	$1,250/ea/day	$250/ea/hr	NA	$3,000/ea/Bellingham-Seattle	75 cy/hr	American & General Constr.	
Dredge, barge-mounted backhoe, 5-cy bucket	$3,000/ea/Seattle-Bellingham	NA	$1,500/ea/day	$200/ea/hr	NA	$3,000/ea/Seattle-Bellingham	50 cy/hr	American Construction	
Hopper/Tremie, barge-mounted backhoe	$3,000/ea/Seattle-Bellingham	NA	$1,500/ea/day	$200/ea/hr	NA	$3,000/ea/Seattle-Bellingham	50 cy/hr		
Tug, diesel, bow, 900-hp	$1,500/ea/Seattle-Bellingham	NA	$1,000/ea/day	$220/ea/hr	NA	$1,500/ea/Bellingham-Seattle	10 kt		
Dozer, diesel, 200-hp, crawler	$100/ea/Seattle-Barge	NA	$1,000/ea/day	$41/ea/hr	NA	$100/ea/Barge-Seattle	200 cy/hr	01590-200-4260	RS Means 2005
Tug, diesel, push, 500-hp	$2,000/ea/Seattle-Bellingham	NA	$500/ea/day	$200/ea/hr	NA	$2,000/ea/Bellingham-Seattle	6 kt		
Lights, flood, 2-1,000 w, with generator	$75/4 ea/Seattle-Barge	NA	$120/ea/day	$5/ea/hr	NA	$75/4 ea/Barge-Seattle	NA	01590-400-1960	RS Means 2005
Barge, flat-deck, 2,000-ton capacity	$700/ea/Seattle-Bellingham	NA	$1000/ea/day	NA	NA	$700/ea/Bellingham-Seattle	NA	American Construction	
Barge, flat-deck, 6,000-ton capacity	$1,500/ea/Seattle-Bellingham	NA	$2000/ea/day	NA	NA	$1,500/ea/Bellingham-Seattle	NA	American Construction	
Construction office	$150/Seattle-Bellingham	$1,450/ea	$350/month	$630/month	$1,450/ea	$150/Bellingham-Seattle	NA	01520-500-0550&550	RS Means 2004

Material Rates:

	Purchase	Source
Capping sand, including delivery to site (market rate)	$15/cyd	02510-760-0400
Capping sand procurement	$10/cyd	

Labor Rates:

	hour	8-hour day	10-hour day	Source	
General labor	$32.61	$261	$359	WDL&I - Whatcom County	Current wages as of 3/2005
Excavator operator	$39.88	$320	$439	WDL&I - Whatcom County	Current wages as of 3/2005
Crawler crane operator	$39.88	$320	$439	WDL&I - Whatcom County	Current wages as of 3/2005
Dozer operator	$39.49	$316	$435	WDL&I - Whatcom County	Current wages as of 3/2005
Equipment service engineer	$39.49	$316	$435	WDL&I - Whatcom County	Current wages as of 3/2005
Equipment mechanic	$40.34	$323	$444	WDL&I - Whatcom County	Current wages as of 3/2005
Dredge leverman	$41.04	$329	$452	WDL&I - Whatcom County	Current wages as of 3/2005
Dredge mate	$39.52	$317	$435	WDL&I - Whatcom County	Current wages as of 3/2005
Dredge deckhand	$38.76	$311	$427	WDL&I - Whatcom County	Current wages as of 3/2005
Dredge oiler	$39.16	$314	$431	WDL&I - Whatcom County	Current wages as of 3/2005
Survey party chief	$13.40	$108	$148	WDL&I - Whatcom County	Current wages as of 3/2005
Survey instrument person	$11.40	$92	$126	WDL&I - Whatcom County	Current wages as of 3/2005
Survey chain person	$9.35	$75	$103	WDL&I - Whatcom County	Current wages as of 3/2005
Construction foreman	$46.75	$374	$515	01310-700-0140	RS Means 2005
Construction superintendent	$71.50	$572	$787	01310-700-0280	RS Means 2005
Construction clerk	$13.20	$106	$146	01310-700-0010	RS Means 2005
Construction timekeeper	$36.44	$292	$401	01310-700-0290	RS Means 2005

Other Rates:

Quoted (Envirogreen) disposal and tipping fee of $25/ton.

Quoted (Waste Management) $3,100/100-ton gondola Bellingham to Arlington, OR, plus $1,200/gondola/month lease charge, plus $20/ton disposal and tipping fee at Columbia Ridge.

Quoted (Tau/Rabanco) $29.90/ton hauling by 2-20' box railcar from Bellingham to Roosevelt landfill, includes disposal and tipping fee; $25.90/ton hauling by 2-20' box railcar from Seattle (Pier 25) to Roosevelt landfill,

Whatcom Waterway -- ASB Remediation (Area 8)

Unit Rates Used in Construction Cost Estimates -- $2004 Rates, Adjusted in Final Estimates to $2005 Using Scaling Factor

Equipment Rates:

	Mob	Setup	Rental	Operation	Teardown	Demob	Production Rate	Source
Loader, front-end, wheel, Cat 950, 183 hp, 3-cy bucket	$100/ea/Seattle-Bellingham	NA	$5,000/ea/month	$22/ea/hr	NA	$100/ea/Bellingham-Seattle	130 cy/hr	MP&E
Excavator, crawler, Cat 320, 2-cy bucket	$100/ea/Seattle-Bellingham	NA	$5,200/ea/month	$25/ea/hr	NA	$100/ea/Bellingham-Seattle	110 cy/hr	MP&E
Pump, centrifigal (water & sludge), 6", motor-driven	$100/4 ea/Seattle-Bellingham	$200/ea	$2,000/ea/month	$5/ea/hr	$100/ea	$100/4 ea/Bellingham-Seattle	2,000 gpm max, use 1,600 gpm	MP&E
Dozer, 75 hp, crawler, JD450	$100/ea/Seattle-Bellingham	NA	$3,900/ea/month	$16/ea/hr	NA	$100/ea/Bellingham-Seattle	60 cy/hr	Hertz
Conveyor, 24" x 50', trough belt, 7-1/2 hp electr.	$200/5 ea/Seattle-Bellingham	$200/ea	$1,000/ea/month	$0.42/ea/hr	$150/ea	$200/5 ea/Bellingham-Seattle	200 cy/hr	Balzer Pacific
Marsh Buggie, excavator, 1-1/2 cy bucket	$30,000/ea/Marrero,LA-Bellingham	NA	$25,000/ea/month	$20/ea/hr	NA	$26,000/ea/Bellingham-Marrero,LA	90 cy/hr	Wilco
Crane, crawler, 75-ton capacity, 3 cy bucket	$370/ea/Seattle-Bellingham	$1,400/ea	$12,500/ea/month	$53/ea/hr	$1,100/ea	$370/ea/Bellingham-Seattle	110 cy/hr	01590-600-1100
Crane, truck-mounted, 60-ton capacity	$250/ea/Seattle-Bellingham	NA	$1,100/ea/day	$34/ea/hr	NA	$250/ea/Bellingham-Seattle	NA	01590-600-2000
Lights, flood, 2-1,000 w, with generator	$100/4 ea/Seattle-Bellingham	NA	$1,000/ea/month	$100/day	NA	$100/4 ea/Bellingham-Seattle	NA	01590-400-1960
Dredge, hydraulic, 10", portable	$3,200/ea/ plus add $2/ea/mi	$1,400/ea	$2,000/ea/day	$75/hr	$1,400/ea	$2,600/ea/ plus add $2/ea/mi	100 cy/hr	JS dredge program
Construction office	NA	$1,450/ea	$350/month	$630/month	$1,450/ea	NA	NA	01520-500-0550&550
Toplift, container box, 35-ton capacity	$5,000/ea/Seattle-Bellingham	NA	$8,000/ea/week	incl. in rental	NA	$5,000/ea/Bellingham-Seattle	8 boxes/hr	SSA Marine
Dump truck, road, 12-ton capacity	$50/ea/local	NA	$300/ea/day	$22/hr	NA	NA	6 ton/hr	01590-200-5250
Shuttle truck and chassis, 20' container box	NA	NA	$270/ea/8-hr day	incl. in rental	NA	NA	8 boxes/hr	SSA Marine

Material Rates:

	Purchase	Source
HDPE pipe, 10"	$17.50/ft	02510-760-0400
HDPE pipe, 12"	$22.55/ft	02510-760-0500
HDPE pipe, 18"	$43.45/ft	02510-760-0800
Conveyor, 24" x 50', trough belt, 7-1/2 hp electr.	$12,950/ea	Balzer Pacific
HDPE elbow, 10"	$407/ea	02510-760-1500
HDPE elbow, 12"	$682/ea	02510-760-1600
HDPE elbow, 18"	$1,210/ea	02510-760-1900
HDPE tee, 10"	$445/ea	02510-760-2500
HDPE tee, 12"	$622/ea	02510-760-2600
HDPE tee, 18"	$1,210/ea	02510-760-2900
Conveyor floats, 4'x10', polystyrene, steel frame, wood deck	$1,220/ea	02390-350-1340

Lagoon Water Volumes:

Elevation (MLLW)	Water Volume (Gal)
20 to 10	90,146,000
10 to 3	55,278,000
3 to 0	21,590,000
0 to -10	30,896,000
-10 to -12	519,000
-12 to -15	94,000
Total	**198,523,000**

Labor Rates:

	$2004 Rates (Prior to Scaling Factor Addition)			Rates as of 3/2005			
	hour	8-hour day	10-hour day	hour	8-hour day	10-hour day	Source
Demolition labor	$31.86	$255	$351	$32.61	$261	$359	WDL&I - Whatcom County
General labor	$31.86	$255	$351	$39.88	$320	$439	WDL&I - Whatcom County
Excavator operator	$39.19	$314	$432	$39.88	$320	$439	WDL&I - Whatcom County
Crawler crane operator	$39.19	$314	$432	$39.49	$316	$435	WDL&I - Whatcom County
Dozer operator	$38.36	$307	$422	$39.49	$316	$435	WDL&I - Whatcom County
Equipment service engineer	$38.36	$307	$422	$40.34	$323	$444	WDL&I - Whatcom County
Equipment mechanic	$39.19	$314	$432	$39.19	$314	$432	WDL&I - Whatcom County
Pump operator	$36.19	$290	$399	$37.26	$299	$410	WDL&I - Whatcom County
Truck crane operator	$38.36	$307	$422	$39.88	$320	$439	WDL&I - Whatcom County
Dump truck driver	$19.32	$155	$213	$19.32	$155	$213	WDL&I - Whatcom County
Dredge leverman	$39.85	$319	$439	$41.04	$329	$452	WDL&I - Whatcom County
Dredge mate	$38.37	$307	$423	$39.52	$317	$435	WDL&I - Whatcom County
Dredge deckhand	$37.91	$304	$418	$38.76	$311	$427	WDL&I - Whatcom County
Dredge oiler	$38.02	$305	$419	$39.16	$314	$431	WDL&I - Whatcom County
Survey party chief	$13.40	$108	$148	$13.40	$108	$148	WDL&I - Whatcom County
Survey instrument person	$11.40	$92	$126	$11.40	$92	$126	WDL&I - Whatcom County
Survey chain person	$9.35	$75	$103	$9.35	$75	$103	WDL&I - Whatcom County
Construction foreman	$46.75	$374	$515	$46.75	$374	$515	01310-700-0140
Construction superintendent	$71.50	$572	$787	$71.50	$572	$787	01310-700-0280
Construction clerk	$13.20	$106	$146	$13.20	$106	$146	01310-700-0010
Construction timekeeper	$36.44	$292	$401	$36.44	$292	$401	01310-700-0290
ILWU Gang (1 foreman, 1 clerk, 2 toplift drivers, 1 utility			SS&H			SS&H	SSA Marine
1 mechanic, 6 truck drivers)		$8,636	$11,400		$8,636	$11,400	

Other Rates:

Quoted (Sumas) $32-36/wet ton by truck (tandem) from Bellingham to East Wenatchee, distance of 190 miles, return included.
Quoted (Envirogreen) disposal and tipping fee of $25/ton.
Quoted (Waste Management) $3,100/100-ton gondola Bellingham to Arlington, OR, plus $1,200/gondola/month lease charge, plus $20/ton disposal and tipping fee at Columbia Ridge.
Quoted (Waste Management) $40/ton to barge from Bellingham to Arlington, OR, includes barge, roundtrip, nd unloading, plus $20/ton disposal and tipping fee at Columbia Ridge.
Quoted (Tau/Rabanco) $29.90/ton hauling by 2-20' box railcar to Roosevelt landfill, includes disposal and tipping fee.
Quoted (Tau/Rabanco) $25.90/ton hauling by 2-20' box railcar from Seattle (Pier 25) to Roosevelt landfill, includes disposal and tipping fee.
Quoted (City of Bellingham POTW) discharge to City sewers at $2.21/ccf, plus BOD @ $0.17/lb and TSS @ $0.15/lb.

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 5 - Phase 1
Capping in Areas 2A, 2B, 2C, 3B
Dredge Areas 1C1, 1C2, 1C3, 2A, 2B, 2C, 3B, 5B
Estimate assumes that ASB berm sands reused as capping material.

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$114,428**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	4,800	1.0185	$4,888.80	$9,778		4
1.2	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	40,000	1.0185	$40,740.00	$40,740		2
1.5	Front-end loader	EA	3	100	1.0185	$101.85	$306		3
1.6	Tug, push, diesel, 500-hp	EA	1	2,000	1.0185	$2,037.00	$2,037		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	2	700	1.0185	$712.95	$1,426		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
1.10	Construction office steup	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	50,000	1.0185	$50,925.00	$50,925		4
2	**Construct Dredge Spoil Offload Facility**							**$547,159**	
2.1	Track Installation - 100-lb rail, steel ties in concrete, incl fasteners and plates	FT	1,600	224	1.0185	$228.14	$365,030.40		28
2.2	Track Switch Installation	EA	1	28,820	1.0185	$29,353.17	$29,353.17		29
2.3	Sediment Stockpile Construction	LS	1	75,000	1.0185	$76,387.50	$76,388		4
2.4	Stormwater Upgrades	LS	1	75,000	1.0185	$76,387.50	$76,388		4
3	**Dredging - Waterway**							**$1,034,518**	1
3.1	Dredge contaminated sediments (Areas 2A, 2B, 3B, 1C, 5B)	DAY	40	5,725	1.0185	$5,830.91	$232,404		7,8
3.2	Overdredge contaminated sediments	DAY	13	3,500	1.0185	$3,564.75	$46,822		18,19
3.3	Floodlights	MONTH	6	16,000	1.0185	$16,296.00	$89,704		10
3.4	Construction office	MONTH	6	76,717	1.0185	$78,136.26	$430,114		11
3.5	Water Quality Monitoring	MONTH	6	42,000	1.0185	$42,777.00	$235,473		21
4	**Offloading and On-shore Management**							**$1,199,533**	
4.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	61	283	1.0185	$288.24	$17,456.22		31
4.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	61	238	1.0185	$242.40	$14,680.50		32
4.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		33
4.4	Water Filtration Unit, handle upto 300 gpm	MONTH	3	20000	1.0185	$20,370.00	$61,110.00		24, 37
4.5	Chitosan for Filtration, 1% solution	GAL	371	11	1.0185	$11.20	$4,156.50		25
4.6	Water Treatment Unit Operator, full-time	DAY	61	500	1.0185	$509.25	$30,841.39		4
4.7	Transport sediment to offload facility	DAY	53	7,000	1.0185	$7,129.50	$377,806.97		16
4.8	Offload Sediments to Stockpile	CY	80,352	5.73	1.0185	$5.84	$469,069.68		26
4.9	Transport to Railcar or Large Stockpile	CY	80,352	0.86	1.0185	$0.88	$70,380.91		27
4.10	Load into Railcars	CY	80,352	0.63	1.0185	$0.65	$51,830.90		34
4.11	Yard Locomotive	DAY	53	516	1.0185	$525.55	$27,849.77		35
4.12	Assorted Water Management	MONTH	3	20,000	1.0185	$20,370.00	$61,110.00		4
5	**Capping**							**$616,471**	1
5.1	Barge delivery from ASB to placement point	DAY	57	4,100	1.0185	$4,175.85	$238,447		13,14, 23
5.2	Sand cap placement by small dredge	CY	57,101	7	1.0185	$6.62	$378,025		4
5.3	Bathymetric Survey (50 ft center to center, single beam sonar)	Acre	51	50	1.0185	$50.93	$2,592		4,30
6	**Disposal**							**$3,670,446**	1
6.1	Railcar transport to and tipping at Roosevelt, WA	TON	120,528	30	1.0185	$30.45	$3,670,446		2, 36
7a	**Under Dock Work**	LS	1	591,659	1.0185	$602,604.69	$602,605	**$602,605**	
7b	**Log Pond Cap Contingency Actions (Addendum 1)**	LS	1	362,877	1.0000	$362,877.35	$362,877	**$362,877**	
8	**Demobilization**							**$63,300**	1
8.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	4,800	1.0185	$4,888.80	$9,778		4
8.2	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
8.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
8.4	Barge-mounted backhoe, 5-cy bucket	EA	1	40,000	1.0185	$40,740.00	$40,740		
8.5	Front-end loader	EA	3	100	1.0185	$101.85	$306		3
8.6	Tug, push, diesel, 500-hp `	EA	1	2,000	1.0185	$2,037.00	$2,037		4
8.7	Barge, flat-deck, 2,000-ton capacity	EA	2	600	1.0185	$611.10	$1,222		4
8.8	Barge, flat-deck, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
8.9	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
8.10	Construction office teardown	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$8,211,338**	1
	Design, Engineering & Permitting (Year 1 and 3)		12%					$985,361	4
	Construction management and monitoring		7%					$574,794	4
	Long-term environmental monitoring		LS					$1,080,000	4
	Sales Taxes		8.4%					$689,752	
	TOTAL Cost Excluding Construction Contingency							$11,541,245	
	Contingency @		30%					$2,463,401	4
	Total* (including contingency)							**$14,004,646**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham, escalated per note 1.
4 Professional judgement based on previous projects. Assumes 6 monitoring events (years 1, 3, 5, 10, 20, 30) with a current cost of $180,000 per event.
7 Dredge contaminated sediment: 170 cy/hr x 20 hr/day = 3,400 cy/20-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 10 hr or $3,500/day totals $5,725/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day.
$1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
13 Capping sand transport to site by barge at 2,000 ton/trip/1.5 ton/cy = 1,300 cy/trip; assume trip takes 1/2 hr; unload 1,300 cy @ 100 cy/hr in 13hr
14 Assume two 2,000-ton barge and one tug combinations . Cost each combination for rental ($800/day barge + $500/day tug) at $2,100/day plus operations ($200/hr x 10 hr tug) at $2,000/day for a total of $4,100/day. Labor included in

operations cost.
16 Assume two 6,000-ton barges available to transport contaminated sediment to offload facility, one tug to alternate to rotate barges between loading at waterway and unloading. Rental (2 ea x $2000/ea/day barges + 1 ea x $800/day tug) at $4,800/day plus operations (1 ea x $220/hr x 10 hr tug) at $2,200/day for a total of $7,000/day. Labor included in operations costs.
18 Overdredge contaminated sediment production rate: 1,400 cy/20-hr day
19 Ovedredge contaminated sediment: backhoe dredge at $1,500/day plus operating costs of $200/hr (equipment and personnel) x 10 hr or $2,000/day totals $3,500/day.
21 $1500/day, 28 days/month
23 Assumes that costs of excavation from ASB, transport to barge loading site, and loading of barge included in ASB cost estimate
24 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
25 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*58 shifts = 371 gallons
26 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each)
27 @3400 CY for 20 hours = $0.85/CY
28 Need ~1600 feet trackage to finish loop track for loading (40 CYD/car, each car 65 ft long), Costs 05650-700-1020
29 Assume 1 needed. Costs from 05650-700-2200, plus cost index of 110% for Bellingham
30 Assumes 4 surveys of work area
31 Costs from 01590-800-0010, assumes 7 day/week operation
32 Costs from 01590-400-4400, assumes 7 day/week operation
33 Costs from 02510-760-0900
34 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
35 Costs from 01590-500-7000
36 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal
37 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent

Appendix B – Estimated Remedial Costs

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 5 - Phase 2
Removal within the ASB
Dredge Area 8

Item	Description	Unit	Quantity	Unit Cost	Item Cost	Total Cost	Notes
1	**ASB Dredging (See ASB - Construction Subtotal)**	LS	1	$21,602,915	$21,602,915	**$21,602,915**	
	Subtotal					**$21,602,915**	
	Design, Engineering & Permitting		LS			$1,850,000	
	Construction management and monitoring		7%			$1,512,204	
	Sales Taxes		8.4%			$1,814,645	
	TOTAL Cost Excluding Construction Contingency					$26,779,764	
	Contingency @		30%			$6,480,875	
	Total*					**$33,260,639**	

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)

Appendix B – Estimated Remedial Costs

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 5 - Phase 3
Capping in Areas 5B, 6B, 6C, 2C
Dredge Areas 1A, 1B
Estimate assumes that ASB berm sands can be reused as capping material.

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalation (2004-2005)	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$70,531**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	4,800	1.0185	$4,888.80	$4,889		4
1.2	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
1.3	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
1.4	Tug, push, diesel, 500-hp	EA	2	2,000	1.0185	$2,037.00	$4,074		4
1.5	Barge, flat-deck, 2,000-ton capacity	EA	2	700	1.0185	$712.95	$1,426		4
1.6	Barge, flat-deck or split-hull, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
1.7	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
1.8	Construction office steup	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
1.9	Nonscheduled contract costs	EA	1	50,000	1.0185	$50,925.00	$50,925		4
2	**Dredging - Waterway**							**$687,826**	1
2.1	Dredge uncontaminated sediments (Areas 1A & 1B)	DAY	37	9,225	1.0185	$9,395.66	$343,768		6,8
2.2	Floodlights	MONTH	4	16,000	1.0185	$16,296.00	$59,373		10
2.3	Construction office	MONTH	4	76,717	1.0185	$78,136.26	$284,684		11
4	**Capping**							**$1,753,059**	1
4.1	Barge movement from loading area to capping area	DAY	73	10,600	1.0185	$10,796.10	$785,038		13,14
4.2	Sand cap placement by small dredge	CY	145,430	7	1.0185	$6.62	$962,783		4
4.3	Bathymetric Survey (50 ft center to center, single beam sonar)	Acre	103	50	1.0185	$50.93	$5,237		4
5	**Transportation**							**$536,614**	1
5.1	Barge uncontaminated sediment to Rosario PSDDA Site	DAY	37	14,400	1.0185	$14,666.40	$536,614		16
6	**Disposal**							**$95,025**	1
6.1	PSSDA Disposal Fee	TON	186,599	1	1.0185	$0.51	$95,025		
7	**Demobilization**							**$19,402**	1
7.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	4,800	1.0185	$4,888.80	$4,889		4
7.2	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
7.3	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
7.4	Tug, push, diesel, 500-hp	EA	2	2,000	1.0185	$2,037.00	$4,074		4
7.5	Barge, flat-deck, 2,000-ton capacity	EA	2	600	1.0185	$611.10	$1,222		4
7.6	Barge, flat-deck, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
7.7	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
7.8	Construction office teardown	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12

Appendix B – Estimated Remedial Costs

Subtotal		**$3,162,457**	1
Design, Engineering & Permitting	12%	$379,495	4
Construction management and monitoring	7%	$221,372	4
Long Term Environmental Monitoring	*included in year 1*	NA	
Sales Taxes	8.4%	$265,646	
TOTAL Cost Excluding Construction Contingency		$4,028,971	
Contingency @	30%	$948,737	4
Total*		**$4,977,708**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects.
6 Dredge and overdredge uncontaminated sediment: 3,400 cy/20-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 20 hr or $7,000/day totals $9,225/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day. $1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
13 Capping sand transport to site by barge at 2,000 ton/trip/1.5 ton/cy = 1,300 cy/trip; assume trip takes 1/2 hr; unload 1,300 cy @ 100 cy/hr in 13 hr
14 Assume two 2,000-ton barge and one tug combinationsto bring capping sand to waterway. Cost each combination for rental ($800/day ($800/day barge + $500/day tug) at $2,100/day plus operations ($200/hr x 20 hr tug) at $4,000/day for a total of $6,100/day. Labor included in operations cost.
16 Assume two 6,000-ton barges available to transport uncontaminated sediment to PSDDA site, two tugs alternate to rotate barges between loading at waterway and unloading at habitat berm sites. Rental (2 ea x $2000/ea/day barges + 2 ea x $800/day tug) at $5,600/day plus operations (2 ea x $220/hr x 20 hr tug) at $8,800/day for a total of $14,400/day. Labor included in operations costs.

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 6 - Phase 1
Capping in Areas 2A, 2B, 2C, 3B
Dredge Areas 1C1, 1C2, 1C3, 2A, 2B, 2C, 3B, 5B
Estimate assumes that ASB berm sands can be reused as capping material.

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$116,465**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	4,800	1.0185	$4,888.80	$9,778		4
1.2	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	40,000	1.0185	$40,740.00	$40,740		2
1.5	Front-end loader	EA	3	100	1.0185	$101.85	$306		3
1.6	Tug, push, diesel, 500-hp	EA	2	2,000	1.0185	$2,037.00	$4,074		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	2	700	1.0185	$712.95	$1,426		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
1.10	Construction office steup	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	50,000	1.0185	$50,925.00	$50,925		4
2	**Construct Dredge Spoil Offload Facility**							**$547,159**	
2.1	Track Installation - 100-lb rail, steel ties in concrete, incl fasteners and plates	FT	1,600	224	1.0185	$228.14	$365,030.40		28
2.2	Track Switch Installation	EA	1	28,820	1.0185	$29,353.17	$29,353.17		29
2.3	Sediment Stockpile Construction	LS	1	75,000	1.0185	$76,387.50	$76,388		4
2.4	Stormwater Upgrades	LS	1	75,000	1.0185	$76,387.50	$76,388		4
3	**Dredging - Waterway**							**$815,250**	1
3.1	Dredge contaminated sediments (Areas 2A, 2B, 3B, 1C, 5B)	DAY	31	9,225	1.0185	$9,395.66	$287,859		7,8
3.2	Overdredge contaminated sediments	DAY	21	5,500	1.0185	$5,601.75	$115,764		18,19
3.3	Floodlights	MONTH	3	16,000	1.0185	$16,296.00	$48,888		10
3.4	Construction office	MONTH	3	76,717	1.0185	$78,136.26	$234,409		11
3.5	Water Quality Monitoring	MONTH	3	42,000	1.0185	$42,777.00	$128,331		21
4	**Offloading and On-shore Management**							**$1,716,822**	
4.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	59	283	1.0185	$288.24	$16,899.84		31
4.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	59	238	1.0185	$242.40	$14,212.59		32
4.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		33
4.4	Water Filtration Unit, handle upto 300 gpm	MONTH	3	20000	1.0185	$20,370.00	$61,110.00		24, 37
4.5	Chitosan for Filtration, 1% solution	GAL	540	11	1.0185	$11.20	$6,049.89		25
4.6	Water Treatment Unit Operator, full-time	DAY	59	500	1.0185	$509.25	$29,858.38		4
4.7	Transport sediment to offload facility	DAY	51	9,200	1.0185	$9,370.20	$480,719.96		16
4.8	Offload Sediments to Stockpile	CY	136,799	5.73	1.0185	$5.84	$798,592.61		26
4.9	Transport to Railcar or Large Stockpile	CY	136,799	0.86	1.0185	$0.88	$119,823.72		27
4.10	Load into Railcars	CY	136,799	0.63	1.0185	$0.65	$88,242.28		34
4.11	Yard Locomotive	DAY	51	516	1.0185	$525.55	$26,962.12		35
4.12	Assorted Water Management	MONTH	3	20,000	1.0185	$20,370.00	$61,110.00		4
5	**Capping**							**$208,676**	1
5.1	Sand cap placement by small dredge	CY	31,521	7	1.0185	$6.62	$208,676		4
5.2	Bathymetric Survey (50 ft center to center, single beam sonar)	Acre	30	50	1.0185	$50.93	$1,516		4,30
6	**Disposal**							**$6,248,947**	1
6.1	Railcar transport to and tipping at Roosevelt, WA	TON	205,199	30	1.0185	$30.45	$6,248,947		2, 36
7a	**Under-Dock Work**	LS	1	591,659	1.0185	$602,604.69	$602,605	**$602,605**	
7b	**Log Pond Cap Contingency Actions (Addendum 1)**	LS	1	362,877	1.0000	$362,877.35	$362,877	**$362,877**	
8	**Demobilization**							**$65,337**	1
8.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	4,800	1.0185	$4,888.80	$9,778		4

8.2	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
8.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
8.4	Barge-mounted backhoe, 5-cy bucket	EA	1	40,000	1.0185	$40,740.00	$40,740		
8.5	Front-end loader	EA	3	100	1.0185	$101.85	$306		3
8.6	Tug, push, diesel, 500-hp	EA	2	2,000	1.0185	$2,037.00	$4,074		4
8.7	Barge, flat-deck, 2,000-ton capacity	EA	2	600	1.0185	$611.10	$1,222		4
8.8	Barge, flat-deck, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
8.9	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
8.10	Construction office teardown	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$10,684,138**	1
	Design, Engineering & Permitting		12%					$1,282,097	4
	Construction management and monitoring		7%					$747,890	4
	Long-term environmental monitoring		LS					$960,000	4
	Sales Taxes		8.4%					$897,468	
	TOTAL Cost Excluding Construction Contingency							$14,571,592	
	Contingency @		30%					$3,205,241	4
	Total* (including contingency)							**$17,776,833**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham, escalated per note 1.
4 Professional judgement based on previous projects. Long-term monitoring assumes 6 monitoring events (years 1, 3, 5, 10, 20, 30) with a current cost of $160,000 per event.
7 Dredge contaminated sediment: 170 cy/hr x 20 hr/day = 3,400 cy/20-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 20 hr or $7,000/day totals $9,225/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day.
$1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
16 Assume two 6,000-ton barges available to transport contaminated sediment to offload facility, one tug to alternate to rotate barges between loading at waterway and unloading. Rental (2 ea x $2000/ea/day barges + 1 ea x $800/day tug) at $4,800/day plus operations (1 ea x $220/hr x 20 hr tug) at $4,400/day for a total of $9,200/day. Labor included in operations costs.
18 Overdredge contaminated sediment production rate: 1,400 cy/20-hr day
19 Ovedredge contaminated sediment: backhoe dredge at $1500/day plus operating costs of $200/hr (equipment and personnel) x 20 hr or $4,000/day totals $5500/day.
21 $1500/day, 28 days/month
23 Assumes that costs of excavation from ASB, transport to barge loading site, and loading of barge included in ASB cost estimate
24 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
25 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*84 shifts = 540 gallons
26 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
27 Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each) @3400 CY for 20 hours = $0.85/CY
28 Need ~1600 feet trackage to finish loop track for loading (40 CYD/car, each car 65 ft long), Costs 05650-700-1020
29 Assume 1 needed. Costs from 05650-700-2200, plus cost index of 110% for Bellingham
30 Assumes 4 surveys of work area
31 Costs from 01590-800-0010, assumes 7 day/week operation
32 Costs from 01590-400-4400, assumes 7 day/week operation
33 Costs from 02510-760-0900
34 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
35 Costs from 01590-500-7000
36 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal
37 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 6 - Phase 2
Removal within the ASB
Dredge Area 8

Item	Description	Unit	Quantity	Unit Cost	Item Cost	Total Cost	Notes
1	**ASB Dredging (See ASB - Construction Subtotal)**	LS	1	$21,602,915	$21,602,915	**$21,602,915**	
	Subtotal					**$21,602,915**	
	Design, Engineering & Permitting		LS			$1,850,000	
	Construction management and monitoring		7%			$1,512,204	
	Sales Taxes		8.4%			$1,814,645	
	TOTAL Cost Excluding Construction Contingency					$26,779,764	
	Contingency @		30%			$6,480,875	
	Total*					**$33,260,639**	

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 6 - Phase 3
Capping in Areas 5B, 6B, 6C, 2C
Dredge Areas 1A, 1B
Estimate assumes that ASB berm sands can be reused as capping material.

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalation (2004-2005)	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$70,531**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	4,800	1.0185	$4,888.80	$4,889		4
1.2	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
1.3	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
1.4	Tug, push, diesel, 500-hp	EA	2	2,000	1.0185	$2,037.00	$4,074		4
1.5	Barge, flat-deck, 2,000-ton capacity	EA	2	700	1.0185	$712.95	$1,426		4
1.6	Barge, flat-deck or split-hull, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
1.7	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
1.8	Construction office steup	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
1.9	Nonscheduled contract costs	EA	1	50,000	1.0185	$50,925.00	$50,925		4
2	**Dredging - Waterway**							**$721,497**	1
2.1	Dredge uncontaminated sediments (Areas 1A & 1B)	DAY	37	9,225	1.0185	$9,395.66	$343,768		6,8
2.2	Floodlights	MONTH	4	16,000	1.0185	$16,296.00	$65,184		10
2.3	Construction office	MONTH	4	76,717	1.0185	$78,136.26	$312,545		11
3	**Capping**							**$968,020**	1
3.1	Sand cap placement by small dredge	CY	145,430	7	1.0185	$6.62	$962,783		4
3.2	Bathymetric Survey (50 ft center to center, single beam sona	Acre	103	50	1.0185	$50.93	$5,237		4
4	**Transportation**							**$536,614**	1
4.1	Barge uncontaminated sediment to Rosario PSDDA Site	DAY	37	14,400	1.0185	$14,666.40	$536,614		16
5	**Disposal**							**$95,025**	1
5.1	PSSDA Disposal Fee	TON	186,599	0.50	1.0185	$0.51	$95,025		
6	**Demobilization**							**$19,402**	1
6.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	4,800	1.0185	$4,888.80	$4,889		4
6.2	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	1	3,000	1.0185	$3,055.50	$3,056		4
6.3	Tug, bow, diesel, 900-hp	EA	1	1,500	1.0185	$1,527.75	$1,528		4
6.4	Tug, push, diesel, 500-hp `	EA	2	2,000	1.0185	$2,037.00	$4,074		4
6.5	Barge, flat-deck, 2,000-ton capacity	EA	2	600	1.0185	$611.10	$1,222		4
6.6	Barge, flat-deck, 6,000-ton capacity	EA	2	1,500	1.0185	$1,527.75	$3,056		4
6.7	Dozer, diesel, crawler, 100-hp	EA	1	100	1.0185	$101.85	$102		3
6.8	Construction office teardown	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12

Subtotal		**$2,411,090**	1
Design, Engineering & Permitting	*12%*	$289,331	4
Construction management and monitoring	7%	$168,776	4
Long Term Environmental Monitoring	*included in year 1*	NA	
Sales Taxes	8.4%	$202,532	
TOTAL Cost Excluding Construction Contingency		$3,071,729	
Contingency @	30%	$723,327	4
Total*		**$3,795,056**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)

3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.

4 Professional judgement based on previous projects.

6 Dredge and overdredge uncontaminated sediment: 3,400 cy/20-hr day

8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 20 hr or $7,000/day totals $9,225/day.

10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day. $1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.

11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.

12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106). ($800/day barge + $500/day tug) at $2,100/day plus operations ($200/hr x 20 hr tug) at $4,000/day for a total of $6,100/day. Labor included in operations cost.

16 Assume two 6,000-ton barges available to transport uncontaminated sediment to PSDDA site, two tugs alternate to rotate barges between loading at waterway and unloading at habitat berm sites. Rental (2 ea x $2000/ea/day barges + 2 ea x $800/day tug) at $5,600/day plus operations (2 ea x $220/hr x 20 hr tug) at $8,800/day for a total of $14,400/day. Labor included in operations costs.

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 7 - Phase 1
Capping in Areas 2A, 2B, 2C, 3A, 3B
Dredge Areas 2A, 2B, 2C, 3A and 3B, 5B

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$116,262**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
1.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$40,000.00	1.0185	$40,740.00	$40,740		4
1.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
1.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$700.00	1.0185	$712.95	$1,426		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
1.1	Construction office steup	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	$50,000.00	1.0185	$50,925.00	$50,925		4
2	**Construct Dredge Spoil Offload Facility**							**$547,159**	
2.1	Track Installation - 100-lb rail, steel ties in concrete, incl fasteners and plates	FT	1,600	224	1.0185	$228.14	$365,030.40		25
2.2	Track Switch Installation	EA	1	28,820	1.0185	$29,353.17	$29,353.17		26
2.3	Sediment Stockpile Construction	LS	1	75,000	1.0185	$76,387.50	$76,388		4
2.4	Stormwater Upgrades	LS	1	75,000	1.0185	$76,387.50	$76,388		4
3	**Dredging**							**$2,099,128**	1
3.1	Dredge contaminated sediments (Areas 2A, 2B, 2C, 3A & 3B, 5B)	DAY	112	$9,225.00	1.0185	$9,395.66	$1,055,440		7,8
			1 production dredges, 20-hr days, 170 cy/hr production						
3.2	Overdredge contaminated sediments	DAY	29	$5,500.00	1.0185	$5,601.75	$162,344		22,23
					1 articulated dredge, 10-hr days, 50 cy/yr production rate				
3.3	Floodlights	MONTH	6	$16,000.00	1.0185	$16,296.00	$104,675		10
3.4	Construction office	MONTH	6	$76,717.00	1.0185	$78,136.26	$501,897		11
3.5	Water Quality Monitoring	MONTH	6	42,000	1.0185	$42,777.00	$274,772		24
4	**Offloading and On-shore Management**							**$4,977,573**	
4.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	162	283	1.0185	$288.24	$46,550.42		28
4.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	162	238	1.0185	$242.40	$39,148.41		29
4.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		30
4.4	Water Filtration Unit, handle upto 300 gpm	MONTH	7	20000	1.0185	$20,370.00	$142,590.00		27, 31
4.5	Chitosan for Filtration, 1% solution	GAL	1792	11	1.0185	$11.20	$20,076.67		32
4.6	Water Treatment Unit Operator, full-time	DAY	162	500	1.0185	$509.25	$82,244.57		4
4.7	Transport sediment to offload facility	DAY	141	9,200	1.0185	$9,370.20	$1,324,137.51		16
4.8	Offload Sediments to Stockpile	CY	420,284	5.73	1.0185	$5.84	$2,453,493.26		33
4.9	Transport to Railcar or Large Stockpile	CY	420,284	0.86	1.0185	$0.88	$368,131.00		34
4.10	Load into Railcars	CY	420,284	0.63	1.0185	$0.65	$271,104.23		35
4.11	Yard Locomotive	DAY	141	516	1.0185	$525.55	$74,266.84		36
4.12	Assorted Water Management	MONTH	7	20,000	1.0185	$20,370.00	$142,590.00		4
5	**Capping**							**$1,867,232**	1
5.1	Capping sand procurement and delivery (Areas 2A, 2B, 2C, 3A, 3B)	CY	65,584	$15.00	1.0185	$15.28	$1,001,963		3, 38
					1 unit, 10-hr days, high production				
5.2	Front-end loader for loading barges	MONTH	2	$15,780.00	1.0185	$16,071.93	$36,855		2, 39
5.3	Transport capping sand to placement locations	DAY	85	$4,500.00	1.0185	$4,583.25	$389,873		14
5.4	Sand cap placement	CY	65,584	$6.50	1.0185	$6.62	$434,184		4
5.5	Bathymetric Survey (50 ft center to center, single beam sonar)	Acre	86	$50.00	1.0185	$50.93	$4,356		4,40
					three events				
6	**Log Pond Cap Contingency Actions (Addendum 1)**	LS	1	362,877	1.000	$362,877	$362,877	**$362,877**	
7	**Disposal**							**$19,198,460**	1
7.1	Railcar transport to and tipping at Roosevelt, WA	TON	630,426	30	1.0185	$30.45	$19,198,460		2, 37
8	**Demobilization**							**$27,449**	1
8.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
8.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
8.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
8.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$3,000.00	1.0185	$3,055.50	$3,056		4

8.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
8.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
8.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$600.00	1.0185	$611.10	$1,222		4
8.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
8.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
8.10	Construction office teardown	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$29,196,139**	1
	Design, Engineering & Permitting		9%					$2,627,652	4
	Construction management and monitoring		7%					$2,043,730	4
	Long-term environmental monitoring		LS					$960,000	4
	Sales Taxes		8.4%					$2,452,476	
	TOTAL Cost Excluding Construction Contingency							$37,279,997	
	Contingency @		30%					$8,758,842	4
	Total*							**$46,038,838**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects. Long-term monitoring Assumes 6 monitoring events (years 1, 3, 5, 10, 20, 30) with a current cost of $160,000 per event.
7 Dredge contaminated sediment: 1700 cy/hr x 20 hr/day = 3,400 cy/20-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 20 hr or $7,000/day totals $9,225/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day. $1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
14 Assume two 2,000-ton barge and one tug to bring capping sand to waterway. Cost each combination for rental ($1000/day barge + $500/day tug) at $2,500/day plus operations ($200/hr x 10 hr tug) at $2,000/day for a total of $4,500/day. Labor included in operations cost.
16 Assume two 6,000-ton barges available per dredge to transport contaminated sediment to offload, one tugs alternate to rotate barges between loading at waterway and unloading at offload site. Rental (2 ea x $2000/ea/day barges + 1 ea x $800/day tug) at $4,800/day plus operations (1 ea x $220/hr x 20 hr tug) at $4,400/day for a total of $9,200/day. Labor included in operations costs.
22 Overdredge sediment production rate: 1400 cy/20-hr day
23 Ovedredge contaminated and uncontaminated sediment: backhoe dredge at $1500/day plus operating costs of $200/hr (equipment and personnel) x 20 hr or $4,000/day totals $5500/day.
24 $1500/day, 28 days/month
25 Need ~1600 feet trackage to finish loop track for loading (40 CYD/car, each car 65 ft long), Costs 05650-700-1020
26 Assume 1 needed. Costs from 05650-700-2200, plus cost index of 110% for Bellingham
27 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
28 Costs from 01590-800-0010, assumes 7 day/week operation
29 Costs from 01590-400-4400, assumes 7 day/week operation
30 Costs from 02510-760-0900
31 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent
32 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*280 shifts = 1792 gallons
33 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
34 Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each) @3400 CY for 20 hours = $0.85/CY
35 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
36 Costs from 01590-500-7000
37 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal
38 Assumes 45,000 CYD available from ASB, rest must be purchased
39 Assumes that costs of excavation from ASB, transport to barge loading site, and loading of barge included in ASB cost estimate for sands from ASB
40 Assumes 4 surveys of work area

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 7 - Phase 2
Removal within the ASB
Dredge Area 8

Item	Description	Unit	Quantity	Unit Cost	Item Cost	Total Cost	Notes
1	**ASB Dredging (See ASB - Construction Subtotal)**	LS	1	$21,602,915	$21,602,915	**$21,602,915**	
	Subtotal					**$21,602,915**	
	Design, Engineering & Permitting		LS			$1,850,000	
	Construction management and monitoring		7%			$1,512,204	
	Sales Taxes		8.4%			$1,814,645	
	TOTAL Cost Excluding Construction Contingency					$26,779,764	
	Contingency @		30%			$6,480,875	
	Total*					**$33,260,639**	

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 7 - Phase 3

Dredge Areas 1A, 1B and 1C
Cap Areas 5B, 6B, 6C

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$114,428**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
1.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$40,000.00	1.0185	$40,740.00	$40,740		4
1.5	Front-end loader	EA	2	$100.00	1.0185	$101.85	$204		3
1.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	4	$700.00	1.0185	$712.95	$2,852		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	0	$1,500.00	1.0185	$1,527.75	$0		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
1.10	Construction office steup	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	$50,000.00	1.0185	$50,925.00	$50,925		4
2	**Dredging**							**$1,008,559**	1
2.1	Dredge uncontaminated sediments (Areas 1A & 1B)	DAY	37	$5,725.00	1.0185	$5,830.91	$213,341		6,8
			1 production dredge, 10-hr days, 150 cy/hr production total from the dredge						
2.2	Dredge contaminated sediments (Areas 1C1, 1C2 & 1C3)	DAY	47	$5,725.00	1.0185	$5,830.91	$272,085		7,8
			1 production dredge, 10-hr days, 150 cy/hr production total from the dredge						
2.3	Overdredge contaminated sediments (Areas 1C1, 1C2 & 1C3)	DAY	13	5,500	1.0185	$5,601.75	$75,059		18,19
2.4	Floodlights	MONTH	4	$16,000.00	1.0185	$16,296.00	$61,666		10
2.5	Construction office	MONTH	4	$76,717.00	1.0185	$78,136.26	$295,676		11
2.6	Water Quality Monitoring	MONTH	2	42,000	1.0185	$42,777.00	$90,731		24
3	**Offloading and On-shore Management**							**$1,485,336**	
3.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	69	283	1.0185	$288.24	$19,785.07		31
3.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	69	238	1.0185	$242.40	$16,639.03		32
3.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		33
3.4	Water Filtration Unit, handle upto 300 gpm	MONTH	3	20000	1.0185	$20,370.00	$61,110.00		25, 37
3.5	Chitosan for Filtration, 1% solution	GAL	371	11	1.0185	$11.20	$4,156.50		26
3.6	Water Treatment Unit Operator, full-time	DAY	69	500	1.0185	$509.25	$34,955.95		4
3.7	Transport sediment to offload facility	DAY	60	9,200	1.0185	$9,370.20	$562,790.72		16
3.8	Offload Sediments to Stockpile	CY	92,406	5.73	1.0185	$5.84	$539,437.27		27
3.9	Transport to Railcar or Large Stockpile	CY	92,406	0.86	1.0185	$0.88	$80,939.12		28
3.10	Load into Railcars	CY	92,406	0.63	1.0185	$0.65	$59,606.33		34
3.11	Yard Locomotive	DAY	60	516	1.0185	$525.55	$31,565.22		35
3.12	Assorted Water Management	MONTH	3	20,000	1.0185	$20,370.00	$61,110.00		4
4	**Capping**							**$626,212**	1
4.1	Transport capping sand to placement locations	DAY	47	$4,500.00	1.0185	$4,583.25	$216,704		14
4.2	Sand cap placement	CY	61,466	$6.50	1.0185	$6.62	$406,922		4
				Sand from ASB					
4.3	Bathymetric Survey (50 ft center to center, single beam sonar)	Acre	51	$50.00	1.0185	$50.93	$2,587		4, 30
5	**Transportation**							**$536,614**	1
5.1	Barge uncontaminated sediment to Rosario PSDDA Site	DAY	37	14,400	1.0185	$14,666.40	$536,614		15
6	**Disposal**							**$4,316,095**	1
6.1	PSSDA Disposal Fee	TON	186,599	1	1.0185	$0.51	$95,025		
6.2	Railcar transport to and tipping at Roosevelt, WA	TON	138,609	29.9	1.0185	$30.45	$4,221,069		2, 36
7	**Under Dock Work**	LS	1	591,659	1.0185	$602,604.69	$602,605	**$602,605**	
8	**Demobilization**							**$63,096**	1
8.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
8.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4

8.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
8.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$40,000.00	1.0185	$40,740.00	$40,740		4
8.5	Front-end loader	EA	2	$100.00	1.0185	$101.85	$204		3
8.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
8.7	Barge, flat-deck, 2,000-ton capacity	EA	4	$600.00	1.0185	$611.10	$2,444		4
8.8	Barge, flat-deck, 6,000-ton capacity	EA	0	$1,500.00	1.0185	$1,527.75	$0		4
8.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
8.10	Construction office teardown	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$8,752,945**	1
	Design, Engineering & Permitting		9%					$787,765	4
	Construction management and monitoring		7%					$612,706	4
	Long-term environmental monitoring		*included in Year 1*					NA	
	Sales Taxes		8.4%					$735,247	
	TOTAL Cost Excluding Construction Contingency							$10,888,663	
	Contingency @		30%					$2,625,883	4
	Total*							**$13,514,547**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects.
6 Dredge uncontaminated sediment: 1500 cy/hr x 10 hr/day x 1 = 1,500 cy/10-hr day
7 Dredge contaminated sediment: 1500 cy/hr x 10 hr/day x 1 = 1,500 cy/10-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 10 hr or $3,500/day totals $5,725/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day. $1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
14 Assume two 2,000-ton barge and one tug to bring capping sand to waterway. Cost each combination for rental ($1000/day barge + $500/day tug) at $2,500/day plus operations ($200/hr x 10 hr tug) at $2,000/day for a total of $4,500/day. Labor included in operations cost.
15 Assume two 6,000-ton barges available to transport uncontaminated sediment to PSDDA site, two tugs alternate to rotate barges between loading at waterway and unloading at habitat berm sites. Rental (2 ea x $2000/ea/day barges + 2 ea x $800/day tug) at $5,600/day plus operations (2 ea x $220/hr x 20 hr tug) at $8,800/day for a total of $14,400/day. Labor included in operations costs.
16 Assume two 2,000-ton barges available to transport contaminated sediment to offload, two tugs alternate to rotate barges between loading at waterway and unloading at CAD. Rental (2 ea x $1000/ea/day barges + 2 ea x $800/day tug) at $3,600/day plus operations (2 ea x $220/hr x 10 hr tug) at $4,400/day for a total of $8,000/day. Labor included in operations costs.
18 Pipe rerouting includes a dredge mate and a general laborer working each shift to move pipe (1 shift/day x ($307/shift + $255/shift) = $562/day) plus a skiff ($150/day) for a total of $712/day.
19 Anchor dozers (2 dozers ea dredge x 11 months x $3,900/month + 2 ea x 219 days x 4 hr operating/day x $16/hr + 1 dozer operators x 219 days x $307/8-hr day = $181,065/ dredge) for 2 dredges per month (2 x $181,065 / 11 months) is $32,921/month.
24 $1500/day, 28 days/month
25 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
26 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*58 shifts = 371 gallons
27 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each)
28 @3400 CY for 20 hours = $0.85/CY
30 Assumes 4 surveys of work area
31 Costs from 01590-800-0010, assumes 7 day/week operation
32 Costs from 01590-400-4400, assumes 7 day/week operation
33 Costs from 02510-760-0900
34 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
35 Costs from 01590-500-7000
36 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal
37 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent

Appendix B – Estimated Remedial Costs

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 8 - Phase 1
Capping in Areas 2A, 2B, 2C, 3A, 3B
Dredge Areas 2A, 2B, 2C, 3A, 3B

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$127,771**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	$4,800.00	1.0185	$4,888.80	$9,778		4
1.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	3	$3,000.00	1.0185	$3,055.50	$9,167		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$40,000.00	1.0185	$40,740.00	$40,740		4
1.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
1.6	Tug, push, diesel, 500-hp	EA	3	$2,000.00	1.0185	$2,037.00	$6,111		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$700.00	1.0185	$712.95	$1,426		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	3	$1,500.00	1.0185	$1,527.75	$4,583		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
1.1	Construction office steup	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	$50,000.00	1.0185	$50,925.00	$50,925		4
2	**Construct Dredge Spoil Offload Facility**							**$547,159**	
2.1	Track Installation - 100-lb rail, steel ties in concrete, incl fasteners and pl	FT	1,600	224	1.0185	$228.14	$365,030.40		25
2.2	Track Switch Installation	EA	1	28,820	1.0185	$29,353.17	$29,353.17		26
2.3	Sediment Stockpile Construction	LS	1	75,000	1.0185	$76,387.50	$76,388		4
2.4	Stormwater Upgrades	LS	1	75,000	1.0185	$76,387.50	$76,388		4
3	**Dredging**							**$2,201,525**	1
3.1	Dredge contaminated sediments (Areas 2A, 2B, 2C, 3A & 3B)	DAY	119	$9,225.00	1.0185	$9,395.66	$1,122,576		7,8
			1 production dredges, 20-hr days, 170 cy/hr production						
3.2	Overdredge contaminated sediments	DAY	28	$5,500.00	1.0185	$5,601.75	$157,943		22,23
			1 articulated dredge, 10-hr days, 50 cy/yr production rate						
3.3	Floodlights	MONTH	7	$16,000.00	1.0185	$16,296.00	$109,386		10
3.4	Construction office	MONTH	7	$76,717.00	1.0185	$78,136.26	$524,484		11
3.5	Water Quality Monitoring	MONTH	7	42,000	1.0185	$42,777.00	$287,137		24
4	**Offloading and On-shore Management**							**$5,276,686**	
4.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	169	283	1.0185	$288.24	$48,645.37		28
4.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	169	238	1.0185	$242.40	$40,910.24		29
4.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		30
4.4	Water Filtration Unit, handle upto 300 gpm	MONTH	8	20000	1.0185	$20,370.00	$162,960.00		27, 31
4.5	Chitosan for Filtration, 1% solution	GAL	1869	11	1.0185	$11.20	$20,939.34		32
4.6	Water Treatment Unit Operator, full-time	DAY	169	500	1.0185	$509.25	$85,945.87		4
4.7	Transport sediment to offload facility	DAY	148	9,200	1.0185	$9,370.20	$1,383,728.58		16
4.8	Offload Sediments to Stockpile	CY	445,699	5.73	1.0185	$5.84	$2,601,856.95		33
4.9	Transport to Railcar or Large Stockpile	CY	445,699	0.86	1.0185	$0.88	$390,392.03		34
4.10	Load into Railcars	CY	445,699	0.63	1.0185	$0.65	$287,498.01		35
4.11	Yard Locomotive	DAY	148	516	1.0185	$525.55	$77,609.12		36
4.12	Assorted Water Management	MONTH	8	20,000	1.0185	$20,370.00	$162,960.00		4
5	**Capping**							**$1,867,232**	1
5.1	Capping sand procurement and delivery (Areas 2A, 2B, 2C, 3A, 3B)	CY	65,584	$15.00	1.0185	$15.28	$1,001,963		3, 38
				1 unit, 10-hr days, high production					
5.3	Front-end loader for loading barges	MONTH	2	$15,780.00	1.0185	$16,071.93	$36,855		2, 39
5.4	Transport capping sand to placement locations	DAY	85	$4,500.00	1.0185	$4,583.25	$389,873		14
5.5	Sand cap placement	CY	65,584	$6.50	1.0185	$6.62	$434,184		4
5.6	Bathymetric Survey (50 ft center to center, single beam sonar)	Acre	86	$50.00	1.0185	$50.93	$4,356		4,40
				three events					
6	**Log Pond Cap Contingency Actions (Addendum 1)**	LS	1	$ 362,877	1.0000	$362,877	$362,877	**$362,877**	
7	**Disposal**							**$20,359,398**	1
7.1	Railcar transport to and tipping at Roosevelt, WA	TON	668,548	30	1.0185	$30.45	$20,359,398		2, 37

8	**Demobilization**							**$38,958**	1
8.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	$4,800.00	1.0185	$4,888.80	$9,778		4
8.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
8.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	3	$3,000.00	1.0185	$3,055.50	$9,167		4
8.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$3,000.00	1.0185	$3,055.50	$3,056		4
8.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
8.6	Tug, push, diesel, 500-hp	EA	3	$2,000.00	1.0185	$2,037.00	$6,111		4
8.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$600.00	1.0185	$611.10	$1,222		4
8.8	Barge, flat-deck, 6,000-ton capacity	EA	3	$1,500.00	1.0185	$1,527.75	$4,583		4
8.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
8.10	Construction office teardown	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$30,781,606**	1
	Design, Engineering & Permitting		12%					$3,693,793	4
	Construction management and monitoring		7%					$2,154,712	4
	Long-term environmental monitoring		LS					$870,000	
	Sales Taxes		8.4%					$2,585,655	
	TOTAL Cost Excluding Construction Contingency							$40,085,765	
	Contingency @		30%					$9,234,482	4
	Total*							**$49,320,247**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects. Long-term monitoring Assumes 6 monitoring events (years 1, 3, 5, 10, 20, 30) with a current cost of $145,000 per event.
7 Dredge contaminated sediment: 1700 cy/hr x 20 hr/day = 3,400 cy/20-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 20 hr or $7,000/day totals $9,225/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day.
$1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
14 Assume two 2,000-ton barge and one tug to bring capping sand to waterway. Cost each combination for rental ($1000/day barge + $500/day tug) at $2,500/day plus operations ($200/hr x 10 hr tug) at $2,000/day for a total of $4,500/day. Labor included in operations cost.
16 Assume two 6,000-ton barges available per dredge to transport contaminated sediment to offload, one tugs alternate to rotate barges between loading at waterway and unloading at offload site. Rental (2 ea x $2000/ea/day barges + 1 ea x $800/day tug) at $4,800/day plus operations (1 ea x $220/hr x 20 hr tug) at $4,400/day for a total of $9,200/day. Labor included in operations costs.
22 Overdredge sediment production rate: 1400 cy/20-hr day
23 Ovedredge contaminated and uncontaminated sediment: backhoe dredge at $1500/day plus operating costs of $200/hr (equipment and personnel) x 20 hr or $4,000/day totals $5500/day.
24 $1500/day, 28 days/month
25 Need ~2000 feet trackage to finish loop track for loading (40 CYD/car, each car 65 ft long), Costs 05650-700-1020
26 Assume 3 needed. Costs from 05650-700-2200, plus cost index of 110% for Bellingham
27 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
28 Costs from 01590-800-0010, assumes 7 day/week operation
29 Costs from 01590-400-4400, assumes 7 day/week operation
30 Costs from 02510-760-0900
31 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent
32 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*292 shifts = 1869 gallons
33 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
34 Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each) @3400 CY for 20 hours = $0.85/CY
35 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
36 Costs from 01590-500-7000
37 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal
38 Assumes 45,000 CYD available from ASB, rest must be purchased
39 Assumes that costs of excavation from ASB, transport to barge loading site, and loading of barge included in ASB cost estimate for sands from ASB
40 Assumes 4 surveys of work area

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 8 - Phase 2
Dredge Areas 5A, 5B, 6A, 6B, 6C, 1C

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$121,151**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	$4,800.00	1.0185	$4,888.80	$9,778		4
1.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$40,000.00	1.0185	$40,740.00	$40,740		4
1.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
1.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$700.00	1.0185	$712.95	$1,426		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
1.1	Construction office steup	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	$50,000.00	1.0185	$50,925.00	$50,925		4
2	**Dredging**							**$3,335,688**	1
2.1	Dredge contaminated sediments using production (Areas 5A, 5B, 6A, 6B, 6C, 1C)	DAY	134	$9,225.00	1.0185	$9,395.66	$1,260,799		7,8
					1 production dredges, 20-hr days, 170 cy/hr production				
2.2	Dredge contaminated sediments using fixed-arm dredge (areas 5A, 5B, 6A, 6B, 6C overdredge)	DAY	105	$5,500.00	1.0185	$5,601.75	$585,786		22,23
					1 articulated dredge, 10-hr days, 50 cy/yr production rate				
2.3	Floodlights	MONTH	11	$16,000.00	1.0185	$16,296.00	$176,857		10
2.4	Construction office	MONTH	11	$76,717.00	1.0185	$78,136.26	$847,997		11
2.5	Water Quality Monitoring	MONTH	11	42,000	1.0185	$42,777.00	$464,250		24
4	**Offloading and On-shore Management**							**$7,631,424**	
4.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	273	283	1.0185	$288.24	$78,650.87		28
4.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	273	238	1.0185	$242.40	$66,144.55		29
4.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		30
4.4	Water Filtration Unit, handle upto 300 gpm	MONTH	12	20000	1.0185	$20,370.00	$244,440.00		27, 31
4.5	Chitosan for Filtration, 1% solution	GAL	1869	11	1.0185	$11.20	$20,939.34		32
4.6	Water Treatment Unit Operator, full-time	DAY	273	500	1.0185	$509.25	$138,959.13		4
4.7	Transport sediment to offload facility	DAY	239	9,200	1.0185	$9,370.20	$2,237,242.06		16
4.8	Offload Sediments to Stockpile	CY	606,345	5.73	1.0185	$5.84	$3,539,660.87		33
4.9	Transport to Railcar or Large Stockpile	CY	606,345	0.86	1.0185	$0.88	$531,103.52		34
4.10	Load into Railcars	CY	606,345	0.63	1.0185	$0.65	$391,122.75		35
4.11	Yard Locomotive	DAY	239	516	1.0185	$525.55	$125,480.10		36
4.12	Assorted Water Management	MONTH	12	20,000	1.0185	$20,370.00	$244,440.00		4
5	**Disposal**							**$27,697,666**	1
5.1	Railcar transport to and tipping at Roosevelt, WA	TON	909,517	30	1.0185	$30.45	$27,697,666		2, 37
6	**Under Dock Work**	LS	1	591,659	1.0185	$602,604.69	$602,605	**$602,605**	
7	**Demobilization**							**$32,337**	1
7.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	2	$4,800.00	1.0185	$4,888.80	$9,778		4
7.2	Tug, bow, diesel, 900-hp	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
7.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4

7.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$3,000.00	1.0185	$3,055.50	$3,056		4
7.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
7.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
7.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$600.00	1.0185	$611.10	$1,222		4
7.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
7.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
7.10	Construction office teardown	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$39,420,871**	1
	Design, Engineering & Permitting		12%					$4,730,504	4
	Construction management and monitoring		7%					$2,759,461	4
	Long-term environmental monitoring		*included in Year 1*					NA	
	Sales Taxes		8.4%					$3,311,353	
	TOTAL Cost Excluding Construction Contingency							$50,222,189	
	Contingency @		30%					$11,826,261	4
	Total*							**$62,048,450**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day. $1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
16 Assume two 6,000-ton barges available per dredge to transport contaminated sediment to offload, one tugs alternate to rotate barges between loading at waterway and unloading at offload site. Rental (2 ea x $2000/ea/day barges + 1 ea x $800/day tug) at $4,800/day plus operations (1 ea x $220/hr x 20 hr tug) at $4,400/day for a total of $9,200/day. Labor included in operations costs.
22 Overdredge sediment production rate: 1400 cy/20-hr day
23 Ovedredge contaminated and uncontaminated sediment: backhoe dredge at $1500/day plus operating costs of $200/hr (equipment and personnel) x 20 hr or $4,000/day totals $5500/day.
24 $1500/day, 28 days/month
27 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
28 Costs from 01590-800-0010, assumes 7 day/week operation
29 Costs from 01590-400-4400, assumes 7 day/week operation
30 Costs from 02510-760-0900
31 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent
32 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*292 shifts = 1869 gallons
33 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
34 Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each) @3400 CY for 20 hours = $0.85/CY
35 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
36 Costs from 01590-500-7000
37 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 8 - Phase 3
Dredge Area 7

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$114,734**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
1.2	Tug, bow, diesel, 900-hp	EA	1	$1,500.00	1.0185	$1,527.75	$1,528		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$40,000.00	1.0185	$40,740.00	$40,740		4
1.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3
1.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$700.00	1.0185	$712.95	$1,426		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
1.1	Construction office steup	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	$50,000.00	1.0185	$50,925.00	$50,925		4
2	**Dredging**							**$1,771,916**	1
2.1	Dredge contaminated sediments using production (Area 7)	DAY	78	$9,225.00	1.0185	$9,395.66	$729,546		7,8
					1 production dredges, 20-hr days, 170 cy/hr production				
2.2	Dredge contaminated sediments using fixed-arm dredge (7 overdredge)	DAY	47	$5,500.00	1.0185	$5,601.75	$264,083		22,23
					1 articulated dredge, 10-hr days, 50 cy/yr production rate				
2.3	Floodlights	MONTH	6	$16,000.00	1.0185	$16,296.00	$92,435		10
2.4	Construction office	MONTH	6	$76,717.00	1.0185	$78,136.26	$443,210		11
2.5	Water Quality Monitoring	MONTH	6	42,000	1.0185	$42,777.00	$242,643		24
3	**Offloading and On-shore Management**							**$4,090,174**	
3.1	Barge rental, 400 ton, 30 ft x 90 ft	DAY	143	283	1.0185	$288.24	$41,107.30		28
3.2	Centrifugal Gas Pump, 6-inch, 90 MGPH	DAY	143	238	1.0185	$242.40	$34,570.80		29
3.3	24-inch HDPE Pipe Installation	LF	200	65	1.0185	$66.20	$13,240.50		30
3.4	Water Filtration Unit, handle upto 300 gpm	MONTH	6	20000	1.0185	$20,370.00	$122,220.00		27, 31
3.5	Chitosan for Filtration, 1% solution	GAL	1869	11	1.0185	$11.20	$20,939.34		32
3.6	Water Treatment Unit Operator, full-time	DAY	143	500	1.0185	$509.25	$72,627.73		4
3.7	Transport sediment to offload facility	DAY	125	9,200	1.0185	$9,370.20	$1,169,306.47		16
3.8	Offload Sediments to Stockpile	CY	330,000	5.73	1.0185	$5.84	$1,926,441.83		33
3.9	Transport to Railcar or Large Stockpile	CY	330,000	0.86	1.0185	$0.88	$289,050.30		34
3.10	Load into Railcars	CY	330,000	0.63	1.0185	$0.65	$212,866.50		35
3.11	Yard Locomotive	DAY	125	516	1.0185	$525.55	$65,582.84		36
3.12	Assorted Water Management	MONTH	6	20,000	1.0185	$20,370.00	$122,220.00		4
4	**Disposal**							**$15,074,309**	1
4.1	Railcar transport to and tipping at Roosevelt, WA	TON	495,000	30	1.0185	$30.45	$15,074,309		2, 37
5	**Demobilization**							**$25,921**	1
5.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
5.2	Tug, bow, diesel, 900-hp	EA	1	$1,500.00	1.0185	$1,527.75	$1,528		4
5.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	2	$3,000.00	1.0185	$3,055.50	$6,111		4
5.4	Barge-mounted backhoe, 5-cy bucket	EA	1	$3,000.00	1.0185	$3,055.50	$3,056		4
5.5	Front-end loader	EA	4	$100.00	1.0185	$101.85	$407		3

5.6	Tug, push, diesel, 500-hp	EA	2	$2,000.00	1.0185	$2,037.00	$4,074		4
5.7	Barge, flat-deck, 2,000-ton capacity	EA	2	$600.00	1.0185	$611.10	$1,222		4
5.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
5.9	Dozer, diesel, crawler, 100-hp	EA	1	$100.00	1.0185	$101.85	$102		3
5.10	Construction office teardown	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$21,077,054**	1
	Design, Engineering & Permitting		12%					$2,529,246	4
	Construction management and monitoring		7%					$1,475,394	4
	Long-term environmental monitoring		*included in Year 1*					NA	
	Sales Taxes		8.4%					$1,770,473	
	TOTAL Cost Excluding Construction Contingency							$26,852,166	
	Contingency @		30%					$6,323,116	4
	Total*							**$33,175,282**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects.
7 Dredge contaminated sediment: 1700 cy/hr x 20 hr/day = 3,400 cy/20-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 20 hr or $7,000/day totals $9,225/day.
10 Floodlights, trailer mounted with generator, 2-1,000 watt lights, rental @ $1,000/month, operation @ $100/day. $1,000/month + (30 days/month x $100/day) = $4,000/month/ea x 4 ea = $16,000/month.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
16 Assume two 6,000-ton barges available per dredge to transport contaminated sediment to offload, one tugs alternate to rotate barges between loading at waterway and unloading at offload site. Rental (2 ea x $2000/ea/day barges + 1 ea x $800/day tug) at $4,800/day plus operations (1 ea x $220/hr x 20 hr tug) at $4,400/day for a total of $9,200/day. Labor included in operations costs.
22 Overdredge sediment production rate: 1400 cy/20-hr day
23 Ovedredge contaminated and uncontaminated sediment: backhoe dredge at $1500/day plus operating costs of $200/hr (equipment and personnel) x 20 hr or $4,000/day totals $5500/day.
24 $1500/day, 28 days/month
27 Assume 20% moisture from one day production equals amount of water to be treated. Avg 1,500 cy/ shift * 0.2 * 27 cf/cy * 7.5 g/cf = 121,500 gpd = 84 gpm, say 100 gpm
28 Costs from 01590-800-0010, assumes 7 day/week operation
29 Costs from 01590-400-4400, assumes 7 day/week operation
30 Costs from 02510-760-0900
31 Filtration unit includes sand filters, pumps and controls. Requires 3-phase power to run the unit. Costs from Rain for Rent
32 $3,000 for a tote of chitosan, 275 gallons at 1% solution. Per vendor, dosage rate is 0.64 gal/hr at 100 gpm, consumption = 0.64gal/hr*10 hr*292 shifts = 1869 gallons
33 Assumes crane rental at $2000/day, plus $200/hr for operating cost, $439 per 10 hour shift for operation, 2 10-hour shifts/day at avg 1200 CY / shift
34 Assume offload at 170 CY/hr, need to move 1000 feet. At 5 CY/trip, 170 CY/hour is 2 min/trip. Use 2 loaders, allow 4 min/trip. Loaders ($350/day rent, plus $15/hr operate, plus $40/hour operator each) @3400 CY for 20 hours = $0.85/CY
35 Assume 1 loader, operating 2 10-hour shifts/day, loading an average of 1200 CYD/sediment/shift
36 Costs from 01590-500-7000
37 Mechanically dredged sediments assumed to be 1.5 tons/in-situ cubic yard at disposal

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 8 - Phase 4a

Dredge Areas 1A, 1B

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator 2004-2005	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$61,874**	1
1.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
1.2	Tug, bow, diesel, 900-hp	EA	1	$1,500.00	1.0185	$1,527.75	$1,528		4
1.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	0	$3,000.00	1.0185	$3,055.50	$0		4
1.4	Barge-mounted backhoe, 5-cy bucket	EA	0	$40,000.00	1.0185	$40,740.00	$0		4
1.5	Front-end loader	EA	0	$100.00	1.0185	$101.85	$0		3
1.6	Tug, push, diesel, 500-hp	EA	0	$2,000.00	1.0185	$2,037.00	$0		4
1.7	Barge, flat-deck, 2,000-ton capacity	EA	0	$700.00	1.0185	$712.95	$0		4
1.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4
1.9	Dozer, diesel, crawler, 100-hp	EA	0	$100.00	1.0185	$101.85	$0		3
1.1	Construction office steup	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
1.11	Nonscheduled contract costs	EA	1	$50,000.00	1.0185	$50,925.00	$50,925		4
2	**Dredging**							**$828,862**	1
2.1	Dredge uncontaminated sediments (Areas 1A & 1B)	DAY	73	$5,725.00	1.0185	$5,830.91	$426,683		6,8
			1 production dredge, 10-hr days, 150 cy/hr production total from the dredge						
2.2	Construction office	MONTH	3	$76,717.00	1.0185	$78,136.26	$259,895		11
2.3	Water Quality Monitoring	MONTH	3	42,000	1.0185	$42,777.00	$142,284		24
3	**Transportation**							**$1,073,228**	1
3.1	Barge uncontaminated sediment to Rosario PSDDA Site	DAY	73	14,400	1.0185	$14,666.40	$1,073,228		15
4	**Disposal**							**$95,025**	1
4.1	PSSDA Disposal Fee	TON	186,599	1	1.0185	$0.51	$95,025		
5	**Demobilization**							**$10,949**	1
5.1	Barge-mounted derrick crane, 100-ton, 7-cy bucket	EA	1	$4,800.00	1.0185	$4,888.80	$4,889		4
5.2	Tug, bow, diesel, 900-hp	EA	1	$1,500.00	1.0185	$1,527.75	$1,528		4
5.3	Barge-mounted derrick crane, 40-ton, 4-cy bucket	EA	0	$3,000.00	1.0185	$3,055.50	$0		4
5.4	Barge-mounted backhoe, 5-cy bucket	EA	0	$40,000.00	1.0185	$40,740.00	$0		4
5.5	Front-end loader	EA	0	$100.00	1.0185	$101.85	$0		3
5.6	Tug, push, diesel, 500-hp	EA	0	$2,000.00	1.0185	$2,037.00	$0		4
5.7	Barge, flat-deck, 2,000-ton capacity	EA	0	$600.00	1.0185	$611.10	$0		4
5.8	Barge, flat-deck, 6,000-ton capacity	EA	2	$1,500.00	1.0185	$1,527.75	$3,056		4

5.9	Dozer, diesel, crawler, 100-hp	EA	0	$100.00	1.0185	$101.85	$0		3
5.10	Construction office teardown	EA	1	$1,450.00	1.0185	$1,476.83	$1,477		3,12
	Subtotal							**$2,069,938**	1
	Design, Engineering & Permitting		12%					$248,393	4
	Construction management and monitoring		7%					$144,896	4
	Long-term environmental monitoring		*included in Year 1*					NA	
	Sales Taxes		8.4%					$173,875	
	TOTAL Cost Excluding Construction Contingency							$2,637,100	
	Contingency @		30%					$620,981	4
	Total*							**$3,258,082**	1

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.
4 Professional judgement based on previous projects.
6 Dredge uncontaminated sediment: 1500 cy/hr x 10 hr/day x 1 = 1,500 cy/10-hr day
8 Big (100-ton) dredge at $2,225/day plus operating costs of $350/hr (equipment and personnel) x 10 hr or $3,500/day totals $5,725/day.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($787/10-hr shift x 30 days/month = $23,610/month), 2-foremen ($515/ea/10-hr shift x 30 day/month x 2 ea = $30,900/month), 2-clerks ($146/ea/10-hr shift x 30 day/month x 2 ea = $8,760), 1-timekeeper ($401/ea/10-hr shift x 30 days/month = $12,030/month) for a total of $76,717/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
15 Assume two 6,000-ton barges available to transport uncontaminated sediment to PSDDA site, two tugs alternate to rotate barges between loading at waterway and unloading at habitat berm sites. Rental (2 ea x $2000/ea/day barges + 2 ea x $800/day tug) at $5,600/day plus operations (2 ea x $220/hr x 20 hr tug) at $8,800/day for a total of $14,400/day. Labor included in operations costs.
24 $1500/day, 28 days/month

Whatcom Waterway Remediation
Estimated Costs

ALTERNATIVE 8 - Year 4
Removal within the ASB
Dredge Area 8

Item	Description	Unit	Quantity	Unit Cost	Item Cost	Total Cost	Notes
1	**ASB Dredging (See ASB - Construction Subtotal)**	LS	1	$21,602,915	$21,602,915	**$21,602,915**	
	Subtotal					**$21,602,915**	
	Design, Engineering & Permitting		LS			$1,850,000	
	Construction management and monitoring		7%			$1,512,204	
	Sales Taxes		8.4%			$1,814,645	
	TOTAL Cost Excluding Construction Contingency					$26,779,764	
	Contingency @		30%			$6,480,875	
	Total*					**$33,260,639**	

* Exclusions include land costs for staging area, mitigation, legal costs associated with deed restrictions and property owner agreements, and litigation costs.

Notes 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)

Whatcom Waterway - ASB Remediation (Area 8)

Estimated Costs

Item	Description	Unit	Quantity	Unit Cost (2004)	Cost Escalator (2004-2005)	Unit Cost	Item Cost	Total Cost	Notes
					1.85%				
1	**Mobilization**							**$95,759**	1
1.1	Hydraulic Dredge	EA	2	3,260	1.0185	$3,320.31	$6,641		4
1.2	Pumping equipment	EA	3	100	1.0185	$101.85	$306		2
1.3	Bulldozer	EA	4	100	1.0185	$101.85	$407		2
1.4	Crane	EA	1	250	1.0185	$254.63	$255		3
1.5	Front-end loader	EA	4	100	1.0185	$101.85	$407		2
1.6	Excavator	EA	2	100	1.0185	$101.85	$204		
1.7	Conveyor system	EA	1	200	1.0185	$203.70	$204		2
1.8	Pipe	EA	3	100	1.0185	$101.85	$306		3
1.9	Dewatering centrifuge	EA	2	27,000	1.0185	$27,499.50	$54,999		2
1.10	Construction office setup	EA	1	1,450	1.0185	$1,476.83	$1,477		3,12
1.11	Equipment yard preparation	EA	1	30,000	1.0185	$30,555.00	$30,555		
2	**Site Preparation**							**$3,802,107**	1
2.1	Demo sheet pile weir	DAY	27	5,000	1.0185	$5,092.50	$137,498		3
2.2	Demo aerators	EA	2,023	25	1.0185	$25.58	$51,758		2,3,15
2.3	Layout 18" pipeline to dewatering facility	LF	1,300	47	1.0185	$48.01	$62,416		3
2.4	Layout 12" pipeline to dredge	LF	2,000	23	1.0185	$23.66	$47,320		3
2.5	Pump setup	EA	3	200	1.0185	$203.70	$611		4
2.6	Pump lagoon to elev. +3'	DAY	39	900	1.0185	$916.65	$35,749		2,6
2.7	Pump rental	MONTH	7	6,000	1.0185	$6,111.00	$41,546		2, 27
2.8	Setup dredges using truck crane	EA	2	2,302	1.0185	$2,344.59	$4,689		2,5
2.9	Construct gravel ramps	CY	1,200	23	1.0185	$23.43	$28,111		4
2.10	Remove top of berm to +16 and inside of berms to +10	CY	48,000	4	1.0185	$4.07	$195,552		2, 24
2.11	Transport removed material to load/stockpile site	CY	48,000	3	1.0185	$3.06	$146,664		22, 24
2.12	Load onto barge or stockpile	CY	48,000	1	1.0185	$0.63	$30,148		23, 24
2.13	Pile driving equipment and labor, including setup	DAY	180	6,473	1.0185	$6,593.04	$1,186,746		3
2.14	Steel sheet piling (to be salvaged)	SF	180,000	10	1.0185	$10.19	$1,833,300		3
3	**Sludge Removal**							**$1,485,818**	1
3.1	Hydraulic Dredging	CY	378,000	2	1.0185	$2.34	$885,484		4,8
3.2	Pipe rerouting	DAY	130	712	1.0185	$725.17	$94,522		4,10
3.3	Bulldozer anchors	MONTH	7	32,921	1.0185	$33,530.04	$227,954		2,7,9
3.4	Construction office	MONTH	7	40,128	1.0185	$40,870.37	$277,857		3,7,11
4	**Sludge Dewatering**							**$3,785,869**	1
4.1	Centrifuge chemicals	CY	378,000	6	1.0185	$5.94	$2,244,509		2
4.2	Centrifuge processing	CY	378,000	4	1.0185	$3.92	$1,482,223		2
4.3	Rent Clarifier	MONTH	6	3,000	1.0185	$3,055.50	$18,103		4
4.4	Operate Clarifier	MONTH	6	6,800	1.0185	$6,925.80	$41,034		4
5	**Sludge Handling/Transfer**							**$114,665**	1
5.1	Conveyor system	MONTH	6	3,222	1.0185	$3,281.61	$19,443		2,16
5.2	Front-end loader	MONTH	6	15,780	1.0185	$16,071.93	$95,222		2
6	**Sludge Transportation & Disposal**							**$6,166,829**	1

6.1	2-20' boxes (30 ton/box) railcars to Roosevelt	TON	202,502	30	1.0185	$30.45	$6,166,829		2, 25
7	**Debris Transportation & Disposal**							**$99,218**	1
7.1	Truck debris to county landfill	TON	2,645	27	1.0185	$27.33	$72,278		3,13,14,17
7.2	Debris disposal	TON	2,645	10	1.0185	$10.19	$26,939		2,14,17
8	**Demolition**							**$58,055**	1
8.1	Outfall outlet structure	EA	1	27,000	1.0185	$27,499.50	$27,500		4
8.2	Plug outfall under breakwater	EA	1	30,000	1.0185	$30,555.00	$30,555		4
9	**Sediment Transportation & Disposal**							**$2,330,154**	1
9.1	Excavate sediment down to elvations -15' to -16'	CY	38,444	4	1.0185	$4.07	$156,623		2
9.2	Truck roundtrip 20' boxes from lagoon to railcars	CY	38,444	2	1.0185	$2.17	$83,402		19,21
9.3	Toplift boxes to railcars, then empty onto truck	CY	38,444	9	1.0185	$8.69	$333,998		19,20
9.4	2-20' boxes (30 ton/box) railcars to Roosevelt	TON	57,667	30	1.0185	$30.45	$1,756,132		2, 26
10	**Discharge to POTW**							**$1,088,364**	1
10.1	From +3' to "dry"	CCF	70,865	14	1.0185	$13.77	$975,820		2,18
10.2	Rainwater from lagoon	CCF	50,000	2	1.0185	$2.25	$112,544		2
11	**Remove Materials from Berm for Waterway Use**							**$1,897,805**	
11.1	Excavate Materials	CY	170,000	4	1.0185	$4.07	$692,580		2, 24
11.2	Transport to barge loading site	CY	170,000	3	1.0185	$3.06	$519,435		22, 24
11.3	Stockpile or Load onto barge	CY	170,000	1	1.0185	$0.63	$106,773		23, 24
11.4	Barge movement from loading area to capping area	DAY	85	6,100	1.0185	$6,212.85	$528,092		29,30
11.5	Site Controls	LS	1	50,000	1.0185	$50,925.00	$50,925		
12	**Demobilization**							**$678,274**	1
12.1	Pile extraction equipment and labor	DAY	120	5,000	1.0185	$5,092.50	$611,100		3
12.2	Excavator	LS	1	300	1.0185	$305.55	$306		2
12.3	Pile driving equipment	LS	1	25,000	1.0185	$25,462.50	$25,463		3
12.4	Hydraulic Dredge	EA	2	4,902	1.0185	$4,992.69	$9,985		4
12.5	Bulldozer	EA	4	100	1.0185	$101.85	$407		2
12.6	Crane	EA	1	250	1.0185	$254.63	$255		3
12.7	Front-end loader	EA	2	100	1.0185	$101.85	$204		2
12.8	Conveyor system	LS	1	200	1.0185	$203.70	$204		2
12.9	Pumping equipment	EA	3	100	1.0185	$101.85	$306		2
12.10	Dewatering centrifuge	EA	1	25,000	1.0185	$25,462.50	$25,463		2
12.11	Construction office teardown	EA	1	4,500	1.0185	$4,583.25	$4,583		3,12
	SubTotal							**$21,602,915**	1
	Engineering & Permitting		LS					$1,850,000	4
	Construction management and Monitoring		7%					$1,512,204	4, 28
	Sales Tax		8.4%					$1,814,645	4
	TOTAL Cost Excluding Construction Contingency							$26,779,764	
	Contingency		30%					$6,480,875	4
	Total							**$33,260,639**	1

Notes

1 2005 dollars, based on escalating 2004 unit costs by 1.85% (RS Means Construction Cost Increase)
2 Supplier quote.
3 RSMeans *Heavy Construction Cost Data 2004* with cost index of 110% for Bellingham.

4 Professional judgement.
5 Dredge setup includes truck crane ($1,100), crane operator ($307), dredge leverman ($319), and dredge deckhand ($304) working 1-8 hr day with crane operations (8 hr x $34/hr = $272) per each machine, or $2,302/ea.
6 Assume water volume =~ 145,500,000gal; assume 6" pump operating 20hr/day at 1,600gpm pumps ~1,900,000gal/day, allow 77 days or 3 months. MP&E rental at $2,000/month per each; maintenance mechanic at $400/10-hr day; each pump operates at $5/hr or $100/day; assume 2 mechanics to cover 20 hr/day x $400/day plus $100/day operating cost for a total of $900/day; assume two pumps operating full time requires 39 days to pump down, third pump on standby, alternate pumps daily;
7 378,000 cy of sludge to remove; 2 dredges at 145 cy/hr x 10 hr/day x 20 day/month = 58,000 cy/month, so allow 7 months.
8 Dredge operations include rental ($3,32.89/day), operations (10 hours/day) (1 ea @ 8 hr/day @ 219 days x $319/8hr-day = $69,861), dredge deckhand (1 ea @ 8 hr/day @ 219 days x $304/8hr-day = $66,576), dredge oiler (1 ea @ 8 hr/day @ 219 days x $305/8hr-day = $66,795) for a total of $772,632/dredge x 2 ea = $1,545,264/350,000 cy is $4.42/cy.
9 Anchor dozers (2 dozers ea dredge x 11 months x $3,900/month + 2 ea x 219 days x 4 hr operating/day x $16/hr + 1 dozer operators x 219 days x $307/8-hr day = $181,065/ dredge) for 2 dredges per month (2 x $181,065 / 11 months) is $32,921/month.
10 Pipe rerouting includes a dredge mate and a general laborer working each shift to move pipe (1 shift/day x ($307/shift + $255/shift) = $562/day) plus a skiff ($150/day) for a total of $712/day.
11 Construction office includes rental ($350/month), utilites and equipment ($630/month), 1-superintendent ($572/8-hr shift x 22 days/month = $12,584/month), 2-foremen ($374/ea/8-hr shift x 22 day/month x 2 ea = $16,456/month), 2-clerks ($106/ea/8-hr shift x 22 day/month x 2 ea = $4,664), 1-timekeeper ($292/ea/8-hr shift x 22 days/month = $6,424/month) for a total of $40,128/month.
12 Office setup or teardown includes 1-day time for 1-superintendent ($572), 1- foreman ($374) 1-timekeeper ($292), 2-clerks (2 x $106).
13 Debris disposal assumes 4 trips to the landfill per day: truck (rental @ $300/day, operation cost @ $22/hr x 8 hr/day = $176/day, and driver @ $155/day), front-end loader (rental @ $167/day, operation @ $176/day, operator @ $314/day) for a total of $1,288/day; assuming 4-round trips per day at 12 ton/trip = $26.83/ton.
14 Demolition debris assumes 600 ton of wood piling, 50 ton of concrete anchors, 25 ton of plastic aerators and rope, 2,000 tons of asphalt, 20 tons of plastic pipe, 30 tons of aluminum pipe, 10 tons of miscellaneous debris. A total of 2,135 tons of demolition debris.
15 Assume team of 1 foreman ($48/hr) and 4 laborers ($32/hr) pulling 6 aerators and ancillary equipment per hour, working from powered barge ($500/Day):
Foreman at $48/hr x 8 hr/day = $384
Labor at $32/hr x 4 ea x 8 hr/day = $1,024
Barge at $500/day = $500
Total = $1,908/day, and at 6 aerators/hr x 8 hr/day = 48 ea/day
$1,908/day divided by 48 ea/day = $39.75/ea.
16 Conveyor cake from dewatering facility to railcars: assume 3 ea (rental @ $1,000/ea/month, operations at $0.42/ea/hr x 8 hr/day x 22 days/month) at $1,074/ea/month, or for 3 at total of $3,222/month.
17 Outlet structure debris assume 30' dia x 1' thick x 50' high x 155 pcf + ramp of 4' wide x 1' thick x 60' long x 155 pcf = 388 ton; outfall pipe under berm assume 5' dia x 6" thick x 200' long x 155 pcf = 122 ton; total of 510 ton of debris.
18 Assume 53,000,000 gal to pump (from +3' to "dry") to POTW. This is ~71,000 ccf x $2.21/ccf = $156,900. Assume monthly average of 6.25 lb BOD/1,000 lb of effluent, and monthly average of 5.0 lb TSS/1,000 lb of effluent.
19 Assume each truck hauls 20 cy (30 ton)/trip, with 6 trucks making 10 trips/day yields 1,200 cy/day.
20 Toplift rental and operation at $1,600/day and ILWU gang labor [($8,636/day) at total of $10,236/day, or $10,236/day//1,200 cy/day is $8.53/cy.
21 Truck rental and operation ($270/ea/day x 6 ea) at $1,620/day and labor [($155/day x 6 ea) at $930/day for total of $2,550/day, or $2.13/cy.
22 Assumes 6 trucks at 10 trips ea/day at $75/hr for 1200 cy/day = $3/cy
23 Assumes loader at $250/day rental, operator at $334/day, and operating cost at $22/hr. For 8 hours days, 1200 cy/day = $0.62/cy
24 Assumes that all types of berm materials moved at same rates
25 formula based on .177 in-situ wet density x .908 total tons/total CY = .161 tons solid/ total CY then multiply by total CY to get total solids, and make up total tonnage based on 30% by weight solids (i.e. divide by 0.3
26 Assumes 1.5 T sediment shipped /*in-situ CY excavated*
27 3 pumps * 39 days each = 4 months + 2 months for final dewatering = 6 months
28 Assumes design & permitting are conducted jointly with the Whatcom Waterway cleanup work and with the design & permitting of future ASB marina. Higher costs for independent work.
29 Capping sand transport to site by barge at 2,000 ton/trip/1.5 ton/cy = 1,300 cy/trip; assume trip takes 1/2 hr; unload 1,300 cy @ 100 cy/hr in 13 hr
30 Assume two 2,000-ton barge and one tug combinationsto bring capping sand to waterway. Cost each combination for rental ($800/day ($800/day barge + $500/day tug) at $2,100/day plus operations ($200/hr x 20 hr tug) at $4,000/day for a total of $6,100/day. Labor included in operations cost.

Addendum 1
Whatcom Waterway Remediation -- Log Pond Cap Contingency Actions (Appendix A)
Estimated Costs

REMEDIAL COST ELEMENTS	COSTS ASSUMING ASB MATERIAL REUSE					COSTS ASSUMING NO ASB MATERIAL REUSE				
	Quantity	Units	Unit Cost	Probable Costs		Quantity	Units	Unit Cost	Probable Costs	
REMEDIAL CONSTRUCTION COSTS										
Mobilization, Demobilization, Non-Scheduled Contract	10	%	$ 329,889	$ 32,989		10	%	$ 475,387	$ 47,539	
Demolition										
Removal of pilings, debris	1	total est.	$ 15,000	$ 15,000		1	total est.	$ 15,000	$ 15,000	
Beach Stabilization & Enhancement										
Western Groin (Armor Stone)										
Material Placement	2,400	cyd	$ 7	$ 16,800		2,400	cyd	$ 7	$ 16,800	
Material Purchase & Delivery	3,600	ton	$ -	$ -		3,600	ton	$ 23	$ 82,800	
Eastern Groin (Armor Stone)										
Material Placement	533	cyd	$ 7	$ 3,731		533	cyd	$ 7	$ 3,731	
Material Purchase & Delivery	800	ton	$ -	$ -		800	ton	$ 23	$ 18,389	
Central Groin (Armor Stone)										
Material Placement	770	cyd	$ 7	$ 5,390		770	cyd	$ 7	$ 5,390	
Material Purchase & Delivery	1,155	ton	$ 3	$ 3,465		1,155	ton	$ 23	$ 26,565	
Type 1 Material (Fine Gravel Mix)										
Material Placement	5,247	cyd	$ 7	$ 36,729		5,247	cyd	$ 7	$ 36,729	
Material Purchase & Delivery	7,871	ton	$ 18	$ 141,669		7,871	ton	$ 18	$ 141,669	
Type 2 Material (Coarse Gravel Mix)										
Material Placement	2,911	cyd	$ 7	$ 20,377		2,911	cyd	$ 7	$ 20,377	
Material Purchase & Delivery	4,367	ton	$ 18	$ 78,597		4,367	ton	$ 18	$ 78,597	
Type 3 Material (Stone)										
Material Placement	707	cyd	$ 7	$ 4,949		707	cyd	$ 7	$ 4,949	
Material Purchase & Delivery	1,061	ton	$ 3	$ 3,182		1,061	ton	$ 23	$ 24,392	
	CONSTRUCTION SUBTOTAL				**$ 362,877**	**CONSTRUCTION SUBTOTAL**				**$ 522,926**
ENGINEERING & REGULATORY					**$ 157,209**					**$ 208,905**
Design, Permitting (12%)	12%	of Construction Costs		$ 43,545		12%	of Construction Costs		$ 62,751	
Construction Management & Monitoring (7%)	12%	of Construction Costs		$ 43,545		12%	of Construction Costs		$ 62,751	
Additional Bathymetric Monitoring Events	2	total est.	$ 20,000	$ 40,000		2	total est.	$ 20,000	$ 40,000	
WSST (8.3%)	8.3%	of Construction Costs		$ 30,119		8.3%	of Construction Costs		$ 43,403	
TOTAL EXCLUDING CONTINGENCY					**$ 520,087**					**$ 731,831**
CONTINGENCY (30%)					$ 156,026					$ 219,549
TOTAL INCLUDING CONTINGENCY					**$ 676,113**					**$ 951,380**

Notes:

Costs for design and permitting assume that the work is completed as part of the design & permitting of the Whatcom Waterway site final remedial action.

EXHIBIT C

SCHEDULE OF WORK AND DELIVERABLES

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
(360) 586-6760

EXHIBIT C
SCHEDULE OF WORK AND DELIVERABLES

Written Notification to Ecology of selected contractor name and qualifications	Within 45 days of the Effective Date of the Consent Decree
Draft Project Plans for Pre-Design Investigation[1]	Within 90 days of the Effective Date of the Consent Decree.
Final Project Plans for Pre-Design Investigation	Within 30 days of Receipt of Ecology's comments on the Draft Project Plans.
Pre-Design Investigation Report	Within 270 days of Submittal to Ecology of the Final Project Plans unless Ecology approves an alternate schedule.
Preliminary Design Concept Report	Within 120 days of Submittal to Ecology of Pre-Design Investigation Report
Ecology Review Draft Engineering Design Report[2]	Within 150 days of receipt of Ecology's written comments on the Preliminary Design Concept Report
Public Review Draft Engineering Design Report	Within 60 days of receipt of Ecology's comments on the Ecology Review Draft
Final Draft Engineering Design Report	Within 90 days of receipt of Ecology's comments on the Public Review Draft, following public review, and issuance of final permits (whichever occurs later in time)
Final Engineering Design Report	Within 30 days of receipt of Ecology's comments on the Final Draft Engineering Design Report[3]
Begin Construction of Cleanup Action	Construction to begin within 1 year of Ecology approval of Final Engineering Design Report unless Ecology approves an alternate schedule. Construction schedule to be consistent with Ecology-approved Final Engineering Design Report
Draft Institutional Control Plan (IC Plan), including proposed Restrictive Covenants	At completion of the active cleanup measures required by the CAP
Final IC Plan, Implement IC Plan and Record Restrictive Covenants	Within 60 days of receipt of Ecology comments on Draft IC Plan and proposed RCs.
AS-Built Report to Ecology	Within 120 days of completion of construction activities.

1. Project Plans include the following: Work Plan, Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan. Ecology will not approve the Health and Safety Plan, however it must be submitted for Ecology review and comment. All Plans will include a schedule for implementation, as applicable.

2. Engineering Design Report to include Construction Quality Assurance Project Plan, and Compliance Monitoring and Contingency Response Plan. The Engineering Design Report will include a schedule for implementation of all work, as applicable. Ecology will not approve the Final Engineering Design Report until the required permits have been obtained.

EXHIBIT D

LIST OF REQUIRED PERMITS

ATTORNEY GENERAL OF WASHINGTON
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(360) 586-6760

EXHIBIT D
LIST OF REQUIRED PERMITS

Cleanup actions at the Site require the following permits:

- Permit for the discharge of dredged, excavated or fill material to waters of United States pursuant to Section 404 of the Clean Water Act, 33 U.S.C. § 1344.

- Water Quality Certification from the State of Washington pursuant to Section 401 of the Clean Water Act, 33 U.S.C. § 1341.

- Permit for discharge of pollutants pursuant to Section 402 of the Clean Water Act, 33 U.S.C. § 1342 [required if generated wastewater cannot be discharged to the local sanitary sewer system].

- Washington State Scientific Collection Permit for the collection of food fish, shellfish, or wildlife or their nests and/or eggs for the purpose of research or display pursuant to WAC 220-20-045 and WAC 232-12-276.

EXHIBIT E

APPLICABLE SUBSTANTIVE REQUIREMENTS

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
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(360) 586-6760

EXHIBIT E
APPLICABLE SUBSTANTIVE REQUIREMENTS

The applicable substantive requirements of the following exempt permits or approvals (as identified at the time of entry of this Decree) will be more particularly identified during remedial design of the cleanup action.

- Hydraulic Project Application (RCW 77.55.021)

- City of Bellingham Shoreline Substantial Development Permit

EXHIBIT F

PUBLIC PARTICIPATION PLAN

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
(360) 586-6760

EXHIBIT F

PUBLIC PARTICIPATION PLAN

WHATCOM WATERWAY SITE
BELLINGHAM, WASHINGTON

SEPTEMBER 2007

Prepared by the Washington State Department of Ecology

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

TABLE OF CONTENTS

FIGURE 1

INTRODUCTION

The Washington State Department of Ecology (Ecology) has developed this public participation plan (PPP) in accordance with the Model Toxics Control Act (MTCA) to promote meaningful community involvement during the cleanup of the Whatcom Waterway site (Site) in Bellingham, Washington. Public participation is an integral part of Ecology's responsibilities under the MTCA. Ecology's goal is to provide the public with timely information and meaningful opportunities for participation. This PPP describes the tools that Ecology plans to use to inform the public about the Site and identifies opportunities for the community to become involved.

LOCATION AND SITE BACKGROUND

Location

The Site is located within Bellingham Bay and consists of lands within and adjacent to the Whatcom Waterway (Figure 1).

Site Background

The Site includes lands that have been impacted by contaminants historically released from industrial waterfront activities, including mercury discharges from the former Georgia Pacific (GP) chlor-alkali plant. The chlor-alkali plant was constructed by GP in 1965 to produce chlorine and sodium hydroxide for use in bleaching and pulping wood fiber. The chlor-alkali plant discharged mercury-containing wastewater into the Log Pond (an industrially-constructed pond open to the Whatcom Waterway) between 1965 and 1971. Between 1971 and 1979 pretreatment measures were installed to reduce mercury discharges. Chlor-alkali plant wastewater discharges to the Log Pond were discontinued in 1979 following construction of the Aerated Stabilization Basin (ASB). The ASB was constructed by GP for management of pulp and tissue mill wastewaters in compliance with the Clean Water Act. The outfall from the ASB continues to be owned by GP and wastewater and sediment quality in the outfall area are monitored under the National Pollutant Discharge Elimination System (NPDES) permit program.

Initial environmental investigations of the Site identified mercury in sediment at concentrations that exceeded MTCA standards (Chapter 173-340 Washington Administrative Code [WAC]) and Sediment Management Standards (SMS; Chapter 173-204 WAC). These are the state standards that govern the cleanup of contaminated sediment sites. The MTCA regulations specify criteria for the evaluation and conduct of a cleanup action. The SMS regulations dictate the standards for cleanup.

The key MTCA and SMS decision-making document for Site cleanup actions is the Remedial Investigation and Feasibility Study (RI/FS). The RI/FS for the Whatcom Waterway Site was initiated in 1996 by GP under the terms of an Agreed Order with Ecology. The RI/FS included detailed sampling and analysis in 1996 and 1998. These sampling events formed the basis for development of an RI/FS Report which was completed in July 2000 following public notice and opportunity to comment.

In parallel with the RI/FS, the Bellingham Bay Comprehensive Strategy Draft EIS (DEIS) was prepared and issued for public review. The EIS was both a project-specific DEIS, evaluating a range of cleanup alternatives for the Site, and a programmatic DEIS, evaluating the Bellingham Bay Comprehensive Strategy. The Comprehensive Strategy was developed by an interagency consortium known as the Bellingham Bay Demonstration Pilot (Pilot). The Pilot brought together a partnership of agencies, tribes, local government and businesses known collectively as the Pilot Work Group, to develop a cooperative approach to expedite source control, sediment cleanup and associated habitat restoration in Bellingham Bay. The Comprehensive Strategy was issued by Ecology as a Final EIS in October 2000. The 2000 RI/FS and EIS documents would have formed the basis for Ecology's selection of a final cleanup action for the Site under existing land uses. However, following completion of the 2000 documents significant land use changes made it necessary to complete a supplemental FS and supplemental Draft EIS for the Site.

During 1999 and 2000, GP closed its chlor-alkali plant, its pulp mill and its chemical plant, dramatically reducing water treatment needs. With the reduced treatment needs, the contamination issues within the ASB could be addressed as part of the cleanup of the Site.
To address this new portion of the Site, a new remedial alternative was evaluated in 2002 through a Supplemental Draft FS (Anchor, 2002) and a Supplemental Draft EIS (Ecology, 2002b). The new remedial alternative proposed using a portion of the ASB as a near shore fill disposal facility for disposal of contaminated materials removed from areas of the Site outside the ASB and from other contaminated sediment sites in Bellingham Bay. The proposal included maintenance of a down-sized wastewater treatment facility constructed within the footprint of the existing ASB.

Following completion of the 2002 Supplemental Draft FS, additional Site data were collected by GP during 2002, 2003, and 2004 under the terms of new and existing Agreed Orders with Ecology. The data collection included sediment testing of areas of the Site outside the ASB as well as testing of the ASB sludges and berm materials.

In late 2000 and early 2001 GP implemented an interim action to clean up sediment contamination in the Log Pond area of the Site. The work was performed under the terms of an Agreed Order with Ecology. The Log Pond project beneficially reused 43,000 cubic yards of clean dredging materials to cap contaminated sediments in the Log Pond, and to improve habitat substrate and elevations for use by aquatic organisms. The habitat restoration component of the project was voluntarily implemented by GP in accordance with the Bellingham Bay Comprehensive Strategy.

In January of 2005, the Port of Bellingham (Port) acquired 137 acres of waterfront property from GP including property within the Site. As a result the existing Agreed Orders between Ecology and GP for completion of an RI/FS and for the Log Pond Interim Remedial Action were amended to add the Port as a signatory.

When the original 2000 RI/FS was approved by Ecology land use in and around the Site was designated and used for industrial purposes, therefore the remedial alternatives under consideration reflected those uses. However, with Port ownership land use plans changed. The City of Bellingham and the Port are moving towards mixed-use zoning designations for upland areas adjacent to the Site. In addition, the Port has recommended legislative changes to convert the Inner Whatcom Waterway from a federal industrial waterway to a locally-managed multi-purpose waterway and plans to develop the ASB portion of the Site for aquatic uses.

A new Supplemental RI/FS (RETEC, 2006) was completed and made available for public comment between October and December of 2006. The document integrates previous Site investigations and studies and provides a comprehensive evaluation of Site conditions and cleanup options under current and anticipated land uses. Ecology developed a Responsiveness Summary addressing public comments received and approved the 2006 Supplemental RI/FS on June 29, 2007.

Concurrent with public issuance of the 2006 Supplemental RI/FS, Ecology issued a Draft Supplemental EIS (DSEIS; Ecology, 2006) consistent with the State Environmental Policy Act (SEPA) and with the programmatic elements of the Pilot Comprehensive Strategy. The DSEIS evaluates the potential environmental impacts associated with the RI/FS remedial alternatives and potential mitigation measures that could be used to address these impacts.

Using information presented in the 2006 Supplemental RI/FS, DSEIS, and in consideration of public comments received on these documents, Ecology completed a draft Cleanup Action Plan (DCAP) that described the actions proposed for the cleanup of contamination at the Site. The DCAP, and a draft PPP were issued for public comment in July of 2007 as exhibits to a draft Consent Decree, which proposes to settle the liability of the parties agreeing to implement the cleanup.

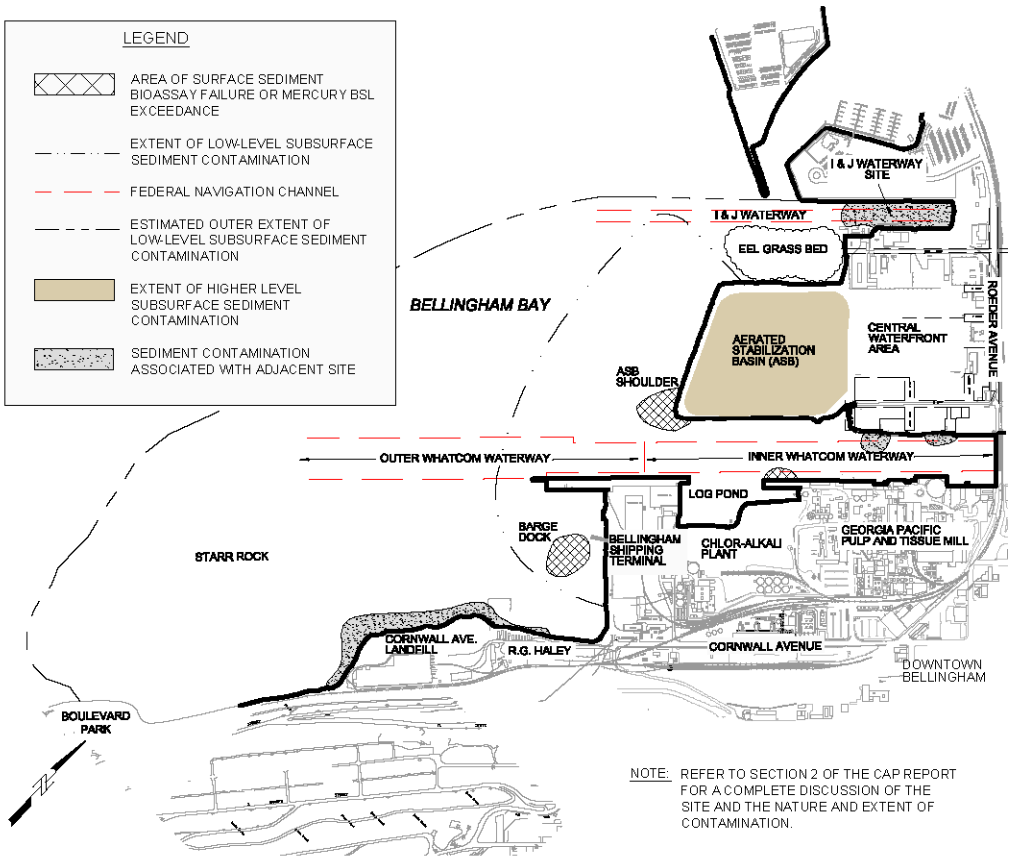
Public comment did not result insignificant changes to the draft Consent Decree and its exhibits, including the DCAP and the draft PPP. Therefore, Ecology is issuing a final Consent Decree, which includes a final CAP and this final PPP. Ecology is also jointly issuing a final SEIS (FSEIS; Ecology 2007) and a Responsiveness Summary addressing comments received on the draft Consent Decree and exhibits.

The final Consent Decree will now be signed by Ecology and the parties agreeing to implement the cleanup. After the Consent Decree has been signed it will be entered into the records of Whatcom County Superior Court. Entry of the Consent Decree into court records establishes the effective date for the Consent Decree, and initiates the schedule of required cleanup activities defined in the Consent Decree and its exhibits.

Following entry of the Consent Decree in court the cleanup will move forward into remedial design and permitting which is expected to take between 2 and 3 years. As part of the design and permitting phase of the cleanup, a draft Engineering Design Report (EDR) will be issued for public review and comment. The draft EDR is expected to be released for public review in late 2009 or early 2010. The draft EDR will contain design details on the proposed caps and other cleanup elements, as well as a Construction Quality Assurance Project Plan and a Compliance Monitoring and Contingency Response Plan. The objective of the plans is to confirm that cleanup standards have been achieved, and also to confirm the long-term effectiveness of cleanup actions at the Site. The plans will contain discussions on duration and frequency of monitoring; the trigger for contingency response actions. Following Ecology approval of the EDR, detailed construction plans and specifications will be developed, and construction of the cleanup action will be implemented.

Construction of the cleanup action is expected to take 3 years following completion of remedial design and permitting. Long-term monitoring activities will be initiated following completion of construction activities

Figure 1 – Location Map of Whatcom Waterway Site



HOW THE SITE WILL BE CLEANED UP

The cleanup action described in the CAP includes the following:

- Removal (dredging) of buried contaminated sediments in the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal that may be disturbed through future dredging activities. Off-site disposal of dredged material at a permitted Subtitle D disposal facility. No institutional controls (limits or prohibitions on activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances) are anticipated for this area of the Site;
- Partial removal (dredging) and containment (capping) of buried contaminated sediments in the Inner Whatcom Waterway that have a low potential to be disturbed given planned multi-purpose use of this area of the Site and planned mixed-use of the adjacent uplands. Off-site disposal of dredged material at a permitted Subtitle D disposal facility. Institutional controls will be required;
- Containment of contaminated surface sediments in the "ASB Shoulder" and the "Barge Dock" Site areas, including institutional controls;
- Contingency actions to contain contaminated surface sediments and to prevent cap erosion in the previously remediated Log Pond area of the Site. Continued institutional controls;
- Removal of contaminated material from the ASB, followed by reconnection of the ASB to the waters of Bellingham Bay, and reuse of clean berm materials as part of other Site cleanup activities. No institutional controls are anticipated for this area of the Site;
- Monitoring of remaining areas of the Site which currently comply with applicable surface sediment cleanup standards to ensure continued compliance. Institutional controls will be required; and,
- Monitoring of active cleanup areas to confirm that cleanup standards have been met and to confirm the long-term effectiveness of the cleanup actions.

The design and implementation of the cleanup of the Site will occur over a period of approximately six years following signing of the Consent Decree, with a longer subsequent period of long-term monitoring. Engineering design and permitting is anticipated to require two to three years. Construction is anticipated to occur in three phases over a period of four years.

KEY COMMUNITY CONCERNS

Through comments received on the 2006 Supplemental RI/FS and on the draft Consent Decree, Ecology has identified the following concerns and interests that may apply to the cleanup of the Site:

- Protection of human health and the environment

- Avoidance of impacts to important fisheries resources and habitats
- Coordination of cleanup actions with other Bellingham Bay site cleanups
- Relationship between land use decisions and cleanup decisions
- Opportunities for public involvement
- Compliance with regulatory requirements
- Post construction monitoring

Additional public concerns may be identified over the course of the Site cleanup through: public comment periods; hearings; meetings; and other contacts with individuals, community groups, or organizations.

PUBLIC PARTICIPATION ACTIVITIES AND RESPONSIBILITIES

Ecology is responsible for implementing this PPP for the Site. However the signatories to the Consent Decree will cooperate and assist Ecology with the various public participation activities. This section of the plan addresses how Ecology will share information and receive public comments and community input on the Site activities.

Public Participation Activities: Ecology uses a variety of activities to facilitate public participation in the planning and cleanup of MTCA sites. The following is a list of the public involvement activities that Ecology will use during the cleanup of the Site.

Public Comment Period

A draft Engineering Design Report (EDR), including the following, will be issued for a minimum 30-day public review period in late 2009 or early 2010:

- Construction Quality Assurance Project Plan
- Compliance Monitoring and Contingency Response Plan

The draft EDR will be placed at the information repositories, on Ecology's website at http://www.ecy.wa.gov/programs/TCP/sites/whatcom/ww.htm, and on CD by request.

Comments will be accepted at any time during the public comment period by letter or email to:

Lucille T. McInerney, P.E.
Site Manager
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452
(425) 649-7272
lpeb461@ecy.wa.gov

As part of implementing the CAP, Ecology will oversee the development of a draft EDR for the cleanup actions. During public review of this document a public meeting will be held to provide information and answer questions.

Ecology will consider the need for changes or revisions to the draft documents based on the public comments received. If significant changes are made, then a second comment period may be held. If no significant changes are made, then the draft documents will be finalized.

Responsiveness Summary

A responsiveness summary is a summary of oral and written public comments which have been received by Ecology during a comment period, and Ecology's responses to those comments. Ecology will prepare a responsiveness summary to address comments received on the draft EDR for this Site. The responsiveness summary will be placed in the Site information repositories. Notification of the availability of the responsiveness summary will be provided to those who commented, and a notice will be placed in the Site Register.

Information Repositories

Ecology maintains repositories of information regarding the Site for the convenience of interested persons. During the comment period, the Site documents will be available for review at information repositories. Ecology can also make copies of documents for a fee.

For this Site, the information repositories are:

- Bellingham Public Library, 210 Central Avenue, Bellingham
  Phone: (360) 676-6860

- Department of Ecology, Bellingham Field Office, 1440 – 10th Street, Suite 102
  Phone: (360) 715-5200

- Department of Ecology, Northwest Regional Office, 3190 160th Avenue SE, Bellevue
  Phone: (425) 649-7190

Information on the Site will also be posted on the Ecology website at: http://www.ecy.wa.gov/programs/tcp/sites/blhm_bay/sites/bel_bay_sites.html

Site Register

The Site Register is published by Ecology bi-monthly to inform the public of:

- Activities related to the study and cleanup of contaminated sites

- Public meetings/hearings and public comment periods

- Discussion or negotiations of legal agreements

- Availability of cleanup reports

- Hazard rankings of sites

If you would like to regularly receive the Site Register, please contact:

Site Register
Department of Ecology-Toxics Cleanup Program
PO Box 47600
Olympia WA 98504-7600
(360) 407-7170

If you would like to be placed on the Site Register's e-mailing list, complete the electronic form at http://www.ecy.wa.gov/programs/tcp/pub_inv/pub_inv2.html

Mailing List

Ecology has compiled a mailing list for the Site. The list includes individuals, groups, public agencies, elected officials, private businesses, potentially affected parties, and other known interested parties. The list is updated as needed.

Fact Sheets

Ecology will mail fact sheets to those entities on the Site mailing list to inform them of public hearings, meetings, and comment opportunities; and important Site activities. Ecology may also mail fact sheets about the progress of Site activities.

Newspaper Ads

At a minimum, Ecology will place an ad in *The Bellingham Herald* to announce public comment periods and public meetings or hearings for the Site.

Plan Update

This public participation plan may be updated as the project proceeds. If a substantive update is necessary, the revised plan will be submitted to the public for comment.

Public Points of Contact

If you have questions or need more information about this plan or this Site, please contact the following persons:

Lucille T. McInerney, P.E.
Site Manager
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452
(425) 649-7272
lpeb461@ecy.wa.gov

Shannon Sullivan
Public Information Officer
Washington State Department of Ecology
Bellingham Field Office
1440 – 10th Street, Suite 102
Bellingham, WA 98225
(360) 715-5200
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GLOSSARY

Cleanup: The implementation of a cleanup action or interim action. In other words, the term “cleanup” includes actions taken to address a release, or threatened release of hazardous substances that could affect public health and/or the environment.

Cleanup Action: Any remedial action, except interim actions, taken at a site to eliminate, render less toxic, stabilize, contain, immobilize, isolate, treat, destroy, or remove a hazardous substance.

Cleanup Action Plan (CAP): The document prepared by Ecology that selects the cleanup action for the site, and specifies cleanup standards and other requirements for the cleanup action. The Cleanup Action Plan is based on information and technical analysis generated during the remedial investigation/feasibility study. Ecology also considers public comments and community concerns.

Comment Period: A time period during which the public can review and comment on various documents and Ecology actions. For example, a comment period is provided to allow community members to review and comment on proposed cleanup action alternatives and proposed plans. Also, a comment period is held to allow community members to review and comment on draft feasibility studies.

Consent Decree: A legal document that is entered in court, which formalizes an agreement reached between the state (and EPA if involved) and the potentially liable person(s) to implement cleanup. A Consent Decree settles the liability for performing parties that implement the cleanup. Consent Decrees are subject to public comment. If substantial change is proposed to a decree, an additional comment period is provided under the terms of the decree before the decree is formally entered in court.

Feasibility Study (FS): This study uses information obtained in a remedial investigation to develop and evaluate a range of cleanup options for a site, termed cleanup “alternatives.” The FS must include cleanup alternatives that protect human health and the environment (including, as appropriate, terrestrial and ecological receptors) by eliminating, reducing, or otherwise controlling risks posed through each exposure pathway and migration route.

Information Repository: A file containing current information, technical reports, and reference documents available for public review. The information repository is usually located in a public building that is convenient for local residents such as a public school, city hall or library.

Model Toxics Control Act (MTCA): Legislation passed in the state of Washington by voter initiative in 1988, which became effective in 1989 and was codified as Chapter 70.105D RCW. Its purpose is to identify, investigate, and clean up facilities where hazardous substances have been released. It defines the role of Ecology and encourages public involvement in the decision making process. .

Potentially Liable Person (PLP): Any person whom Ecology finds, based on credible evidence, to be liable under MTCA, RCW 70.105D.040. This includes, but is not limited to, individuals or companies, state agencies, and others, who are the owners or operators of a facility; who owned or operated the facility at the time of disposal or release of hazardous substances; who generated hazardous substances disposed of at the facility, or who otherwise owned the hazardous substances and arranged for disposal; or who transported hazardous substances for disposal. Whenever possible, Ecology requires these PLPs, through administrative and legal actions, to clean up sites.

Public Participation Plan: A plan prepared to encourage coordinated and effective public involvement designed to meet the public's needs at a particular site.

Remedial Investigation: This study characterizes the site and defines the nature and extent of contamination.

Remedial Investigation/Feasibility Study: Two distinct but related studies. The FS is usually performed immediately following the RI, and together they are referred to as the "RI/FS." They are intended to collect, develop, and evaluate sufficient information regarding a site to select a cleanup action, including:

- Gather the data necessary to determine the type and extent of contamination;
- Establish criteria for cleaning up the site;
- Identify and screen cleanup alternatives for remedial action; and
- Analyze in detail the technology and costs of the alternatives.

Responsiveness Summary: A summary of oral and/or written public comments received by Ecology during a public comment period on key documents, and Ecology's responses to those comments. The responsiveness summary is not required for MTCA documents. However, Ecology sometimes chooses to prepare them as part of site-specific public participation activities.

Site or "Facility": Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft; or any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited stored, disposed of, or placed, or otherwise come to be located.

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