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ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TECHNICAL MEMORANDUM

TO: Ms. Mary O'Herron, Washington State Department of Ecology

FROM: Larry Beard, L.H.G. and Evalyn Albright

DATE: November 29, 2006

RE: **WELDCRAFT STEEL AND MARINE (GATE 2 BOATYARD) SITE SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN ADDENDUM**

INTRODUCTION

This technical memorandum presents an addendum to the *Supplemental Remedial Investigation (RI) Work Plan, Weldcraft Steel and Marine (Gate 2 Boatyard) Site* dated April 21, 2006, to conduct supplemental site characterization activities at the Weldcraft Steel and Marine site in Bellingham, Washington. The RI activities are being conducted under Agreed Order DE 03TCPBE-5623 between the Port of Bellingham (Port) and the Washington State Department of Ecology (Ecology) for remedial action at the site. The site is owned by the Port and is currently occupied by its tenant, Seaview Boatyard. Figure 1 is a site plan showing existing site features and the investigation area.

The metals groundwater results from the recent sampling performed as part of the Supplemental RI indicate elevated concentrations of zinc and nickel in monitoring wells MW-10, MW-11, and MW-12, which were installed during the Supplemental RI field activities. These wells were installed as close as practical to the recently constructed galvanized sheetpile bulkhead and exhibited higher concentrations than observed in previously existing monitoring wells MW-3, MW-4, and MW-7 located about 20 ft farther upgradient. Copper is also more elevated in one of the new wells (MW-11), but copper concentrations for the other two well pairs are similar in the upgradient and downgradient wells.

The available groundwater data indicate that the elevated metals concentrations are not a background condition, and may result from corrosion of the galvanized sheetpile bulkhead and tieback anchors. This work plan addendum presents the scope of work for additional groundwater and surface water quality monitoring to further evaluate the cause of the elevated metals concentrations in the shoreline vicinity, and to develop an approach for achieving compliance with groundwater cleanup standards.

SCOPE OF WORK

The scope of work addressed in this work plan addendum includes the following activities:

- Collection of two additional rounds of groundwater samples at selected groundwater monitoring wells.

- Collection of groundwater samples from up to three weep hole locations at the base of the sheetpile bulkhead.

- Collect one background surface water quality sample from Squalicum Outer Harbor at distance from the site.

The following sections describe the methods and procedures that will be used for groundwater and surface water sample collection activities. Sample transport, handling, custody, and documentation procedures, equipment decontamination procedures, waste management, health and safety, quality assurance and quality control procedures will be conducted using procedures outlined in the Supplemental RI Work Plan.

Groundwater Sampling

Groundwater sampling activities will be performed using the procedures outlined in the Supplemental RI Work Plan (Landau Associates 2006). Groundwater elevation data will be collected from all onsite wells (MW-1 through MW-12) prior to collection of water quality samples. Groundwater samples will be collected, using low-flow sampling techniques, from monitoring wells MW-3, MW-4, MW-7, MW10, MW-11, and MW-12, and analyzed for dissolved copper, nickel, zinc, nitrate, and sulfate. In addition to the field parameters identified in the Supplemental RI Work Plan [pH, temperature, conductivity, dissolved oxygen (DO), and turbidity], oxidation/reduction potential (ORP) and ferrous iron data will be collected from each groundwater monitoring well prior to sample collection. Groundwater monitoring well locations are shown on Figure 1.

Groundwater quality monitoring will be conducted during both low and high tidal cycles to evaluate the impact of tidal stage on groundwater quality. The two sampling rounds will be conducted during the maximum high tide and minimum low tide during a "spring tide" tidal cycle; spring tides occur during the full moon and the new moon phases and represent the greatest tidal extremes within the lunar tidal cycle. The two sampling rounds will be conducted within a 24-hour time period during either a full moon or new moon phase.

Weep Hole Sampling

Groundwater samples will be collected from up to four weep holes located along the base of the sheetpile bulkhead. Three samples will be collected from weep holes located most directly downgradient from monitoring wells MW-10, MW-11, and MW-12. An additional sample will be collected from the weep hole located in the vicinity of the former marine railway well that discharges at a high flow rate, if this weep hole does not represent one of the three downgradient weep holes. Only one round of samples will be conducted since the weep holes will be submerged during the high tide groundwater sampling event.

Groundwater samples will be collected by slowly filling laboratory supplied containers with water as it flows out of the bulkhead weep hole. Groundwater samples will be analyzed for dissolved copper, nickel, and zinc, nitrate, sulfate, gasoline-range petroleum hydrocarbons, benzene, toluene, ethylbenzene, and total xylenes. As part of the gasoline-range petroleum hydrocarbon analysis, quantification of trimethylbenzene (TMB) isomers using EPA Method 8260 will be requested. In addition, pH, temperature, conductivity, dissolved oxygen (DO), turbidity, ORP, and ferrous iron data will be collected in the field.

Surface Water Quality Sampling

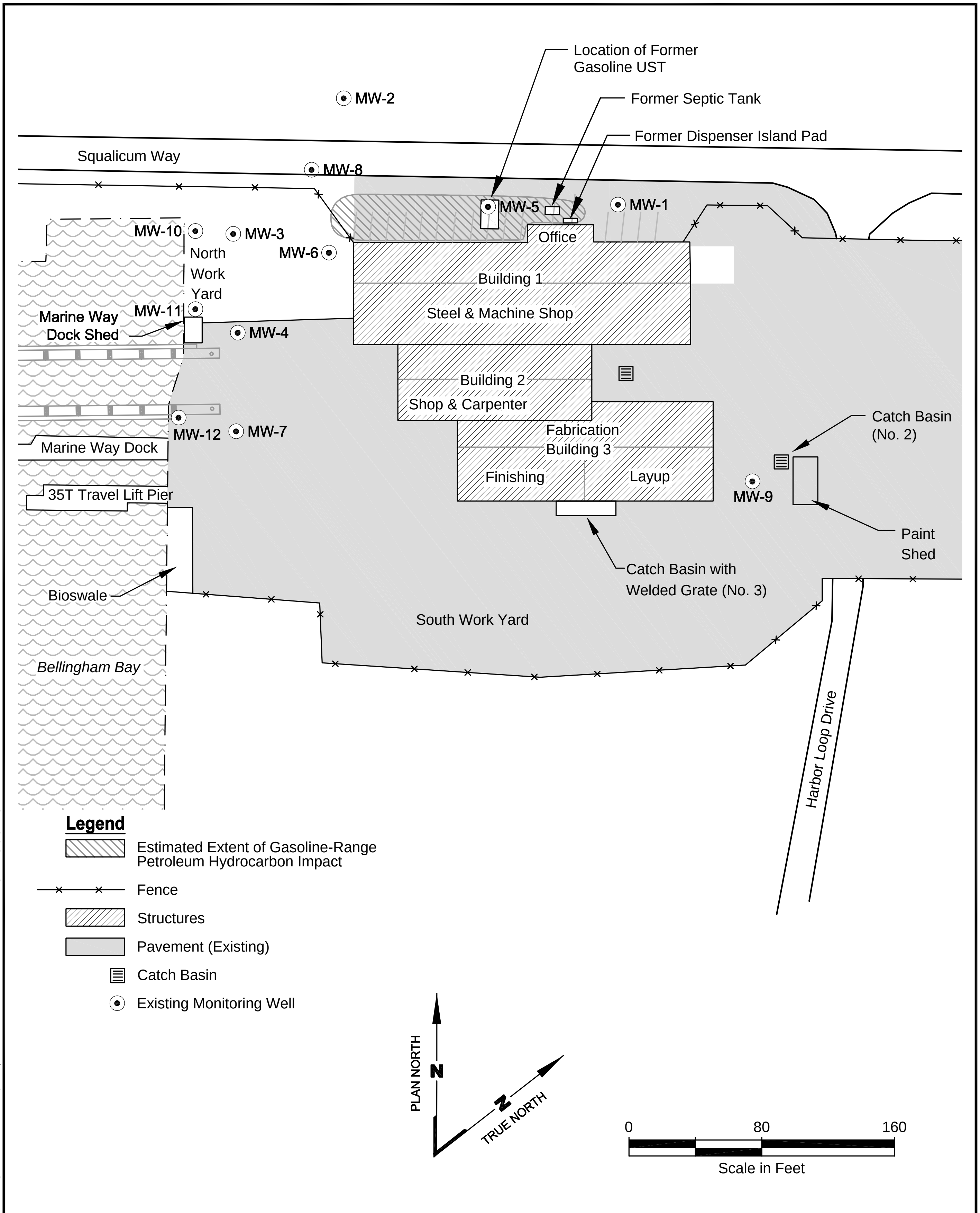
One surface water quality sample will be collected from Squalicum Outer Harbor at a location distant from the site to assist in evaluating the influence of surface water on groundwater quality. The specific sampling location has not been selected, but will be located about 500 ft from the site to ensure that it is not affected by site groundwater discharge.

The surface water sample will be collected by lowering a capped, unpreserved, laboratory-supplied sample bottle beneath the water surface to avoid entraining any surface debris in the sample. The bottle will then be slowly uncapped and allowed to fill, and will be recapped prior to removal from the water. The full sample bottle will be used to fill laboratory-provided sample bottles containing the appropriate preservative, as applicable. The same field parameters will be measured for surface water as described above for groundwater samples, and the surface water quality sample will be tested for the same analytical parameters as groundwater samples.

REPORTING

The results of this investigation will be presented with other supplemental RI data in the revised RI/FS report. The revised RI/FS report will also address Ecology comments from the previous draft.

LDB/rgm



Port of Bellingham/Gate 2 Boatyard | V:\001\024\270\DWP Addendum\Fig1.dwg (A) "Figure 1" 11/29/2006

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Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Supplemental RI WP Addendum

Figure
1

Interim Action Completion Report
Sediment Remediation and Redevelopment Project
Weldcraft Steel and Marine (Gate 2 Boatyard) Site
Bellingham, Washington

August 18, 2006

Prepared for

Port of Bellingham
Bellingham, Washington

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1.0 INTRODUCTION

This interim action completion report documents the implementation of the sediment remediation and redevelopment project at the former Weldcraft Steel and Marine (Gate 2 Boatyard) site (Site) at the Port of Bellingham (Port) in Bellingham, Washington. A Site vicinity map is shown on Figure 1, and a project area Site map with an aerial photograph taken prior to conducting the interim action is shown on Figure 2.

The sediment interim action was conducted by the Port under Agreed Order No. DE 03TCPBE-5623 issued by the Washington State Department of Ecology (Ecology), which has an effective date of July 15, 2003. Project activities were conducted in accordance with the Ecology-approved Interim Action Work Plan (Landau Associates 2003a), which was prepared in accordance with Ecology's Model Toxics Control Act regulations (MTCA; WAC 173-340-430) and the Washington State Sediment Management Standards (SMS; WAC 173-204; Ecology 1995).

The interim action was also consistent with the goals of the Bellingham Bay Comprehensive Strategy. The Site was one of several sediment cleanup sites identified in the final Environmental Impact Statement (FEIS; Anchor Environmental 2000) developed under the Bay-wide Demonstration Pilot.

The primary objectives of the Gate 2 Boatyard sediment remediation and redevelopment project were to:

- Remediate contaminated sediments impacted by boatyard activities of the Port's former Site tenant, Weldcraft Steel and Marine
- Implement Site repairs and improvements necessary to allow continuing Site use as a water-dependent boatyard by the Port's new tenant, Seaview North Boatyard, Inc.
- Provide significant new marine habitat in the project vicinity, in addition to compensatory mitigation to address habitat losses associated with sediment dredging and Site improvements
- Beneficially use dredged material from the U.S. Army Corps of Engineers (USACE) maintenance dredging of the Squalicum Creek Waterway for construction of the new marine habitat bench along the existing Federal breakwater.

This report has been prepared for Ecology to document the satisfactory completion of the sediment interim action and Site redevelopment construction activities, and meets the Agreed Order requirements for an interim action completion report. The overall objective of this report is to document that the sediment remediation and marine habitat bench construction activities were completed in overall conformance with the Interim Action Work Plan, the Site preliminary cleanup levels based on the SMS Sediment Quality Standards, project permits and approvals, and the construction drawings and technical specifications included with the Port's contact documents (Port of Bellingham 2003). Brief summaries of the various Site redevelopment activities that were not part of the MTCA cleanup action are also included in this report for documentation purposes.

Project permits and approvals associated with the Gate 2 Boatyard sediment remediation and redevelopment project included the following:

- Clean Water Act (CWA) Section 404 Individual Permit No. 200201330, issued by the USACE, dated July 29, 2003, as modified on February 13, 2004 to extend the in-water construction period from February 15, 2004 to March 1, 2004

- Hydraulic Project Approval (Log No. ST-F7729-01) issued by the Washington State Department of Fish and Wildlife (WDFW) on June 9, 2003

- Water Quality Certification/Modification Order #03SEAHQ-5664 issued by Ecology on July 22, 2003, and First Amendment dated August 21, 2003

- City of Bellingham Building Permit No. BLD2003-00225 issued August 1, 2003 and Public Works Permit No. PBW2003-00932 issued August 1, 2003

- Authorization for a Habitat Bench in PMA #22-080025, Parcel 2, issued by the Washington State Department of Natural Resources (WDNR) dated July 18, 2003.

This interim action was focused on the in-water portion of the Site. Upland remediation will be addressed separately, following completion of a Site-wide remedial investigation/feasibility study (RI/FS) also being conducted under the Agreed Order between the Port and Ecology.

Section 2.0 of this report presents a summary of Site conditions. Section 3.0 presents a summary of the interim action construction activities. Section 4.0 presents a summary of sediment quality monitoring associated with the interim action. Section 5.0 presents the Professional Engineer's statement regarding implementation of the interim action. Section 6.0 presents the references for this document.

2.0 SITE CONDITIONS

This section presents a summary of Site conditions relevant to the Gate 2 Boatyard sediment remediation and redevelopment project. Additional details are presented in the Interim Action Work Plan (Landau Associates 2003a) and the Site-wide RI/FS report (Landau Associates 2005).

2.1 SITE LOCATION

The Site is located on Port property just south of Squalicum Way at Section 25, Township 38 North, Range 2 East, within and adjacent to Squalicum Outer Harbor in Bellingham, Washington, as shown on the Site map on Figure 2. The street address for the current Site tenant (Seaview North Boatyard) is 2652 Harbor Loop Drive, Bellingham, Washington, 98225.

2.2 SITE HISTORY

Historic fire insurance maps from 1904 and 1913 show the Site area was undeveloped tidelands of Bellingham Bay. In the 1920s, the area was filled with material dredged during construction of the Squalicum Creek Waterway. By the 1940s and 1950s, various large businesses began operation in the filled areas along the waterway. Construction of the existing Federal breakwater and dredging of the Squalicum marina area to Elevation -12 ft mean lower low water (MLLW) occurred in the early 1950s.

The Port became owner of the Site in 1927. Weldcraft Steel and Marine (Weldcraft) first leased the Site in 1946 and operated primarily as a shipyard that conducted boat construction, repair, and maintenance; vessel haul-out and launching; marine pipefitting; sheet metal work; painting; and other various shipyard activities.

The Port's lease with Weldcraft was terminated in February 2000 and the Port obtained full operational control of the Site in July 2000. The Site has been occupied by the Port's current tenant, Seaview North Boatyard, since April 2002.

2.3 SITE FEATURES PRIOR TO THE INTERIM ACTION

Site features that existed prior to the interim action are shown on Figure 3 and are summarized below, with an emphasis on Site features within the nearshore work areas versus the upland portions of the Site. A discussion of how the Site features were modified during the interim action is presented in Section 3.0. The relationship between true north and plan north used for the project is indicated on Figure 3 and other plan view figures.

The upland portion of the Site is relatively flat with a ground surface between about Elevation 13 and 15 ft MLLW. A preconstruction bathymetric survey of the near-shore marine area was performed by Blue Water Engineering of Seattle, Washington in October 2001. The horizontal survey data were referenced to Washington State plane coordinates - north zone (NAD 83), and the vertical data were referenced to MLLW datum. The bathymetric survey data were supplemented by spot mudline elevation measurements made by Landau Associates. The resulting preconstruction bathymetric contours are shown on Figure 3 and Drawings C-1 and C-2 in Appendix A.

A timber bulkhead had been constructed along the waterfront on the north and east sides of the Site to support the upland fill areas adjacent to Squalicum Outer Harbor. The timber bulkhead was constructed with creosote-treated timber piles that support horizontal timber lagging with tieback rods and deadman anchors at most pile locations. The bulkhead alignment was subdivided into three segments (A, B, and C) for Port planning purposes, as indicated on Figure 3. The bulkhead lengths for Segments A, B, and C are approximately 144 ft, 222 ft, and 258 ft, respectively. About 176 ft of bulkhead along the north side of the Site is covered by the Segment C timber wharf.

A marine railway structure had been constructed from the upland railway well area (approximately 30 ft wide by 100 ft long) into the water about 235 ft beyond the timber bulkhead, as indicated on Figure 3. The marine railway was supported on creosote-treated timber piles, with timber pile caps and stringers supporting the two steel rails. The sides of the marine railway well were supported by timber piles and lagging supplemented with concrete side walls along a portion of the structure. A concrete-lined vault at the east end of the railway well housed the winch and cable assemblies used to move the railway platform along the marine railway.

The existing 35-ton travel lift piers are supported on pairs of creosote-treated timber piles with timber cross bracing, and the timber and steel carrier beams extend about 77 ft beyond the timber bulkhead. The north travel lift float is a timber structure that extends about 350 ft beyond the timber bulkhead and is secured by fifteen timber piles.

The Segment C wharf located along the north side of the Site is a creosote-treated timber pile-supported structure with timber decking, stringers, pile caps, and cross bracing. The wharf is approximately 30 ft wide and 176 ft long, as indicated on Figure 3. A small shop building is situated on the eastern side of the wharf and extends upland onto the gravel surfaced area beyond the alignment of the Segment C bulkhead, as shown on Figure 3.

The upland areas to the east of the Segment B bulkhead contained several small sheds, the boatyard buildings, open storage and work areas, parking areas, and a grass bioswale, as indicated on Figure 3. The area north of the railway well was a gravel surfaced storage area, while the areas south of the railway well were paved with asphalt concrete. The upland areas to the east of the Segment A bulkhead contain structures and paved parking areas associated with the Squalicum Yacht Club and the Bellingham Yacht Club.

Several active and inactive stormwater outfall pipes extended through the timber bulkhead on the north and east sides of the Site, as indicated on Figure 3. Additional discussion of Site outfalls is provided in the Site-wide RI/FS report (Landau Associates 2005).

2.4 SITE ENVIRONMENTAL CONDITIONS

Site environmental investigations conducted within the interim action area, and environmental conditions that existed prior to the sediment interim action, are discussed in detail in the Interim Action Work Plan and are briefly summarized below.

The objective of the sediment investigations was to evaluate the horizontal and vertical extent of sediment contamination resulting from the presence and release of wastes or hazardous substances associated with previous Site activities. Many of the sediment samples underwent analysis for SMS metals, semivolatile organic compounds (SVOC), bulk butyltins including tributyltin (TBT), and total organic carbon (TOC). Sediment quality was evaluated based on SMS sediment quality standards (SQS) and cleanup screening levels (CSL). The SQS represents the concentration below, which no adverse affects should occur. The CSL represents the concentration above which more than minor adverse affects may occur. SQS and CSL have not been developed for TBT, so Site-specific cleanup levels were developed with the review and concurrence of Ecology.

Sediment quality exceedances were identified only in surface sediment samples and sediment core samples collected from 0.1 to 4 ft below the mudline. TBT and mercury were determined to be the most common constituents of concern in Site sediment. Bulk TBT concentrations tended to decrease from surface to subsurface sediment, indicating TBT was a more recent contaminant. Mercury concentrations tended to increase from surface to subsurface sediment, indicating mercury was an historical contaminant. Other sediment quality exceedances at the Site, excluding the organic and inorganic exceedances in the marine railway area, consist of copper, bis(2-ethylhexyl)phthalate (BEP), and fluoranthene.

Marine railway well exceedances included metals (arsenic, cadmium, copper, lead, mercury, zinc, and bulk TBT), numerous low and high molecular weight polycyclic aromatic hydrocarbons (PAHs), BEP, dibenzofuran, and n-nitrosodiphenylamine. The concentrations of gas-, diesel-, and oil-range total petroleum hydrocarbons (TPH) were also elevated in the railway sample.

Based on the distribution of Site sediment contamination, as generally indicated on Figure 4, the marine railway well area appeared to be the primary source of sediment contamination. To a lesser extent, the 35-ton travel lift area may have also contributed to sediment contamination in the past. Available data did not suggest that the existing storm drain outfalls were a significant source of Site sediment contamination.

2.5 INTERIM ACTION CLEANUP LEVELS

The primary constituents of concern were TBT and mercury. Other hazardous substances that exceeded the SQS, excluding the numerous organic and inorganic exceedances in the railway sample, consist of copper, BEP and fluoranthene. The SQS, and the Site-specific TBT no-effects cleanup level (79 µg/kg), were the sediment cleanup levels used for the interim action. The interim action sediment cleanup levels for the constituents of concern are presented in Table 1.

3.0 SUMMARY OF INTERIM ACTION CONSTRUCTION ACTIVITIES

This section presents a summary of the interim action construction activities performed by the Port's selected contractor, American Construction Company of Everett, Washington and its subcontractors. A summary of construction monitoring and oversight activities conducted by the Port and its independent quality assurance team is also included in this section.

A half-size set of the interim action construction drawings is included in Appendix A. Record drawings documenting as-constructed conditions for the sediment remediation and marine habitat bench components of the interim action are presented in Appendix B. Selected construction photographs are included in Appendix C. Field reports, record drawings, submittals, photographs, and notes documenting the work are being maintained by the Port and its subconsultants in accordance with the Agreed Order requirements.

3.1 PURPOSE OF THE INTERIM ACTION

The purpose of the interim action was to remediate contaminated sediment affected by the activities of the prior Site tenant, Weldcraft Steel and Marine. The sediment remediation activities were conducted in conjunction with redevelopment of the boatyard facility for use by Seaview North Boatyard. The interim action and redevelopment activities were conducted in accordance with the Interim Action Work Plan and consistent with the goals of the Bellingham Bay Comprehensive Strategy, including cleanup of a high priority contaminated sediment site and construction of a high priority habitat restoration site identified in the FEIS (Anchor Environmental 2000) developed under the Bay-wide Demonstration Pilot. Additionally, the interim action and redevelopment activities removed or isolated a significant amount of creosoted timbers and piling from the marine environment, consistent with the goals of the Whatcom County Marine Creosoted Piling Remediation Program (Ecology 2002).

The interim action consisted of the following four major in-water construction elements:

- Removal of the marine railway structure to facilitate dredging of contaminated sediments
- Installation of a new steel sheetpile bulkhead in front of the Segment B timber bulkhead where contaminated sediments were removed
- Sediment dredging to remove contaminated sediment above the SQS, and
- Construction of new marine habitat bench along the Squalicum Outer Harbor breakwater to address habitat losses associated with post-construction dredge depths and the location of the new bulkhead.

In conjunction with these interim action activities, the following Site redevelopment activities were implemented:

- Construction of a 150-ton travel lift pier to replace the marine railway
- Additional sediment dredging to attain adequate vessel drafts (at least Elevation -10 ft MLLW) in the vicinity of the new 150-ton travel lift
- Installation of a new cantilevered steel sheetpile bulkhead in front of the Segment A timber bulkhead
- Repair of the Segment C timber bulkhead along the north shoreline
- Repair/replacement of damaged timber piles associated with the Segment C wharf and timber bulkhead and the north travel lift float, and
- Repair/replacement of selected structural elements of the Segment C wharf.

3.2 COMPLIANCE MONITORING

In accordance with MTCA requirements in WAC 173-340-410, the project Compliance Monitoring Plan (Landau Associates 2003b) was developed for the interim action activities and was included as Appendix C to the Interim Action Work Plan. Compliance monitoring activities for the project included:

- Protection monitoring to confirm that human health and the environment were adequately protected during interim action construction
- Performance monitoring to confirm that the interim action attained the sediment cleanup standards established for the project and other performance standards (such as construction quality control monitoring necessary to demonstrate compliance with project permits), and
- Confirmational monitoring to confirm the long-term effectiveness of the interim action once the cleanup standards and other performance standards were attained.

3.2.1 HEALTH AND SAFETY

The Site-specific Health and Safety Plan used by Landau Associates and certain Port personnel was included as Exhibit C of the project contract documents. American Construction prepared and implemented its own Site Health and Safety Plan for the project.

3.2.2 SURFACE WATER QUALITY MONITORING

Surface water quality monitoring was performed by both Landau Associates and Port personnel in accordance with the Compliance Monitoring Plan and the Water Quality Certification/Modification Order and First Amendment issued by Ecology.

Background water quality monitoring was conducted on September 10, 2003 prior to the start of in-water construction activities. The two background locations selected for the project (sample sites A and F) were located near the entrances to Squalicum Outer Harbor, as shown on the sketch in Appendix D. The results of the water quality monitoring conducted during the interim action, as previously reported to Ecology, are also included in Appendix D.

3.2.3 SEDIMENT PERFORMANCE MONITORING

The results of sediment quality monitoring performed in conjunction with the interim action sediment dredging and excavation activities are discussed in Section 4.0.

3.3 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

This section summarizes the overall construction quality assurance/quality control (QA/QC) activities and the construction coordination process used during the work. Representatives from the Port, Landau Associates, and Geiger Engineers had primary responsibility for overall construction QA activities. American Construction had primary responsibility for QC of their contracted work. Ecology representatives also conducted periodic Site visits, review of selected submittals, and participated in progress meetings during project implementation.

Construction QA activities were conducted in general accordance with the construction quality assurance plan (CQA Plan), included as Exhibit D to the project contract documents (Port of Bellingham 2003), for the purpose of verifying and documenting that the work was performed in general conformance with the project plans, technical specifications, and construction drawings.

American Construction and their subcontractors were responsible for overall planning and QC of their contracted work. They were responsible for verifying that materials supplied for the work were properly produced or fabricated in compliance with design requirements, monitoring their construction activities, performing necessary testing/sampling/surveying activities, and documenting their work.

American Construction and their subcontractors provided a variety of submittals, shop drawings, construction plans, and material samples and certifications as required by the contract documents. The Port and its representatives reviewed these submittals for overall compliance with the construction drawings and technical specifications. If a submittal was not sufficient or did not represent materials or procedures that complied with the work requirements or the overall intent of the design, American Construction was notified verbally or by written submittal review form. The Port and its representatives also responded to written requests for information and coordinated with American Construction personnel on a frequent basis to respond to verbal questions and comments. The submittal review process and coordination between the Port and American Construction personnel was considered successful in correcting deficiencies in proposed materials or procedures prior to installation or implementation in the field, as well as for adjusting construction methods and sequences when needed to account for Site constraints and conditions encountered during performance of the work.

3.4 INTERIM ACTION CONSTRUCTION SUMMARY

American Construction conducted the in-water work during the agency-approved construction window from September 1, 2003 to March 1, 2004. Due to scheduling concerns, the Port requested an extension of the originally approved date for completion of in-water work activities, and the USACE modified the Section 404 Individual Permit on February 13, 2004 to extend the in-water construction period from February 15 to March 1, 2004.

The in-water and over-water construction and Site redevelopment activities are described in more detail in the following sections.

3.4.1 MARINE RAILWAY DEMOLITION/REMOVAL

The primary purpose for removal of the marine railway was to provide access for dredging of underlying sediment and allow construction of the new 150-ton travel lift finger piers along the railway alignment. American Construction demolished and removed most of the marine railway structure, the adjacent mooring piles, and the Segment C wharf fender piles during the period from September 23 to 25, 2003. A barge-mounted mechanical clamshell was used to pull the creosote-treated timber piles, pile caps, and stringers and offload the debris onto an adjacent flat-deck materials barge. The demolition debris was then cut to appropriate lengths and transported for disposal at Rabanco's Roosevelt Regional Landfill in Goldendale, Washington. The steel components of the marine railway platform and the steel rails were salvaged or recycled.

American Construction deployed a silt curtain around the work area, and water quality monitoring was conducted by the Port and Landau Associates to confirm that removal of the marine railway did not cause an exceedence of the project water quality criteria. The results of the water quality monitoring during removal of the marine railway structure are included in Appendix D.

3.4.2 SEDIMENT REMOVAL, DISPOSAL, AND BACKFILLING

Contaminated sediment removal areas included the designated area west of the new sheetpile bulkhead and the entire marine railway well area east of the new sheetpile bulkhead, as indicated on Figure 4. The planned sediment dredging depths shown on Figure 5 and Drawing C-2 in Appendix A were developed to remove the upper 4 ft of sediment within the identified zone of contamination, to the extent practicable given existing Site constraints, as well as to attain adequate vessel drafts (at least Elevation -10 ft MLLW) in the vicinity of the new 150-ton travel lift. The new Segment B sheetpile bulkhead was installed prior to dredging in front of, and excavating behind, the bulkhead to avoid undercutting and destabilizing the existing timber bulkhead. A total of 6,983 yd^3 of sediment was removed from the Site and disposed at Rabanco's Roosevelt Regional Landfill.

3.4.2.1 Marine Area Dredging

Sediment dredging in the marine area was conducted by American Construction during the period between December 24, 2003 and February 5, 2004 to remove contaminated sediment and to achieve minimum vessel draft requirements for access to the new travel lift. Sediment dredging was conducted using barge-mounted mechanical clamshell dredge equipment, with the dredged material placed on an adjacent barge. Due to the lack of a sufficient number of flat deck barges, American Construction alternately loaded one flat deck barge and one closed bottom dump barge for transportation to the offsite sediment offloading facility. Free water released from sediment placed on the flat deck barge was allowed to drain back to surface water in the work area, with geotextile filter material placed along the side boards of the barge to limit loss of material and control turbidity. Free water released from sediment placed in the closed bottom dump barge was mixed and offloaded with the dredged materials.

The design sediment dredging contours are shown on Figure 5; however, based on the results of initial sediment performance monitoring conducted on January 28, 2004, the Port directed the contractor to dredge additional sediment in the area directly in front of the bulkhead constructed across the former marine railway well. This additional dredging was conducted on February 5, 2004 over an area approximately 60 ft wide and approximately 65 to 73 ft out from the sheetpile bulkhead, and down to approximately Elevation -12 ft MLLW instead of the original design dredge cuts of Elevation -10 ft to -11 ft MLLW in this area.

To avoid adverse undercutting of the slope under the Segment C wharf and in the adjacent unshaded intertidal area, the toe of the dredge cut was offset approximately 12 to 13 ft south to allow the cutslope to daylight near the southern the edge of the wharf, as indicated on Figures 4 and 5. Following sediment dredging in this area, the contractor's progress survey (at Section X_000) showed that some slope material under the Segment C wharf had sloughed into the excavation. This area was subsequently redredged to full depth, but slope material continued sloughing into the excavation, as indicated on the final progress survey (see Appendix B). As agreed by Ecology, this slough material was left in place pending additional sediment performance monitoring. A sample (SPM-12) was collected along the Segment C wharf and analyzed to characterize the slough material (see Section 4.0).

American Construction deployed a silt curtain around most of the marine dredging work areas, and water quality monitoring was conducted by the Port and Landau Associates to confirm that sediment dredging activities did not cause an exceedence of the project water quality criteria. The results of the water quality monitoring during marine sediment dredging are included in Appendix D.

American Construction's surveying subcontractor, CRA-NW Survey Services, performed periodic bathymetric progress surveys to confirm that marine dredging achieved the design dredge depths. These data were reviewed by the Port and Landau Associates as part of construction QA activities. The final progress survey data is included in Appendix B. Based on the survey data, 6,536 yd^3 of sediment was removed from the marine dredging area, including overdredge material and 288 yd^3 of additional dredging that occurred in the area in front of the former marine railway well. This volume is consistent with the design dredge prism with a typical 6-inch overdredge.

3.4.2.2 Marine Sediment Offloading and Disposal

American Construction initially planned to transport the barges of sediment to Hazco's Ecowaste landfill in Richmond, Canada, which had been identified as one of the three pre-approved upland disposal sites. Hazco subsequently proposed to dispose of the sediments at the Mount Waddington Regional District landfill (the 7-Mile Landfill) near Port McNeil on Vancouver Island, but could not provide documentation regarding the adequacy of the landfill for disposal of the dredged material. This, combined with a significant increase in proposed disposal costs due to a stronger Canadian dollar, left the project needing another disposal alternative. American Construction subsequently proposed to transport the barges of sediment to an offsite location in Seattle and/or Everett for offloading and disposal at Rabanco's Roosevelt Regional Landfill in Goldendale, Washington. The Port and Landau Associates coordinated with USACE and Ecology representatives, and on January 5, 2004 received concurrence from the USACE that no modification to the Section 404 individual permit was necessary for this minor modification.

American Construction ultimately decided to offload the majority of the sediment at the Alaska Logistics site pier located along the Duwamish River at 6365 1st Avenue South in Seattle. As directed by the Port and Ecology, Landau Associates' personnel made periodic visits to the offloading facility to observe that American Construction and its subcontractors used sufficient environmental controls (e.g., synthetic liners, straw bales, etc.) to contain and collect minor spillage during the material transfer operations. A land-based crane with a mechanical clamshell bucket was used to transfer the dredged material from the barges to trucks which transported the material to Rabanco's 4th and Lander Street transfer station in Seattle for subsequent disposal at Rabanco's Roosevelt Regional Landfill. Once unloaded, the barges were returned to the Site and refilled. The sediment offloading activities occurred during the period from January 8 to about January 29, 2004. The haul trucks were decontaminated at Rabanco's transfer station, and the synthetic liner materials, the wood decking on the concrete pier, and some potentially contaminated soil at the end of the pier were removed and trucked to the transfer station for disposal at the landfill. The clamshell bucket used for sediment offloading and the barges were eventually decontaminated by removing any residual material at the offloading facility, followed by a final cleanout at the Site.

The last barge of sediment, containing the 288 yd^3 of additional material that was dredged in the area in front of the former marine railway well on February 5, 2004, remained covered at the Site until it was transported to a pier at American Construction's south yard facility at the Port of Everett in late April 2004. The sediment offloading activities occurred on April 27 and 28, 2004, using a barge-mounted crane with a mechanical clamshell bucket to transfer the relatively dry dredged sediment to trucks which transported the material to Rabanco's 4th and Lander St. transfer station in Seattle for subsequent disposal at Rabanco's Roosevelt Regional Landfill. As with the Seattle offloading facility, Landau Associates' personnel made periodic visits to confirm that American Construction used sufficient environmental controls (e.g., synthetic liners, etc.) to contain and collect minor spillage during the material transfer operations. The haul trucks were decontaminated at Rabanco's transfer station, and the synthetic liner materials and some potentially contaminated soil at the end of the pier were removed and trucked to the transfer station for disposal at the landfill. The clamshell bucket and barge were decontaminated at American Construction's facility.

3.4.2.3 Marine Area Backfilling

Marine areas of the Site that were dredged to below Elevation -13 ft MLLW were backfilled up to approximately Elevation -13 ft MLLW with clean imported gravelly sand backfill material, which contained about 17 percent fine gravel and about 83 percent fine to coarse sand. Marine area backfilling activities were conducted on February 4 and 5, 2004. The sand backfill was delivered to the Site by barge and placed with a clamshell bucket. Based on CRA-NW survey data, 1,139 yd^3 of sand backfill was placed in the designated marine areas, with backfill thicknesses ranging from approximately 0.5 to 4 ft. The sediment backfill areas and post-interim action bathymetry are indicated on Figure 6, and on the plan and profile record drawings in Appendix B.

3.4.2.4 Marine Railway Well Excavation and Backfilling

Sediment excavation within the marine railway well was conducted by American Construction and its subcontractors during the nights of January 20 to 21, 2004 in order to conduct the minimum 4-ft deep excavation "in the dry" during low tide, to the extent practicable. Land-based earthwork equipment was used to excavate sediment and remove debris (including creosote-treated piles that supported the former railway structure) located within the marine railway well, starting at the new bulkhead and proceeding in an upland direction. The material was loaded directly into trucks which transported the material to Rabanco's 4th and Lander Street transfer station in Seattle for subsequent disposal at Rabanco's Roosevelt Regional Landfill. Based on CRA-NW survey data, 447 yd^3 of sediment and debris was removed from the marine railway well.

Due to concerns for undercutting and destabilizing the sidewalls of the railway well, quarry spalls and some overlying structural fill was placed in portions of the excavation directly after removal of the contaminated sediment. This was possible because, with Ecology concurrence, two test pits had been excavated below the base of the railway well on January 15, 2004 to determine if the planned 4-ft cut depth would be sufficient to remove the contaminated sediment in the well. Sediment performance samples SPM-7 and SPM-11 were collected at a depth of 4-ft in the two test pits and analyzed to determine if material left at that depth would achieve the sediment cleanup action levels (see Section 4.0). Onsite observations were made by Port and Landau Associates personnel during excavation of the railway well to confirm that the minimum cut depth was achieved and that additional sediment that was cross-contaminated during material excavation and handling was removed for disposal.

Note that a flat-top fiberglass tank (approximately 4-ft wide by 6-ft long by 2-ft deep) was encountered in the upper/eastern portion of the marine railway well in October 2003 following removal of some of the railway stringers and pile caps. Sampling and analysis of the water and sediment in the tank was conducted by Landau Associates to help guide decisions regarding handling and disposal of the tank contents. The sampling results, which were previously reported to Ecology, confirmed that the tank sediment could be managed as a solid waste and that the water in the tank could be disposed along with the sediment removed from the railway well. This fiberglass tank was removed during excavation of the sediment and debris in marine railway well.

Following installation of the deadman anchors and associated tieback rods, the remainder of the area behind the new sheetpile bulkhead was backfilled with structural fill up to about Elevation 14 ft MLLW and subsequently graded and paved with asphalt concrete to support wheel loads associated with the new 150-ton travel lift hoist.

3.4.3 BULKHEAD REPLACEMENT

Approximately 368 feet of new galvanized-steel sheetpile bulkhead was installed about 3 ft in front of (i.e., waterward of) the existing creosote-treated timber pile and lagging bulkhead along the east shoreline. Segment A is within the Site boundary and is approximately 144 ft long and Segment B is south of the Site boundary and is approximately 222 ft long. This bulkhead replacement work was conducted both to facilitate sediment dredging and as part of the Port's Site redevelopment.

The steel sheetpile sections were driven to design depth with a vibratory hammer mounted on a barge-based crane. The alignment of the new sheetpile bulkhead was modified slightly by American Construction to avoid certain conflicts with existing facilities along the shoreline, but the new bulkhead was installed as generally indicated on Figure 7 and as detailed on Drawings S1.0 through S1.3 in Appendix A.

The new Segment B sheetpile bulkhead along the east side of the dredge area closed off the former marine railway well and utilized deadman anchors in the railway well area and helical tieback anchors along the remaining portions to stabilize the bulkhead structure. A.B. Chance® helical tieback anchors were installed by American Construction's subcontractor, Davis Construction Services, Inc., prior to installation of the sheet piling. This activity involved cutting holes in the timber lagging and using a land-based, backhoe-mounted hydraulic torque motor to screw the helical anchors into the fill and native materials behind the existing bulkhead. Due to the presence of debris and a previously unknown wooden bulkhead segment encountered behind the existing timber bulkhead, considerable caving of existing backfill and soil occurred behind the existing bulkhead, which resulted in the need to remove the existing bioswale and additional fill behind the bulkhead. These areas were eventually backfilled with structural fill material and the bioswale was reconstructed as part of Site restoration activities.

The new Segment A sheetpile bulkhead was a cantilevered structure that tied into the existing steel sheetpile bulkhead near the Bellingham Yacht Club building.

The existing Segment A and B timber bulkheads were left in place behind the new steel sheetpile bulkhead segments. The space between the existing and new bulkheads was backfilled with imported, free flowing gravel fill material up to about 2- to 3-ft below existing upland Site grades. Following installation of a geotextile separation layer, the upper portion between the walls was backfilled with topsoil and planted with various shrubs; however, in the areas near the two travel lifts that were eventually paved, this upper portion was backfilled with structural fill and crushed rock.

3.4.4 New 150-Ton Travel Lift Installation

Following removal of the marine railway and marine sediment dredging activities, the finger piers associated with the new 150-ton travel lift were installed as generally indicated on Figure 7 and as detailed on Drawings S2.0 through S2.2 in Appendix A. Each concrete finger pier is approximately 6 ft wide and 145 ft long, with an average 105-ft length extending out beyond the alignment of the new bulkhead, and each finger pier has a 2.5-ft wide open-grated walkway and a handrail attached to the outer edge of the pier.

The two finger piers are supported by 26 2-ft diameter, open-ended, galvanized steel pipe piles driven with pile driving hammers and leads mounted on a barge-based crane. All the vertical and battered piles were installed with a vibratory hammer, except that the last 10 feet of the vertical piles were driven with an impact hammer to help confirm that adequate pile capacities had been obtained. In accordance with project permit requirements, the steel piles installed with an impact hammer were surrounded with an air bubble curtain system to mitigate the potential adverse effect of pile driving on fish that may have been in the work area.

3.4.5 Segment C Bulkhead Repairs

The portion of the timber bulkhead located under the Segment C wharf that received lagging repair is shown on Figure 7. The repairs consisted of installing vertical metal channels along the existing piles and attaching ammoniacal copper zinc arsenate (ACZA)-treated wood lagging between the channels, waterward of the existing lagging. The nominal 4-inch space between the old and new lagging was backfilled with clean, imported granular fill material. These repairs are detailed on Drawing S3.0 in Appendix A.

The Segment C timber bulkhead also contained two timber piles (Nos. 79 and 85) with less than 90 percent remaining cross sectional area that were repaired by removing the wharf decking near each damaged pile, using pile driving equipment to install galvanized steel H-piles on both sides of each damaged pile, and installing a galvanized channel to secure these H-piles to the existing tieback rod. This timber bulkhead pile repair is detailed on Drawing S3.0 in Appendix A.

3.4.6 TIMBER PILE REMOVAL, REPLACEMENT, AND REPAIRS

Based on previous underwater pile condition surveys performed for the Port in 2002, certain timber piles at the Site with less than 90 percent remaining cross sectional area were replaced with driven ACZA-treated timber piles, including:

- Six piles under the Segment C wharf
- All 16 fender piles along the south side of the Segment C wharf
- All 15 piles supporting the north travel lift float (only 5 were damaged, but all were replaced after temporary relocation of the float during sediment dredging activities).

Certain timber piles no longer in use were pulled out of the sediment or cut off below the final mudline elevation. These include piles supporting the marine railway, certain mooring piles, and various derelict pile stubs located adjacent to the Segment C bulkhead. Piles or pile segments that were removed were cut to appropriate lengths and transported for disposal at Rabanco's Roosevelt Regional Landfill.

3.4.7 SEGMENT C WHARF REPAIRS

In addition to the pile repair/replacement activities discussed above, certain structural repairs were made to the existing Segment C wharf as part of Site redevelopment. The wharf rehabilitation activities, as detailed on Drawings S3.0 and S3.1 in Appendix A, included repair/replacement of selected timber pile caps, stringers, decking, chocks, bull railing, and timber cross bracing.

3.4.8 MARINE HABITAT BENCH CONSTRUCTION

Various in-water dredging and filling activities at the Site were estimated to result in the loss of about 0.18 acre of intertidal habitat (above Elevation -4 ft MLLW) and about 0.23 acre of shallow subtidal habitat (between Elevation -4 ft and -10 ft MLLW), and an increase of about 0.46 acre of deep subtidal habitat (below Elevation -10 ft MLLW). In accordance with the project permit requirements, these impacts were mitigated by construction of a new marine habitat bench along the west (seaward) side of the Squalicum Outer Harbor federal breakwater, which is consistent with the habitat restoration goals and objectives of the Comprehensive Strategy for Bellingham Bay. The selected habitat restoration site was one of the high priority habitat action sites identified in the FEIS (Anchor Environmental 2000), and was constructed to provide significant habitat restoration in addition to compensatory mitigation.

The general location and configuration of the new marine habitat bench is shown on Figures 2 and 8. The goal of the marine habitat bench construction was to initially create a minimum of 2 acres of shallow subtidal habitat above Elevation -10 ft MLLW, including a minimum of 1 acre of habitat between Elevation -4 and -6 ft MLLW. Construction of this new habitat bench resulted in at least a 2:1 compensation ratio to address project impacts, plus additional habitat to concurrently fulfill enhancement and restoration objectives and ensure maintenance of compensatory habitat over time. The physical success criteria for the marine habitat bench is that, after 5 years, a minimum of 1 acre of shallow subtidal habitat above Elevation -10 ft MLLW is maintained, including a minimum of 0.5 acres of habitat above Elevation -6 ft MLLW.

Construction of the marine habitat bench was the result of a collaborative effort between the USACE and the Port, and included beneficial use of maintenance dredge material from the nearby Squalicum Creek Waterway as habitat bench fill material. Only sediment from Squalicum Creek Waterway dredge material management units (DMMUs) that exhibited chemical concentrations below the SQS was used as habitat bench fill material. Based on data available from the Puget Sound Dredge Disposal Analysis (PSSDA) sediment characterization report (Striplin Environmental 2000) and other construction considerations, it was decided to use only dredged material from DMMUs C5 through C11 for marine habitat bench construction. The majority of this dredged material was fine-grained silt to clayey silt with greater than about 90 percent material passing the U.S. No. 200 sieve. This material was considered highly desirable for habitat bench construction because the fine-grained material and organic content is expected to provide excellent colonization potential for aquatic invertebrates and eelgrass.

The USACE's maintenance dredging contractor, Manson Construction, used clamshell dredge equipment and bottom dump barges to load, transfer, and place the dredged material at the designated location along the federal breakwater during early January 2004. Manson Construction's survey boat and crew monitored habitat bench fill placement activities, and data from marine surveys conducted on January 15, 22, and 23, 2004 were used to create the as-constructed habitat bench contour plan shown on Figure 8. This figure shows that the habitat bench was constructed larger than the initial construction goals. It is estimated that approximately 39,000 yd^3 of dredged material was placed during habitat bench construction (as compared to the original estimate of about 30,000 to 35,000 yd^3). Based on the January 2004 survey data, about 4.5 acres of shallow subtidal habitat above Elevation -10 ft MLLW was created (as compared to the initial goal of at least 2 acres), about 2.3 acres of habitat above Elevation -6 ft MLLW was created (as compared to the initial goal of at least 1 acre between Elevation -4 and -6 ft MLLW), and about 0.55 acres of habitat above Elevation -4 ft MLLW was created. Future bathymetric surveys of the marine habitat bench in years 1, 2, 3, 5, and 10 will be used to document the stability of the habitat bench over time.

Because of the fine-grained nature of the dredged material, turbidity levels generated during habitat bench fill placement were anticipated to be greater than turbidity levels resulting from Gate 2 Boatyard marine dredging or backfilling activities. Surface water quality monitoring was performed by both Landau Associates and Port personnel to confirm that habitat bench construction did not cause an exceedence of the project water quality criteria. This monitoring was conducted in general accordance with the Compliance Monitoring Plan, the Water Quality Certification/Modification Order and First Amendment issued by Ecology for the Gate 2 Boatyard project, and the Water Quality Certification/Modification Order issued by Ecology for maintenance dredging of the Squalicum Creek Waterway. The results of the water quality monitoring conducted during construction of the marine habitat bench, as previously reported to Ecology, are included in Appendix D.

4.0 SEDIMENT QUALITY MONITORING

Sediment quality monitoring associated with the interim action sediment remediation addressed two objectives: 1) evaluation of the interim action in meeting cleanup standards; and 2) confirmation of the long-term effectiveness of the sediment cleanup action.

Sediment monitoring was accomplished in two main phases. The initial phase was performed in January 2004 and included sampling from 2 test pits excavated in the marine railway well (see Section 3.4.2.4), surface sediment sampling following completion of the planned sediment dredging activities, and sampling of the slough material along the Segment C wharf (see Section 3.4.2.1). Based on the results of the initial phase of sediment monitoring, additional sediment dredging was conducted in February 2004 and additional sediment confirmational monitoring, based on collection of sediment cores, was performed in July 2004.

The remainder of this section consists of summaries of the initial and additional sediment monitoring approaches, the results of the sediment monitoring activities, and comparison of the laboratory results for the initial and additional monitoring activities to the interim action cleanup levels.

4.1 INITIAL SEDIMENT PERFORMANCE MONITORING

Initial sediment performance monitoring was conducted in accordance with the project Sampling and Analysis Plan (SAP; Landau Associates 2003c) to evaluate sediment quality as compared to cleanup standards at locations where contaminated sediments were dredged, as well as at selected locations adjacent to the dredged area. The sampling locations were selected to provide adequate spatial coverage within this area. The initial performance monitoring samples were collected in January 2004 prior to initiation of marine area backfilling activities.

Sediment quality sampling and analysis activities are summarized in Table 2 and consisted of collection of surface sediment from 7 locations within the sediment removal area (SPM-1, SPM-2, SPM-3, SPM-4, SPM-5, SPM-6, and SPM-12), 3 locations outside the sediment removal area (SPM-8, SPM-9, and SPM-10), and two locations from within the marine railway well excavation area (SPM-7 and SPM-11). These sediment performance monitoring locations are shown on Figure 9. Samples were collected from the surface (0 to 12 cm interval) of the existing sediment for all monitoring locations except at locations SPM-7 and SPM-11, where the samples were collected from the lower portion of the sidewalls of 2 test pits advanced below the planned 4-ft sediment excavation depth within the marine railway well.

In accordance with the Compliance Monitoring Plan [(Landau Associates 2003b), included as Appendix C of the Final Interim Action Work Plan], the samples were analyzed for analytes and conventional parameters in accordance with the PSEP guidelines (PSEP 1997a,b,c) and protocols required by the Washington State Sediment Management Standards (SMS; WAC 173-204) (Ecology 1995). These analyses include semivolatile organic compounds (SVOCs) identified on the SMS list of chemical parameters; SMS metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc); bulk organotins [including tributyltin ion (TBT)]; and total organic carbon (TOC) (see Table 2). The samples from the marine railway well area also underwent analysis for TPH using methods NWTPH-Gx and NWTPH-Dx. The analytical results were used to evaluate whether the cleanup levels were met in and adjacent to the dredged area. The chemical testing results of these samples provided a basis for evaluating whether additional dredging or monitoring was appropriate for a particular location.

Subsequent to receipt of analytical results from the initial phase of sediment sampling and discussions with Ecology personnel, marine area backfilling activities were performed by American Construction in the portions of the dredged area where sediment was removed below Elevation -13 ft MLLW (e.g., at sample locations SPM-1 and SPM-2). Backfilling brought the mudline elevations back to approximately Elevation -13 ft MLLW in these areas, as shown on Figure 6 and on the record drawings in Appendix B.

4.2 ADDITIONAL SEDIMENT CONFIRMATION MONITORING

Based on the results of the initial round of sediment performance monitoring and discussions with Ecology personnel, a plan for additional sediment confirmational sampling and analysis was prepared (Landau Associates 2004), approved by Ecology, and implemented in July 2004. The purpose of the additional sampling was to evaluate whether the contamination detected within the dredge prism during the initial round of monitoring was a thin layer of redistributed contamination associated with dredging activities, or indicative of more vertically extensive contamination. An additional goal of the supplementary sampling was to evaluate whether the additional dredging conducted in front of the former marine railway well subsequent to the initial round of sediment sampling achieved cleanup levels in the vicinity of the new travel lift piers. These supplementary samples were collected at locations where the surface sediment samples collected in January 2004 exceeded one or more of the interim action cleanup levels. Sampling consisted of collection of five 7-ft long confirmational core samples at locations SPM-2A through SPM-6A, as shown on Figure 9. Sample locations SPM-3A and SPM-5A were located in the area where additional dredging had occurred subsequent to the initial round of monitoring, although the locations had to be moved slightly because the new 150-ton travel lift piers were installed during the intervening period between the two sampling events.

Subsamples were collected from each core from the following intervals (based on zero being the top of the post-dredging surface or the base of the sand backfill): 0 to 4 inches (0 to 10 cm), 12 to 16 inches, and 24 to 28 inches. Backfill material, if present, was not sampled.

The additional sediment samples were analyzed for mercury. Samples collected from SPM-3 and SPM-5 were also analyzed for TBT, as those were locations where elevated levels of TBT had been detected during the initial sampling round.

4.3 SEDIMENT QUALITY MONITORING RESULTS

This section presents the sediment quality monitoring results, including field methods, laboratory analysis, and comparison to the interim action cleanup levels.

4.3.1 FIELD METHODS

4.3.1.1 Sample Acquisition

Marine area surface sediment samples (SPM-1 through SPM-6, SPM-8 through SPM-10, and SPM-12) were collected in general accordance with the Compliance Monitoring Plan and the SAP. A total of 10 surface sediment samples (0 to 12 cm) were collected using a stainless-steel power grab. The sampling locations (stations) were selected to provide adequate coverage to evaluate compliance within and adjacent to the planned sediment dredging area.

As agreed by Ecology, marine railway well sediment samples SPM-7 and SPM-11 were collected from the lower portion of the sidewalls of 2 test pits advanced below the planned 4-ft sediment excavation depth within the marine railway well. These samples were collected with hand tools on January 15, 2004 in accordance with the SAP.

Sediment cores were collected in general accordance with the Plan for Additional Sediment Confirmation Sampling (Landau Associates 2004). A total of 10 subsurface sediment samples were collected and analyzed from 5 sediment core locations. Subsurface sediment samples were collected using a vibracore with an aluminum core tube attached.

Sediment sampling locations are shown on Figure 9, and the field measured mudline elevations and coordinates are shown in Table 3. As indicated in Table 3, some field measured mudline elevations were slightly deeper than the design finish mudline; however, field measurements were collected by weighted line and tidally corrected, and should be considered approximate.

4.3.1.2 Surface and Subsurface Sediment Sample Processing

Sediment samples were collected from the sampler (power grab, opened core, or hand tool) using a clean stainless-steel spoon and placed in a stainless-steel mixing bowl. Samples were homogenized in the mixing bowl with a clean spoon until the material appeared uniform in color and texture. The homogenized sample was placed in the appropriate sample containers and maintained in a cooler on ice until delivery to the analytical laboratory.

4.3.1.3 Field Observations

Surface sediment field observations (including sample location, sample date, sampler penetration depth, and sediment descriptions) are summarized in Table 4. Field logs for the sediment cores are presented in Appendix E.

4.3.2 LABORATORY ANALYSES

Surface sediment samples from the 10 initial sampling locations within the marine dredging area were analyzed for the constituents identified in Table 2 to evaluate post-dredge surface sediment quality. The two sediment samples collected from the marine railway well area were analyzed for the constituents identified in Table 2. Subsurface confirmational samples from the 5 core sampling locations were analyzed for the constituents that exceeded cleanup levels in the respective surface sediment samples (see Table 2).

Samples were delivered in ice chests at approximately 4°C to the Analytical Resources, Inc. (ARI) laboratory in Tukwila, Washington which conducted the laboratory analyses. The analytical laboratory data for the initial performance and additional confirmational monitoring samples are provided in Appendix F. Landau Associates maintains the laboratory certificates in our project files.

Upon receipt of the laboratory data, Landau Associates performed a data quality evaluation of the analytical results. Data precision was evaluated through matrix spike duplicates and laboratory duplicates, and the accuracy of the data was evaluated through laboratory control samples, surrogate spikes, and matrix spikes. Based on the data quality evaluation, all of the data were determined to be acceptable with no qualifiers. No data were rejected and the completeness for the data was 100 percent.

4.3.3 INITIAL PERFORMANCE MONITORING – COMPARISON TO CLEANUP LEVELS

Table 5 presents the post-dredge surface sediment monitoring results for the Gate 2 Boatyard sediment remediation project. Information presented in Table 5 includes sediment chemical testing results and a comparison to the Sediment Quality Standards (SQS) and the Cleanup Screening Levels (CSL). Table 5 also indicates which sediment samples had constituents that exceeded the SQS or the CSL. The SQS represents the concentration below which no adverse affects should occur, while the CSL represents the concentration above which more than minor affects may occur.

Table 5 shows that the surface sediment samples collected from locations within the marine dredge area (SPM-1, SPM-2, SPM-3, SPM-4, SPM-5, SPM-6, and SPM-12) exceed the SQS or CSL for certain constituents. The exceedances are summarized below:

- **SPM-1** Mercury exceeded the CSL
- **SPM-2** Mercury exceeded the CSL; zinc exceeded the SQS
- **SPM-3*** TBT and PAHs (acenapthylene, fluorene, and phenanthrene) exceeded the SQS
- **SPM-4** Mercury exceeded the CSL; PAHs (acenaphthylene, fluorene, and phenanthrene) and dibenzofuran exceeded the SQS
- **SPM-5*** Mercury and TBT exceed the CSL; PAHs (acenaphthylene, fluorene, phenanthrene, 2-methylnapthalene, LPAH, and fluoranthene) and dibenzofuran exceeded the SQS
- **SPM-6** Mercury exceeded the SQS
- **SPM-12** PAHs (fluoranthene) exceeded the SQS.

* **Note**: Sediment associated with initial samples SPM-3 and SPM-5 was subsequently removed by additional dredging in front of the former marine railway well. The analytical results for SPM-3A and SPM-5A represent current sediment quality in this area, as presented in Table 6.

The analytical results for the three surface sediment samples collected outside the dredged area to assess baseline conditions (SPM-8 through SPM-10) indicate that none of these samples exceed the CSL, as shown in Table 5. However, SMP-8 and SPM-9 exhibited concentrations of mercury that exceeded the SQS.

4.3.4 ADDITIONAL CONFIRMATIONAL MONITORING – COMPARISON TO CLEANUP LEVELS

Chemical testing results for the additional confirmational monitoring samples are provided in Table 6. None of the sediment samples analyzed during the additional confirmational monitoring event exhibited exceedances of the SQS or CSL, except that mercury in SPM-4A (0-4 inches) was detected at a concentration above the CSL.

4.4 CONCLUSIONS

The analytical results for the initial phase of sediment monitoring completed in January 2004 showed that surface sediment exceeded the sediment cleanup levels for some constituents of concern, primarily mercury. The probable cause of these exceedances was redistribution of suspended dredged material during marine dredging activities. However, the possibility that the constituents present in the surface sediment samples represented pre-dredge conditions that could extend to greater depth could not be discounted at that time because only surface samples had been collected.

In the portion of the dredged area associated with the new travel lift pier, represented by initial monitoring results from sample locations SPM-3 and SPM-5, observations by the Port during dredging operations suggested that the exceedances in this area were likely the result of sloughing and spillage of sediment the contractor had not yet dredged along the outside of the adjacent sheetpile bulkhead. As a result, about 290 cy of additional sediment was removed from the SPM-3 and SPM-5 area prior to the additional sediment confirmational monitoring.

The results of the additional sediment confirmational monitoring activities completed in July 2004 indicate the following:

- Because no cleanup level exceedance were detected in core samples collected below surface sediment, post-dredging residual contamination is confirmed as resulting from redistribution caused by dredging activities, and is limited to about the upper 4 inches of sediment.

- Because the additional sediment sampling at SPM-2 and SPM-6 did not reproduce the mercury cleanup level exceedances from the initial round of monitoring, the thin veneer of sediment contamination is either intermittent in coverage or natural recovery processes are already occurring at the Site.

- The additional dredging performed in the vicinity of the new travel lift pier (represented by samples SPM-3A and SPM-5A) was successful in removing contaminated sediment remaining in this area after the first round of dredging.

- Backfilling activities associated with the interim action have covered a large portion of the area where surface sediment exceedances of cleanup levels were detected.

The thin and intermittent nature of residual sediment contamination and relatively low levels of criteria exceedance (less than 2.5 times the preliminary sediment cleanup levels), in conjunction with the limited area over which contaminated sediment is present within the biologically active zone, suggests that the sediment cleanup standards may be achieved through natural recovery for the portion of Site sediment where exceedances remain. This conclusion is supported by sediment data for Bellingham Bay that indicate that the combination of source removal, sedimentation, and bioturbation in the upper 16 cm (6 inches) of sediment have supported natural recovery of mercury-contaminated sediment associated with former releases from the Georgia Pacific Corporation chlor/alkali facility to Bellingham Bay (Patmont, et. al, 2004); the data for that evaluation were collected as part of the RI/FS for the Whatcom Waterway site, which was conducted under the Bay-wide Demonstration Pilot.

Although the sedimentation rate at the Site is likely lower than the rate for Bellingham Bay as a whole because of its location within Squalicum Outer Harbor, the lower initial contaminant concentrations relative to the cleanup levels, and the more limited vertical and areal extent of Site contamination, support an approach that allows sufficient natural recovery to occur at the Site to achieve the sediment cleanup levels within a reasonable restoration time frame. The adequacy of the interim action, and the need for any additional sediment monitoring or cleanup activities, will be evaluated during Site-wide RI/FS. An approach to monitor natural recovery will be incorporated into the Site-wide RI/FS report (Landau Associates 2005).

5.0 PROFESSIONAL ENGINEER'S STATEMENT

Landau Associates was retained by the Port of Bellingham to assist in planning, design, and construction QA oversight for the interim action sediment remediation and redevelopment project at the Weldcraft Steel and Marine (Gate 2 Boatyard) Site in Bellingham, Washington. In that role, Landau Associates, represented by the undersigned, maintained active involvement in the planning and implementation of the various interim action activities, preparation of construction drawings and technical specifications and other project documents, construction QA monitoring and oversight, and documentation of remedial construction activities.

As Landau Associates' representatives, we hereby conclude that, to the best of our knowledge, the interim action construction activities summarized in this report have been satisfactorily completed in substantial compliance with the Interim Action Work Plan, the construction drawings and specifications, and other related documents.

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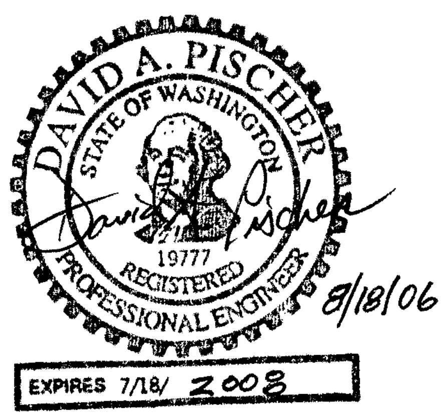

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TABLE 1
INTERIM ACTION SEDIMENT CLEANUP LEVELS
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Analyte	SQS (a)
Metals (mg/kg dry weight)	
Arsenic	57
Cadmium	5.1
Chromium	260
Copper	390
Lead	450
Mercury	0.41
Silver	6.1
Zinc	410
Bulk Organotin (ug/kg dry weight)	
Tributyltin (as TBT ion)	79 (b)
PAHs (mg/kg OC) (c)	
Naphthalene	99
Acenaphthylene	66
Acenaphthene	16
Fluorene	23
Phenanthrene	100
Anthracene	220
2-Methylnaphthalene	38
LPAH (d, e)	370
Fluoranthene	160
Pyrene	1000
Benzo(a)anthracene	110
Chrysene	110
Total Benzofluoranthenes (d,f)	230
Benzo(a)pyrene	99
Indeno(1,2,3-c,d)pyrene	34
Dibenz(a,h)anthracene	12
Benzo(g,h,i)perylene	31
HPAH (d,g)	960
SVOCs (mg/kg OC) (c)	
Dimethylphthalate	53
Diethylphthalate	61
Di-n-Butylphthalate	220
Butylbenzylphthalate	4.9
bis(2-Ethylhexyl)phthalate	47
Di-n-octyl phthalate	58
Dibenzofuran	15
N-Nitrosodiphenylamine	11

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) 79 μg/kg equals site-specific no effects TBT bulk sediment cleanup level.
(c) All organic data are normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.
(d) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:
(i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.
(ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.
(e) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
(f) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.
(g) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

TABLE 2
SEDIMENT PERFORMANCE MONITORING SUMMARY
JANUARY 2004 THROUGH JULY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Sample Location ID	Collection Date	TBT	Total Metals (a)	SVOC	TOC	TPH
Surface Sediment Samples						
SPM-1	1/28/2004	X	X	X	X	
SPM-2	1/28/2004	X	X	X	X	
SPM-3	1/28/2004	X	X	X	X	
SPM-4	1/28/2004	X	X	X	X	
SPM-5	1/28/2004	X	X	X	X	
SPM-6	1/28/2004	X	X	X	X	
SPM-7	1/15/2004	X	X	X	X	X
SPM-8	1/28/2004	X	X	X	X	
SPM-9	1/28/2004	X	X	X	X	
SPM-10	1/28/2004	X	X	X	X	
SPM-11	1/15/2004	X	X	X	X	X
SPM-12	1/28/2004	X	X	X	X	
Sediment Core Samples (intervals in inches)						
SPM-2A (0-6)	7/8/2004		X (b)			
SPM-2A (12-16)	7/8/2004		X (b)			
SPM-2A (24-28)	7/8/2004		A			
SPM-3A (0-6)	7/8/2004	X	X (b)			
SPM-3A (12-16)	7/8/2004	A	A			
SPM-3A (24-28)	7/8/2004	A	A			
SPM-4A (0-6)	7/8/2004		X (b)			
SPM-4A (12-16)	7/8/2004		X (b)			
SPM-4A (24-28)	7/8/2004		A			
SPM-5A (0-6)	7/8/2004	X	X (b)			
SPM-5A (12-16)	7/8/2004	A	A			
SPM-5A (24-28)	7/8/2004	A	A			
SPM-6A (0-6)	7/8/2004		X (b)			
SPM-6A (12-16)	7/8/2004		X (b)			
SPM-6A (24-28)	7/8/2004		A			

Notes:

TBT - Bulk organotins [including tributyltin (TBT)]
SVOC - Semivolatile organic compounds (identified on the SMS list of chemical parameters)
TOC - Total organic carbon
(a) - Total metals: arsenic, cadmium, chromium, copper, lead, mercury, silver and zinc; unless otherwise noted.
(b) - Mercury analysis only.
X - Collected for laboratory analysis and analyzed.
A - Collected for laboratory archive and not analyzed.
SPM-2A (0-6) - Numbers in parentheses indicate sample interval (inches) below identified fill material.

TABLE 3
SEDIMENT PERFORMANCE MONITORING STATION COORDINATES
JANUARY 2004 THROUGH JULY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Sample Location ID	Collection Date	Approximate Mudline Elevation (MLLW, ft)	Northing (a)	Easting (a)
Surface Sediment Samples				
SPM-1	1/28/2004	-17.6	645595.50	1236818.81
SPM-2	1/28/2004	-17.0	645630.84	1236843.71
SPM-3	1/28/2004	-9.9	645666.24	1236893.94
SPM-4	1/28/2004	-14.1	645601.46	1236880.07
SPM-5	1/28/2004	-11.2	645645.00	1236919.62
SPM-6	1/28/2004	-12.1	645600.37	1236958.46
SPM-7	1/15/2004	(b)	(See Figure 9)	
SPM-8	1/28/2004	-11.0	645528.88	1236777.55
SPM-9	1/28/2004	-11.1	645529.03	1236910.67
SPM-10	1/28/2004	-10.8	645551.15	1236984.34
SPM-11	1/15/2004	(b)	(See Figure 9)	
SPM-12	1/28/2004	-7.6	645598.87	1236775.46
Sediment Core Samples				
SPM-2A	7/8/2004	-13.9	645630.87	1236842.10
SPM-3A	7/8/2004	-13.3	645666.75	1236898.38
SPM-4A	7/8/2004	-14.4	645593.60	1236877.89
SPM-5A	7/8/2004	-13.9	645657.26	1236915.46
SPM-6A	7/8/2004	-12.1	645601.54	1236960.50

Notes:

(a) - Washington State Plane North Zone (4601) NAD 83
(b) - Confirmation samples were collected from the sidewalls of test pits advanced approximately 4-5 ft below the pre-excavation grade in the marine railway well. The 4 to 5-inch depth interval below the planned 4-ft excavation depth was collected for analysis.
MLLW - Mean Lower Low Water:

TABLE 4
SURFACE SEDIMENT SAMPLE FIELD OBSERVATIONS
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Sample Location ID	Collection Date	Sampler Penetration Depth (ft)	USCS Classification	Sample Description
SPM-1	1/28/2004	0.5	ML	Dark gray to black, SILT, with fine sand and gravel; slight petroleum odor and moderate to heavy sheen (wet)
SPM-2	1/28/2004	0.6	ML	Dark gray to black, SILT, with fine sand; no odor and minor sheen (wet)
SPM-3	1/28/2004	0.8	SM/ML	Dark gray, silty, fine SAND, with wood debris; heavy sheen and moderate petroleum odor (wet)
SPM-4	1/28/2004	0.9	ML	Dark gray to black, SILT, trace fine sand and wood debris; petroleum odor and heavy sheen, small shrimp present (wet).
SPM-5	1/28/2004	0.7	ML	Dark gray to black, SILT, with trace fine sand; petroleum odor and heavy sheen, shell fragments (wet)
SPM-6	1/28/2004	0.8	ML	Dark gray, SILT, with fine sand, trace wood debris; moderate sheen and no odor (wet)
SPM-7	1/15/2004	(a)	SP	Dark gray, fine to medium sand with a trace to some gravel, no odor and minor sheen (wet)
SPM-8	1/28/2004	0.7	ML	Dark gray to black with some dark green mottles, SILT, with fine sand and trace gravel; minor sheen and no odor (wet)
SPM-9	1/28/2004	1.0	ML	Dark gray to black, SILT, with trace fine sand; petroleum odor and very slight sheen (wet)
SPM-10	1/28/2004	0.7	ML	Dark gray to black, SILT, with trace fine sand; no odor and minor sheen, worms, snails and occasional shell fragments (wet)
SPM-11	1/15/2004	(a)	SP	Dark gray fine sand with lenses of black medium to coarse sand and fine gravel, no odor or sheen (wet).
SPM-12	1/28/2004	0.6	ML	Dark gray to black, SILT, with trace fine sand and gravel; petroleum odor and slight sheen, shell fragments (wet)

Notes:

USCS - Unified Soil Classification System.
All marine area surface sediment samples were collected with a Power Grab unit from the *R/V Peter R*
(a) Collected from marine railway well with hand tools (see text).

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-1 GG43A 1/28/2004	SPM-2 GG43B 1/28/2004	SPM-3 GG43C 1/28/2004	SPM-4 GG43D 1/28/2004	SPM-5 GG43E 1/28/2004	SPM-6 GG43F 1/28/2004	SPM-7 GF53A 1/15/2004	SPM-8 GG43G 1/28/2004
Metals (mg/kg)										
Arsenic	57	93	10	10	7 U	20	13	15	6 U	13
Cadmium	5.1	6.7	0.7	0.8	0.3 U	0.7	0.5	0.4	0.2 U	0.4
Chromium	260	270	65	136	26.9	67	46.5	48.7	23.5	51.2
Copper	390	390	201	190	150	220	309	140	84.3	134
Lead	450	530	48	42	25	48	54	32	7	30
Mercury	0.41	0.59	0.9 J	0.60	0.35	0.7	0.96	0.44	0.13	0.49
Silver	6.1	6.1	0.6 U	0.6 U	0.4 U	0.6 U	0.5 U	0.5 U	0.4 U	0.5 U
Zinc	410	960	210	468	111	230	218	127	89.2	110
Bulk Organotin (ug/kg)										
Tributyltin (as TBT ion)	79 (c)	156 (c)	34	24	140	61	260	69	12	18
PAHs (mg/kg OC) (d)										
Naphthalene	99	170	10	10	72	33	77	8.1	0.1 U	22
Acenaphthylene	66	66	0.7	0.8 U	1.5	1.4	2.7	1.1	0.1 U	0.9
Acenaphthene	16	57	12	10	42	30	54	7.8	0.1 U	9.1
Fluorene	23	79	15	11	33	29	46	8.3	0.1 U	7.8
Phenanthrene	100	480	53	38	119	119	180	31	0.1 U	29
Anthracene	220	1200	8.4	6.9	13	16	22	6.1	0.1 U	11
2-Methylnaphthalene	38	64	6.3	3.8	35	14	43	4.4	0.2	3.7
LPAH (e, f)	370	780	100	77	280	227	382	62	0.1 U	80
Fluoranthene	160	1200	47	38	102	100	220	42	0.1	41
Pyrene	1000	1400	31	30	67	67	123	25	0.2	35
Benzo(a)anthracene	110	270	14	13	21	27	40	14	0.1 U	15
Chrysene	110	460	16	16	33	33	54	20	0.1 U	23
Benzo(b)fluoranthene	None	None	13	13	20	27	34	15	0.1 U	17
Benzo(k)fluoranthene	None	None	11	12	17	22	28	11	0.1 U	13
Total Benzofluoranthenes (e,g)	230	450	24	25	37	50	62	27	0.1	30
Benzo(a)pyrene	99	210	8.1	8.1	12	15	20	8.9	0.1 U	11
Indeno(1,2,3-cd)pyrene	34	88	1.7	2.2	2.6	3.0	4.3	3.1	0.1 U	3.3
Dibenz(a,h)anthracene	12	33	0.6 U	0.8 U	0.7	1.0	1.2	0.9	0.1 U	1.0
Benzo(g,h,i)perylene	31	78	1.1	1.2	1.6	2.0	2.9	2.1	0.1 U	2.3
HPAH (e,h)	960	5300	143	134	277	298	528	143	0.3	161

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-1 GG43A 1/28/2004	SPM-2 GG43B 1/28/2004	SPM-3 GG43C 1/28/2004	SPM-4 GG43D 1/28/2004	SPM-5 GG43E 1/28/2004	SPM-6 GG43F 1/28/2004	SPM-7 GF53A 1/15/2004	SPM-8 GG43G 1/28/2004
SVOCs (mg/kg OC) (e)										
1,2-Dichlorobenzene	2.3	2.3	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,3-Dichlorobenzene	None	None	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,4-Dichlorobenzene	3.1	9	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,2,4-Trichlorobenzene	0.81	1.8	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Hexachlorobenzene	0.38	2.3	0.6 U (i)	0.8 U (i)	0.4 U (i)	0.7 U (i)	0.6 U (i)	0.6 U (i)	0.1 U	0.8 U (i)
Dimethylphthalate	53	53	0.8	1.7	1.0	1.9	2.9	1.1	0.1 U	1.4
Diethylphthalate	61	110	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Di-n-Butylphthalate	220	1700	0.6 U	0.8 U	0.4 U	0.7 U	1.2	0.6 U	0.1 U	0.8 U
Butylbenzylphthalate	4.9	64	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
bis(2-Ethylhexyl)phthalate	47	78	5.0	4.2	8.8	7.4	12.3	4.2	0.2	3.9
Di-n-Octyl phthalate	58	4500	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Dibenzofuran	15	58	9.1	6.5	25.6	19	34	5.6	0.1	6.1
Hexachlorobutadiene	3.9	6.2	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
N-Nitrosodiphenylamine	11	11	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
SVOCs (ug/kg)										
Phenol	420	1200	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
2-Methylphenol	63	63	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
4-Methylphenol	670	670	24	20 U	47	20 U	20 U	20 U	19 U	19 U
2,4-Dimethylphenol	29	29	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
Pentachlorophenol	360	690	97 U	98 U	97 U	98 U	99 U	98 U	96 U	97 U
Benzyl Alcohol	57	73	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
Benzoic Acid	650	650	190 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U
Conventionals										
Total Organic Carbon (percent)	None	None	3.2	2.6	4.3	2.7	3.5	3.6	17	2.3
Total Solids (percent)	None	None	47.7	46.4	71.0	47.0	56.2	56.2	80.2	63.5
Si/Acid Cleaned NWTPH-Dx (mg/kg)										
Diesel	None	None							23	
Motor Oil	None	None							50	
NWTPH-G (mg/kg)	None	None								
Gasoline Range Hydrocarbons	None	None							6.2 U	

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-9 GG43H 1/28/2004	SPM-10 GG43I 1/28/2004	SPM-11 GF53B 1/15/2004	SPM-12 GG43J 1/28/2004
Metals (mg/kg)						
Arsenic	57	93	20	10	5 U	20
Cadmium	5.1	6.7	0.5	0.4 U	0.2 U	0.5
Chromium	260	270	64	72	19.5	63
Copper	390	390	126	110	17.3	124
Lead	450	530	27	20	7	22
Mercury	0.41	0.59	0.57	0.35	0.05	0.27
Silver	6.1	6.1	0.6 U	0.6 U	0.3 U	0.6 U
Zinc	410	960	149	146	123	164
Bulk Organotin (ug/kg)						
Tributyltin (as TBT ion)	79 (c)	156 (c)	25	6.5	3.8 U	12
PAHs (mg/kg OC) (d)						
Naphthalene	99	170	8.9	3.7	0.3 U	3.0
Acenaphthylene	66	66	1.1 U	0.9 U	0.3 U	4.8
Acenaphthene	16	57	13	3.9	0.3 U	7.6
Fluorene	23	79	12	4.3	0.3 U	8.1
Phenanthrene	100	480	54	17	0.3 U	67
Anthracene	220	1200	8.9	4.0	0.3 U	17
2-Methylnaphthalene	38	64	3.2	1.5	0.3 U	1.4
LPAH (e, f)	370	780	97	33	0.3 U	107
Fluoranthene	160	1200	61	29	0.3 U	205
Pyrene	1000	1400	38	20	0.3 U	129
Benzo(a)anthracene	110	270	19	9.5	0.3 U	62
Chrysene	110	460	21	12	0.3 U	105
Benzo(b)fluoranthene	None	None	16	10	0.3 U	57
Benzo(k)fluoranthene	None	None	12	7.3	0.3 U	40
Total Benzofluoranthenes (e,g)	230	450	28	17	0.3 U	97
Benzo(a)pyrene	99	210	12	5.9	0.3 U	31
Indeno(1,2,3-cd)pyrene	34	88	4.1	2.0	0.3 U	10
Dibenz(a,h)anthracene	12	33	1.2	0.9 U	0.3 U	3
Benzo(g,h,i)perylene	31	78	2.8	1.4	0.3 U	6.2
HPAH (e,h)	960	5300	186	97	0.3 U	648

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-9 GG43H 1/28/2004	SPM-10 GG43I 1/28/2004	SPM-11 GF53B 1/15/2004	SPM-12 GG43J 1/28/2004
SVOCs (mg/kg OC) (e)						
1,2-Dichlorobenzene	2.3	2.3	1.1 U	0.9 U	0.3 U	1.0 U
1,3-Dichlorobenzene	None	None	1.1 U	0.9 U	0.3 U	1.0 U
1,4-Dichlorobenzene	3.1	9	1.1 U	0.9 U	0.3 U	1.0 U
1,2,4-Trichlorobenzene	0.81	1.8	1.1 U (i)	0.9 U (i)	0.3 U	1.0 U (i)
Hexachlorobenzene	0.38	2.3	1.1 U (i)	0.9 U (i)	0.3 U	1.0 U (i)
Dimethylphthalate	53	53	1.3	1.0	0.3 U	1.6
Diethylphthalate	61	110	1.1 U	0.9 U	0.3 U	1.0 U
Di-n-Butylphthalate	220	1700	1.1 U	0.9 U	0.3 U	1.0 U
Butylbenzylphthalate	4.9	64	1.1 U	0.9 U	0.3 U	1.0 U
bis(2-Ethylhexyl)phthalate	47	78	16.1	3.1	0.3 U	4.1
Di-n-Octyl phthalate	58	4500	1.1 U	0.9 U	0.3 U	1.0 U
Dibenzofuran	15	58	9.4	3.5	0.3 U	5.2
Hexachlorobutadiene	3.9	6.2	1.1 U	0.9 U	0.3 U	1.0 U
N-Nitrosodiphenylamine	11	11	1.1 U	0.9 U	0.3 U	1.0 U
SVOCs (ug/kg)						
Phenol	420	1200	20 U	20 U	19 U	20 U
2-Methylphenol	63	63	20 U	20 U	19 U	20 U
4-Methylphenol	670	670	20 U	20 U	19 U	20 U
2,4-Dimethylphenol	29	29	20 U	20 U	19 U	20 U
Pentachlorophenol	360	690	98 U	99 U	94 U	98 U
Benzyl Alcohol	57	73	20 U	20 U	19 U	20 U
Benzoic Acid	650	650	200 U	200 U	190 U	200 U
Conventionals						
Total Organic Carbon (percent)	None	None	1.8	2.2	5.7	2.1
Total Solids (percent)	None	None	48.1	49.6	85.7	47.3
Si/Acid Cleaned NWTPH-Dx (mg/kg)						
Diesel	None	None			5.00 U	
Motor Oil	None	None			10 U	
NWTPH-G (mg/kg)	None	None				
Gasoline Range Hydrocarbons	None	None			5.9 U	

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS - FOOTNOTES
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

A blank indicates testing not performed.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Data validation flag indicating the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Boxed results exceed the SQS.

Shaded results exceed the CSL.

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).

(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).

(c) 79 μg/kg equals site-specific no effects TBT bulk sediment screening level. 156 μg/kg equals site-specific potential adverse affects TBT bulk sediment screening level.

(d) Value normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.

(e) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:

(i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.

(ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.

(f) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.

(g) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.

(h) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

(i) Method detection limits exceed the SQS or CSL criteria.

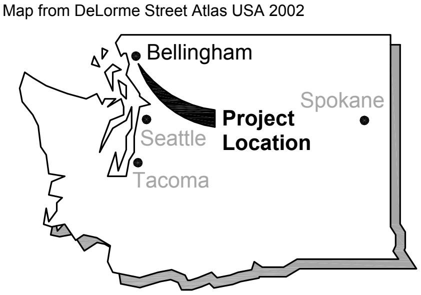
TABLE 6
CONFIRMATIONAL SEDIMENT MONITORING ANALYTICAL RESULTS, JULY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-2A (0-4) GV33A 7/9/2004	SPM-2A (12-16) GV33B 7/9/2004	SPM-3A (0-4) GV33D 7/9/2004	SPM-4A (0-4) GV33M 7/9/2004	SPM-4A (12-16) GV33M 7/9/2004	SPM-5A (0-4) GV33J 7/9/2004	SPM-6A (0-4) GV33G 7/9/2004	SPM-6A (12-16) GV33H 7/9/2004
ORGANOTINS (μg/kg)										
Tributyl Tin Chloride	None	None	NA	NA	24	NA	NA	8.6	NA	NA
Dibutyl Tin Dichloride	None	None	NA	NA	23	NA	NA	8.3	NA	NA
Butyl Tin Trichloride	None	None	NA	NA	5.6 U	NA	NA	6.0 U	NA	NA
TBT as Tributyltin ion	79 (c)	156 (c)	NA	NA	21	NA	NA	7.7	NA	NA
TOTAL METALS (μg/kg)										
Mercury	0.41	0.59	0.09	0.04 U	0.10	0.92	0.05 U	0.05	0.36	0.15

Notes:

Shaded results exceed the CSL.
NA = Not analyzed.
U = Indicates the compound was undetected at the reported concentration.
(a) = SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) = SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) = 79 μg/kg equals site-specific no effects TBT bulk sediment screening level.
156 μg/kg equals site-specific potential adverse affects TBT bulk sedement screening level.

Map from DeLorme Street Atlas USA 2002



Site:	Gate 2 Boatyard, Squalicum Harbor Port of Bellingham (Former Weldcraft Steel & Marine Site)
Address:	2652 Harbor Loop Drive (Intersection Squalicum Way and Harbor Loop Drive) Bellingham, Washington 98225
Directions:	(From Seattle, Washington) I-5 North Exit No. 253 (Lakeway Dr.) Right on King St. Right on Lakeway Dr./E. Holly St. Left on "F" St. Right on Roeder Ave. Left on Squalicum Way Left on Harbor Loop Drive
Latitude:	48° 45' 47"
Longitude:	122° 30' 36"

0 2000 4000

Approximate Scale in Feet

Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001\027\261\F\Interim Action Completion Report\Fig1.dwg (A) "Figure 1" 8/17/2006

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Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Vicinity Map**	Figure 1

Site:	Gate 2 Boatyard, Squalicum Harbor Port of Bellingham (Former Weldcraft Steel & Marine Site)	Latitude: Longitude:	48° 45' 47" 122° 30' 36"
Address:	2652 Harbor Loop Drive (Intersection Squalicum Way and Harbor Loop Drive) Bellingham, Washington 98225		

0 400 800

Approximate Scale in Feet

Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001\027\261\F\Interim Action Completion Report\Fig2.dwg (A) "Figure 2" 8/17/2006

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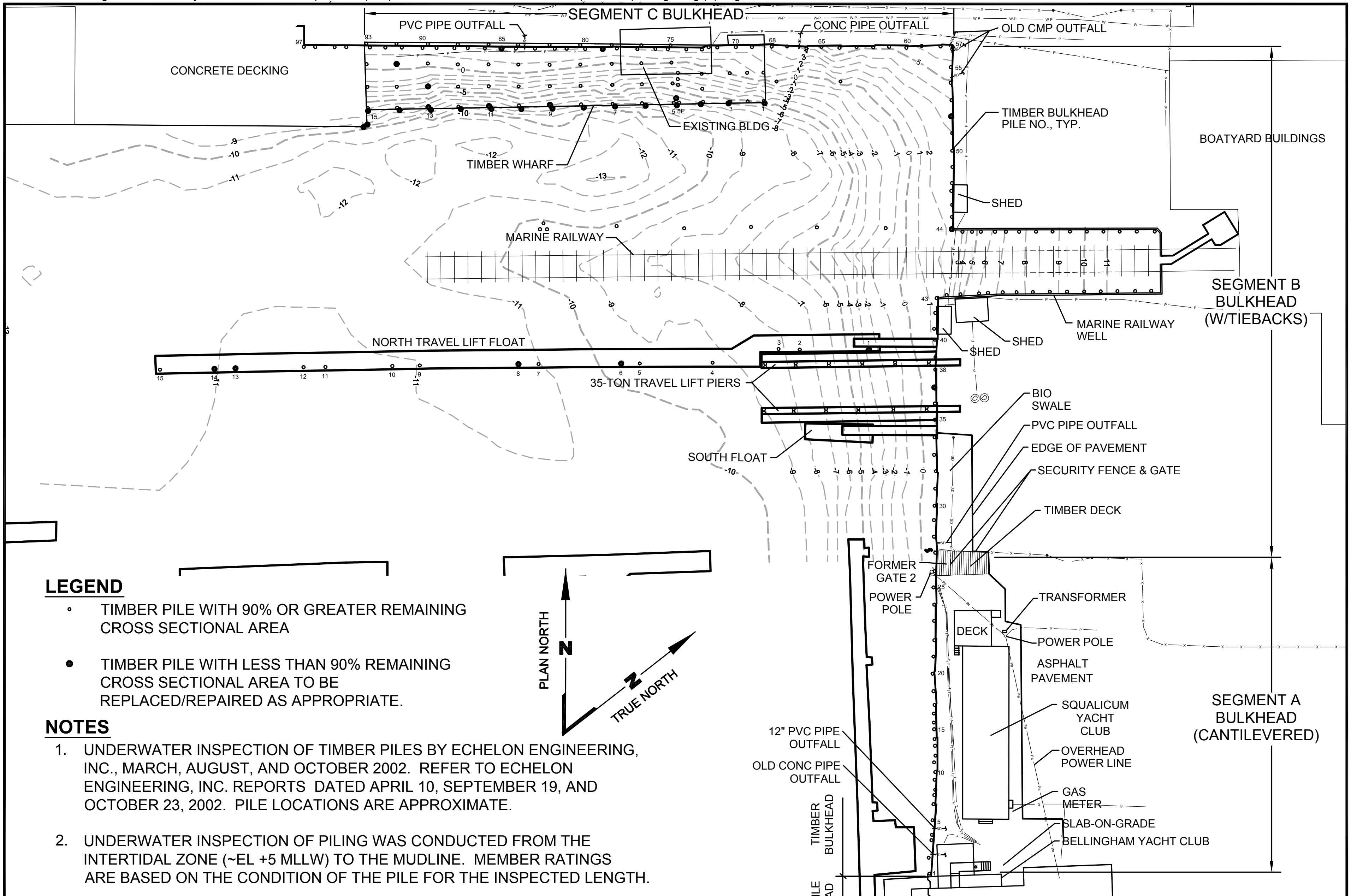
Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Project Area** **Site Map**	Figure 2



LEGEND

- ∘ TIMBER PILE WITH 90% OR GREATER REMAINING CROSS SECTIONAL AREA
- • TIMBER PILE WITH LESS THAN 90% REMAINING CROSS SECTIONAL AREA TO BE REPLACED/REPAIRED AS APPROPRIATE.

NOTES

1. UNDERWATER INSPECTION OF TIMBER PILES BY ECHELON ENGINEERING, INC., MARCH, AUGUST, AND OCTOBER 2002. REFER TO ECHELON ENGINEERING, INC. REPORTS DATED APRIL 10, SEPTEMBER 19, AND OCTOBER 23, 2002. PILE LOCATIONS ARE APPROXIMATE.
2. UNDERWATER INSPECTION OF PILING WAS CONDUCTED FROM THE INTERTIDAL ZONE (~EL +5 MLLW) TO THE MUDLINE. MEMBER RATINGS ARE BASED ON THE CONDITION OF THE PILE FOR THE INSPECTED LENGTH.

0 60 120
Scale in Feet

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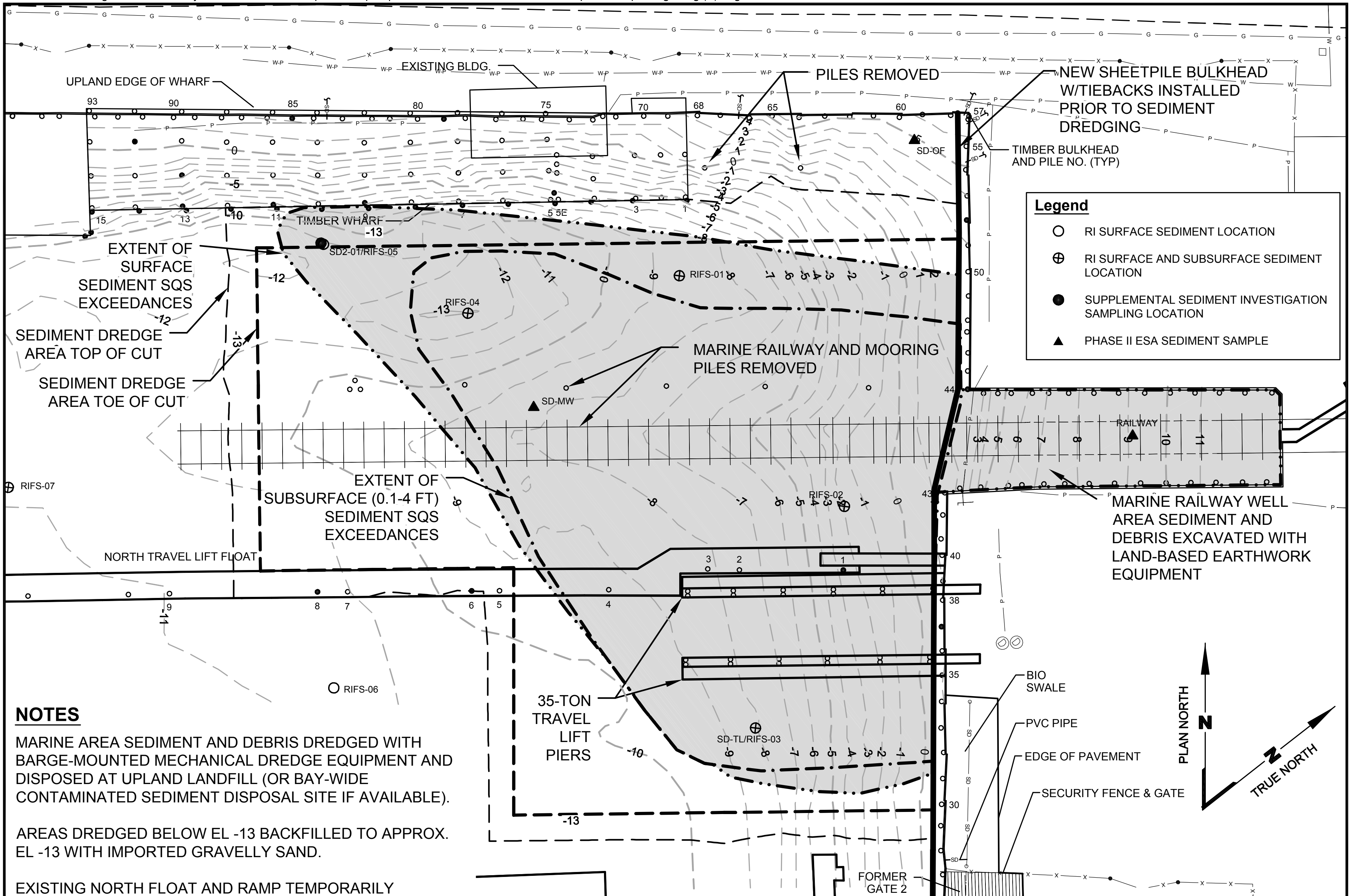
Gate 2 Boatyard
Bellingham, Washington

Former Site Conditions

Figure 3



NOTES

MARINE AREA SEDIMENT AND DEBRIS DREDGED WITH BARGE-MOUNTED MECHANICAL DREDGE EQUIPMENT AND DISPOSED AT UPLAND LANDFILL (OR BAY-WIDE CONTAMINATED SEDIMENT DISPOSAL SITE IF AVAILABLE).

AREAS DREDGED BELOW EL -13 BACKFILLED TO APPROX. EL -13 WITH IMPORTED GRAVELLY SAND.

EXISTING NORTH FLOAT AND RAMP TEMPORARILY RELOCATED DURING DREDGING ACTIVITIES.

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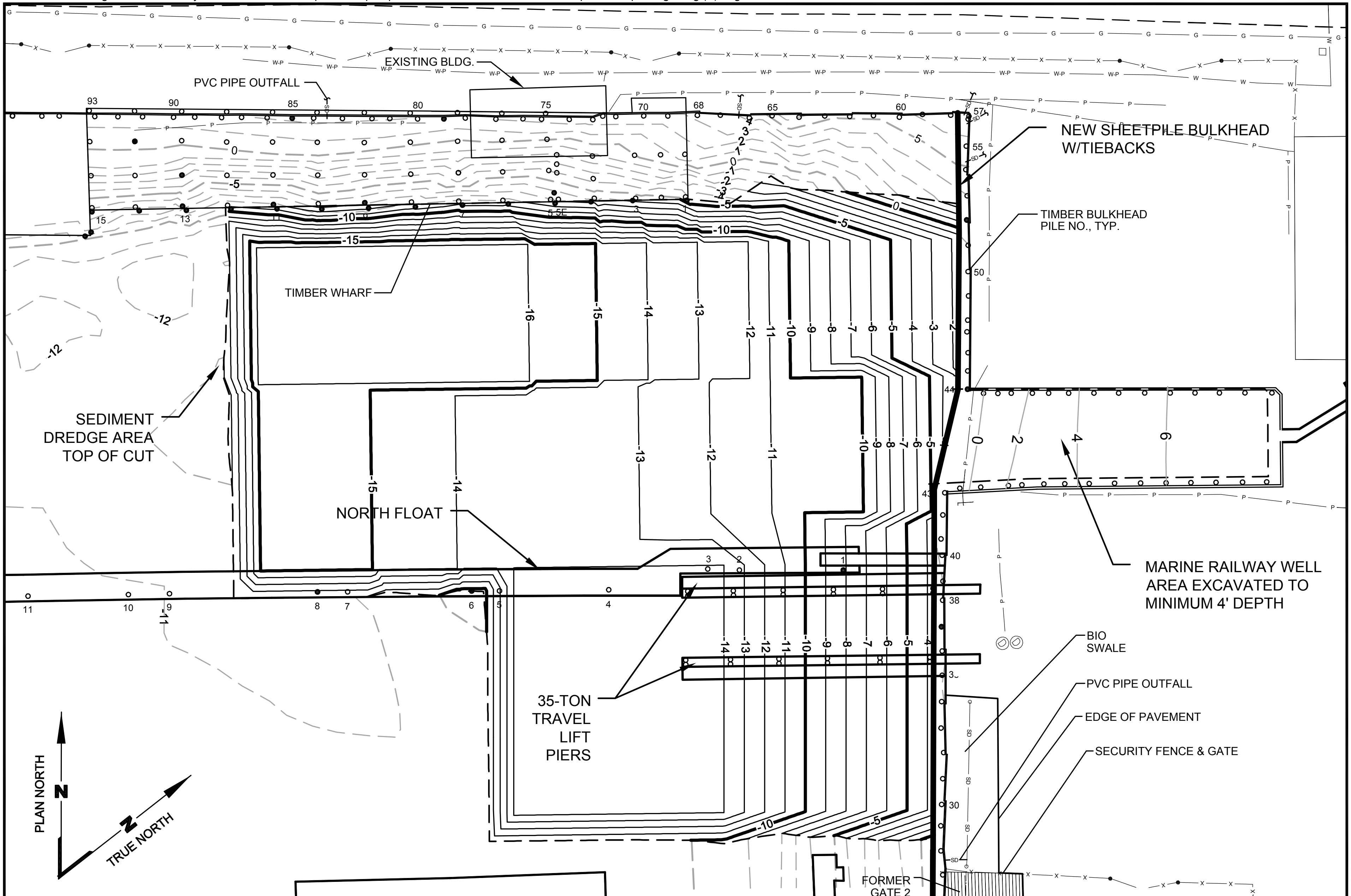
Gate 2 Boatyard
Bellingham, Washington

Sediment Dredging Areas

Figure 4



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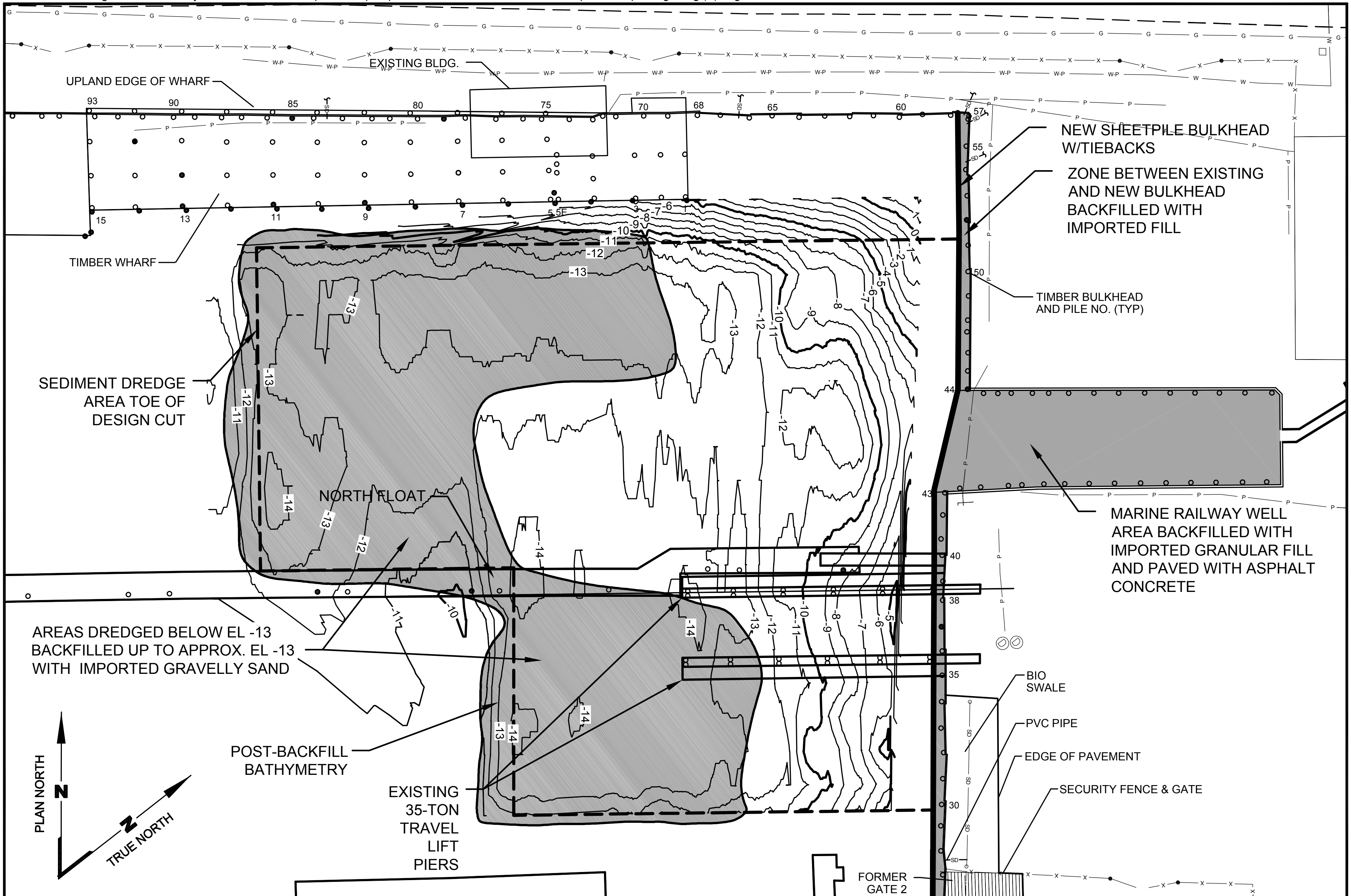
Gate 2 Boatyard
Bellingham, Washington

Design Sediment Dredging Contours

Figure 5



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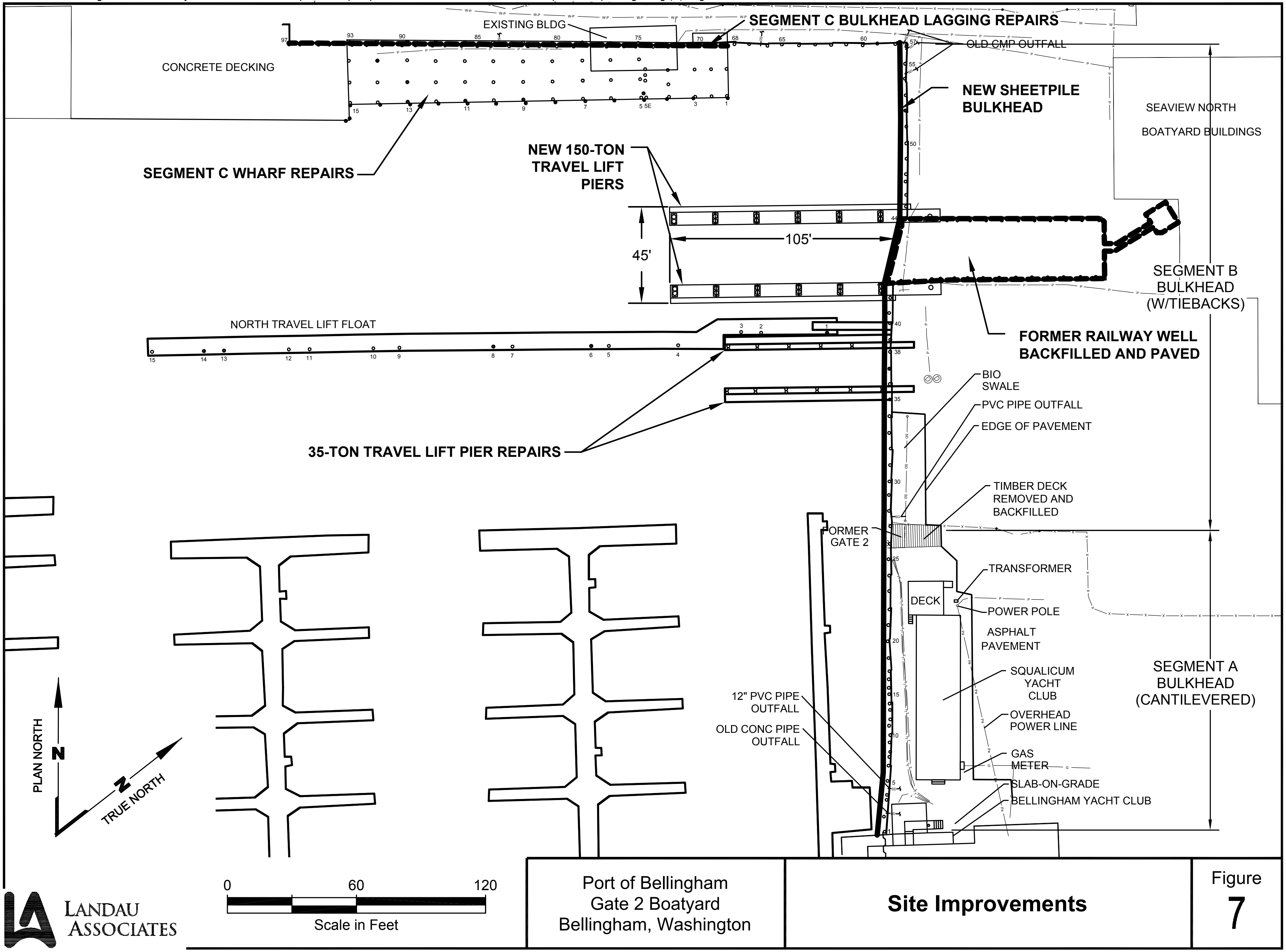
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Sediment Backfill Areas

Figure 6



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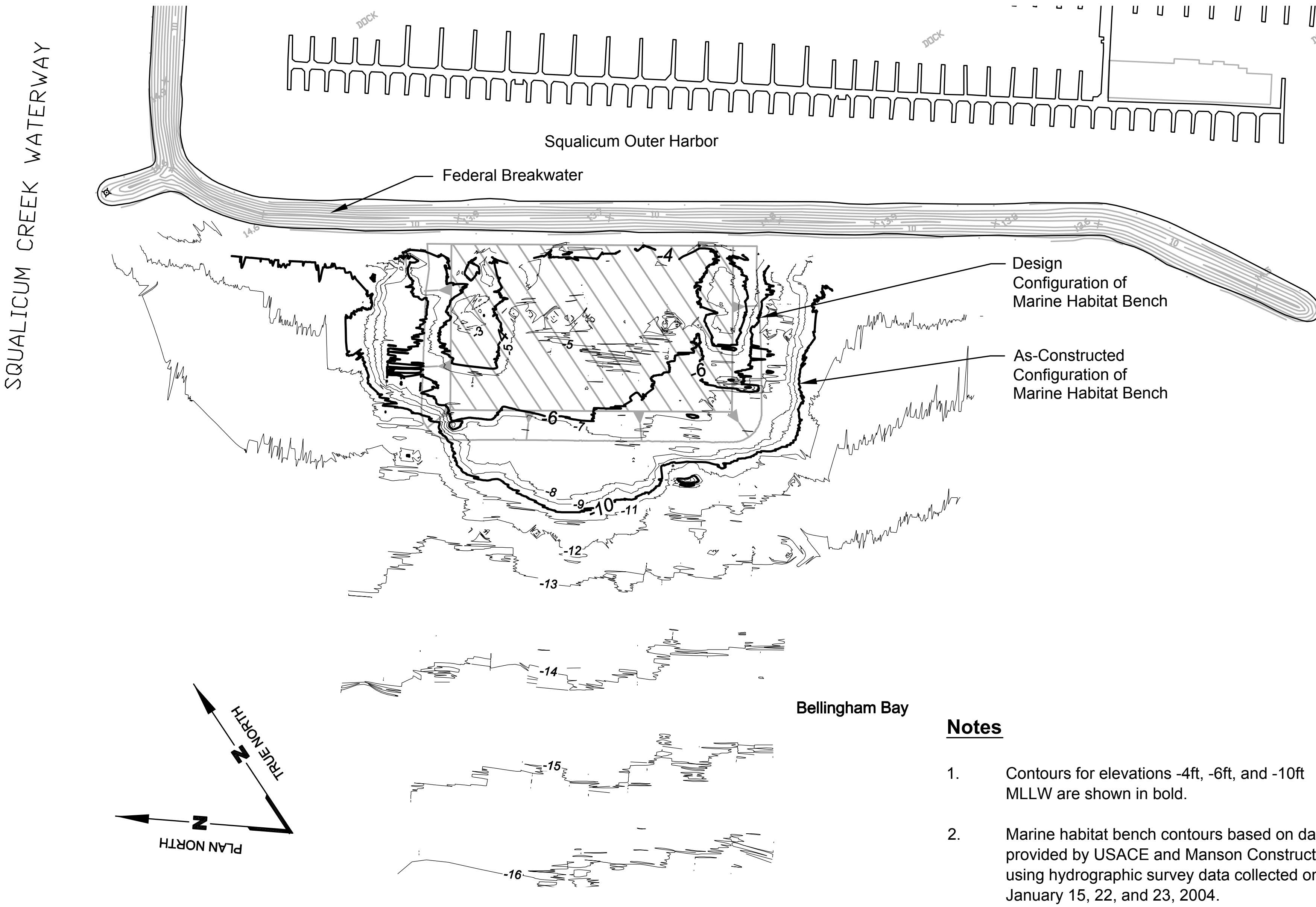
Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Site Improvements**	Figure 7



Notes

1. Contours for elevations -4ft, -6ft, and -10ft MLLW are shown in bold.
2. Marine habitat bench contours based on data provided by USACE and Manson Construction, using hydrographic survey data collected on January 15, 22, and 23, 2004.

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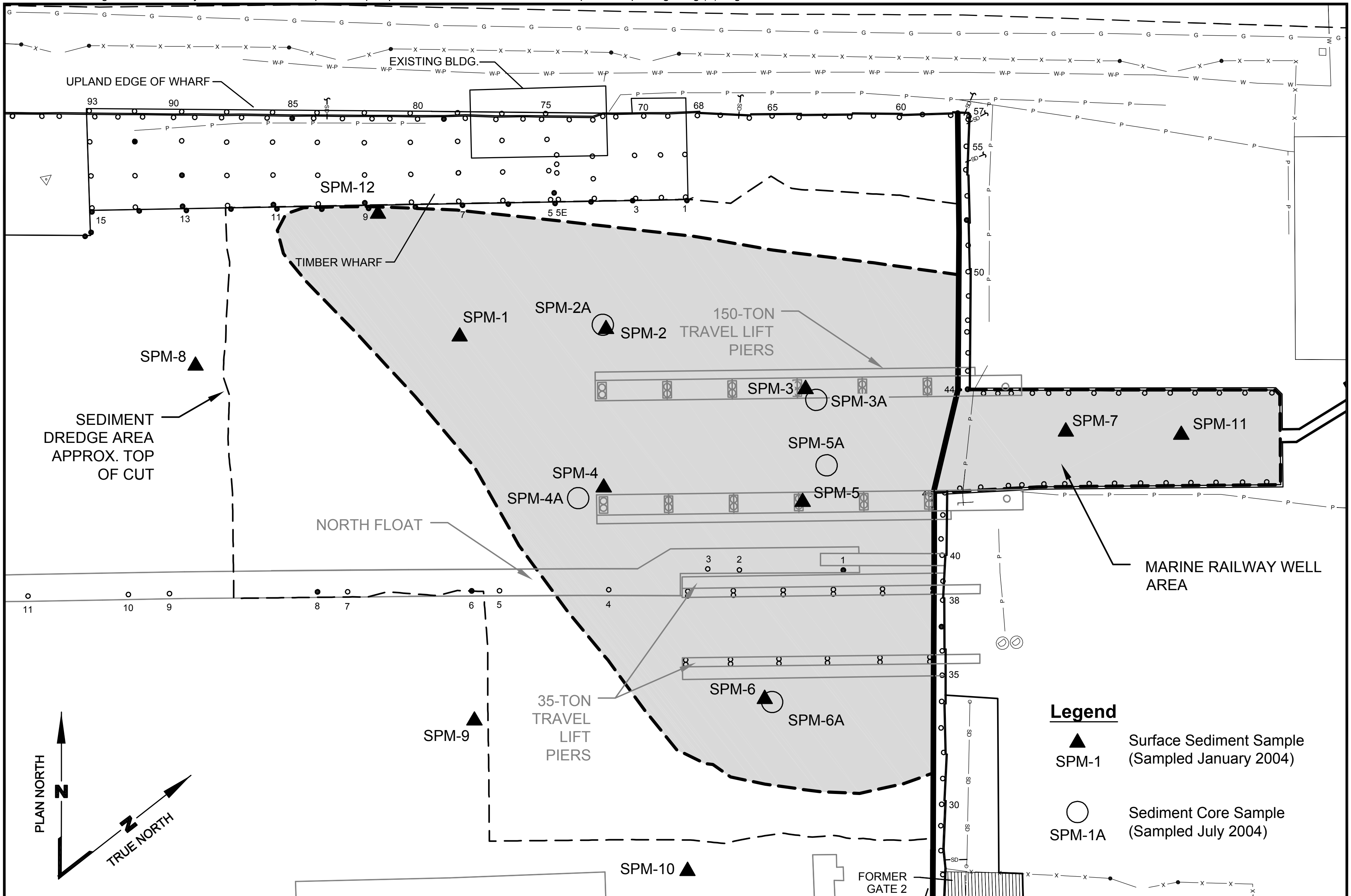
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

New Marine Habitat Bench

Figure 8



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Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Sediment Performance Monitoring Locations

Figure 9