
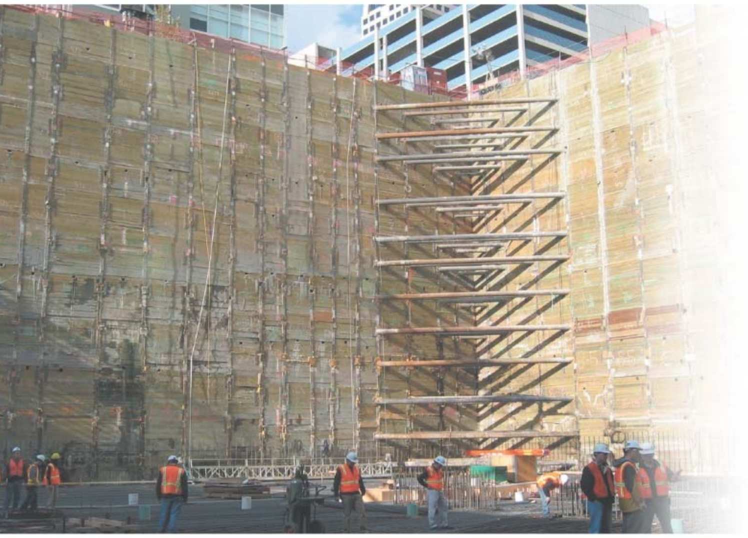

Construction Completion Report

Phase II Interim Intertidal and Selected Subtidal Remedial Action

Custom Plywood Site
Anacortes, Washington

Prepared for
Washington State
Department of Ecology

May 12, 2014
17800-40

HARTCROWSER

www.hartcrowser.com

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ACRONYMS AND ABBREVIATIONS

BMP	Best management practice
CAP	Cleanup Action Plan
CCR	Construction Completion Report
CDD	Chlorinated dibenzo-p-dioxin
CDF	Chlorinated dibenzofuran
CF	Cubic feet
CHE	Coast & Harbor Engineering
cm	Centimeters
CMMP	Conservation Measures and Monitoring Plan
COC	Constituent of concern
Corps	U.S. Army Corps of Engineers
CQA	Construction quality assurance
CSWGP	Construction Stormwater General Permit
CY	Cubic yards
DGPS	Differential global positioning system
Ecology	Washington State Department of Ecology
EDL	Estimated detection limit
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
GBH	GBH Investments, LLC
H	Horizontal
IAWP	Interim Action Work Plan
IS	Internal standard
JARPA	Joint Aquatic Resources Permit Application
MHHW	Mean higher high water
MLLW	Mean lower low water
MTCA	Model Toxics Control Act
NAVD88	North American vertical datum of 1988
NWP-38	US Army Corps of Engineers Nationwide Permit 38 (Cleanup of Hazardous and Toxic Waste)
OHW	Ordinary high water
OPR	Ongoing precision and recovery
Orion	Orion Marine Group, Inc.
POC	Point of compliance
ppt	Parts per trillion
PSE	Pacific Survey & Engineering Inc.
PSI	Puget Sound Initiative
QA	Quality assurance
QC	Quality control
RCW	Revised Code of Washington

RI	Remedial investigation
RL	Reporting limit
RR	Relative response
RRF	Relative response factor
SAP	Sampling and Analysis Plan
Scarsella	Scarsella Brothers, Inc.
Site	Custom Plywood Site
SMA	Sediment management area
SMP	Shoreline Master Program
SMS	Sediment Management Standards
SRM	Standard reference material
SWPPP	Stormwater Pollution Prevention Plan
TCP	Toxics Cleanup Program, Washington State Department of Ecology
TEC	Toxic equivalent concentration
TESC	Temporary erosion and sedimentation control
V	Vertical
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQMP	Water Quality Monitoring Plan
WSDOT	Washington State Department of Transportation
%D	Percent difference

EXECUTIVE SUMMARY

This Construction Completion Report (CCR) summarizes and documents the environmental construction activities completed as part of the Phase II interim intertidal and selected subtidal remedial action (Phase II) at the Custom Plywood Site (site) in Anacortes, Washington. The work was completed following the provisions of the Washington State Model Toxics Control Act (MTCA) and its implementing regulations (Chapter 173-340 WAC), under the direction of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) and in accordance with an agreement with GBH Investments, LLC (GBH), for selected aquatic portions of the site. GBH is the current property owner and represents a potentially liable person per Chapter 173-340-200 WAC. Construction took place from July through December 2013 under the oversight of Hart Crowser.

The Custom Plywood Site, located in Anacortes, Washington, is one of several bay-wide priority sites for Fidalgo/Padilla Bays being addressed by the TCP under the Puget Sound Initiative (PSI). The site includes property owned by GBH covering approximately 6.6 acres of upland and 34 acres of intertidal and subtidal areas. The Custom Plywood Site operated as a lumber and planing mill beginning in about 1900 until it burned down sometime between 1925 and 1937. Through the years, the property changed hands several times and was rebuilt and expanded until Custom Plywood became the operating entity sometime before 1991. The facility was used as a sawmill and plywood manufacturing plant until most of the wooden structures in the main plant area were consumed in a fire on November 28, 1992. Milling activities produced wood waste and chemical contaminants that affected site soil, sediment, and groundwater. During milling operations, a large amount of wood waste was placed on upland and aquatic portions of the site over many years.

Past limited interim remedial actions were conducted under WAC 173-340-515 (Independent Remedial Actions) on the upland portion of the site beginning in 1998. The most recent upland cleanup action at the site was the Phase I interim remedial action completed in the summer of 2011. Before cleanup, the upland was characterized as heavily disturbed and contained abandoned foundations and structures, concrete and wood debris, native and non-native vegetation, and poorly functioning wetlands. The Phase I cleanup work involved demolishing remaining concrete structures in the uplands, removing wooden piling, excavating surface debris and contaminated soil and wood waste, backfilling with clean fill material, and constructing a wetland mitigation area with a vegetated buffer zone and a stormwater swale.

Sediment containing wood waste has been an ongoing source of contamination in the aquatic environment at the site. Wood waste accumulation in nearshore areas and near former overwater structures exceeded 6 feet in places. In sufficient quantities, wood waste can represent an environmental pollutant and deleterious substance per criteria in the Sediment Management Standards (SMS) (WAC 173-240-200(17)). As part of the sediment profile, wood waste in the biologically active zone can adversely affect benthic habitat by potentially generating sulfide, ammonia, phenols, and related degradation products harmful to marine biota. The seaward extent and magnitude of wood waste in quantities sufficient to promote adverse impacts is uncertain.

Dioxins/furans are the other notable contaminants in the aquatic environment. Near-surface sediment throughout the aquatic portion of the site contains dioxin/furan concentrations exceeding Fidalgo Bay background levels. Deeper portions of the sediment profile are also affected; elevated dioxin/furan concentrations have been encountered in deeper sediment associated with relatively thick nearshore accumulations of wood waste. As the thickness and general quantity of wood waste decreases seaward, dioxins/furans are more likely restricted to surface sediment because of secondary redistribution following in-water fill placement or erosion of nearshore deposits.

The Phase II interim remedial action was developed to address the aquatic impacts remaining in the intertidal and subtidal areas at the site, which combined removal of derelict structures, wooden piling, debris, and wood waste contaminated with dioxins/furans, and included construction of shoreline protective features to prevent erosion. A target volume of approximately 45,000 cubic yards (CY) of contaminated sediment was planned to be excavated or dredged and disposed of at an upland landfill facility. The final combined excavation and dredging volume was approximately 44,994 CY (51,591 tons) of impacted material. Approximately 96,697 tons of clean backfill materials (fish/habitat mix and sand backfill) were imported and placed in the excavated and dredged areas. A total of 1,465 wooden piles were removed and disposed of off site.

The primary objective for the Phase II interim remedial action at the site focused on substantially eliminating, reducing, and/or controlling unacceptable risks to the environment posed by constituents of concern (COCs) to the extent practicable. Applicable exposure pathways and receptors of interest for human health included current and future site users, including workers and visitors, potentially exposed to sediment via direct contact pathways and consumption of marine biota and marine waters. Applicable ecological exposure pathways and receptors included organisms in the biologically active zone exposed to sediment by direct contact and food chain uptake. Related ecologically focused cleanup objectives for bay-wide remediation also included providing suitable substrate for promoting recovery/recruitment of aquatic organisms in remediated areas, and minimizing habitat and water quality impacts during construction.

A key related objective was the construction of protective in-water features (extension of the existing jetty and a new aquatic spit) to prevent further shoreline erosion and migration/dispersion of deleterious sawdust and residual contaminated sediment from the site's intertidal areas.

Wood waste and dioxins/furans were the identified COCs for defining sediment management areas (SMAs) for aquatic cleanup at the site. The overall extent of the aquatic interim action area was defined by 10- and 25-ppt (parts per trillion or picograms per gram) dioxin/furan toxic equivalent concentration (TEC) action thresholds. Two general SMAs were defined within this interim action area, based on wood waste accumulation thickness, which were intended to distinguish wood waste accumulations of either greater than or less than 6 feet in thickness below the existing marine sediment surface. The intertidal and subtidal zones addressed in Phase II resided primarily in the nearshore SMA, where wood waste thickness was generally greater than 6 feet.

Necessary permits were obtained to facilitate the Phase II work. The U.S. Army Corps of Engineers (Corps) issues permits to authorize certain activities that require Department of the Army authorization under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899, which includes work in streams, wetlands, and other waters of the United States. The Corps authorized the Phase II work through Nationwide Permit 38 (NWP-38) (Reference NWS-2012-868) for cleanup of hazardous and toxic waste, as proposed through the Joint Aquatic Resources Permit Application (JARPA) submitted by Hart Crowser on behalf of Ecology.

Detailed plans and specifications were prepared to implement Phase II, and a bid package including the plans and specifications was prepared for selection of a contractor to complete the construction phase of the interim action. The contract was awarded to the lowest responsive bidder, Orion Marine Group, Inc. (Orion). Orion subcontracted with Scarsella Brothers, Inc. (Scarsella), to perform the earthwork portions of the project and to provide land-based support for the in-water work. Hart Crowser served as Ecology's on-site representative to observe and document the Phase II interim remedial action.

The overall scope of work completed for the Phase II interim remedial action is summarized below. Ecology deemed the construction work substantially complete as of December 23, 2013.

- Abandoned in-water concrete structures in the intertidal and subtidal areas were demolished, a portion of which was reused as fill in the upland part of the site. Near-surface debris generally consisting of concrete, brick, wood, and other materials was removed as part of the planned excavation and dredging work completed in the intertidal and subtidal areas.
- Wooden piling that remained in the intertidal and subtidal areas was removed. The piling along with other wood waste was disposed of off site at a permitted Subtitle D landfill facility (Republic Services Roosevelt Regional Landfill in Roosevelt, Washington).
- Nearshore subtidal areas containing wood waste and/or affected by dioxin/furan contamination were dredged to native material or the prescribed dredging depth, whichever was reached first. The extent of wood waste and historical dioxin/furan TECs measured in this area served as the basis for determining the design excavation and dredging depths.
- Sediment dredged from the subtidal areas was loaded directly to barges and transported to the transloading facility operated by Lafarge North America in Seattle, Washington. From the transloading facility, the material was transported to the Roosevelt Regional Landfill by rail for off-site disposal.
- Material excavated from the intertidal area was temporarily stockpiled on site, allowed to drain, and was shipped off site for disposal at the Roosevelt Regional Landfill.
- The excavated and dredged areas were backfilled with clean fill materials that are beneficial to aquatic habitat and provide a cap to isolate any remaining impacted sediment from potential receptors.
- Shoreline protection features, including an extension of the jetty at the north end of the site and a protective spit at the wetland mitigation complex (constructed in Phase I), were constructed as part of Phase II. In addition, the cobble berm constructed in Phase I to protect the wetland area

was partially breached to connect the wetland area to Fidalgo Bay. At the southern end of the site, shoreline armoring was constructed to provide protection against erosion.

- The interim remedial action provided shoreline enhancements intended to improve habitat for juvenile salmonids, forage fish spawning, shorebirds and waterfowl, and other aquatic species on and adjacent to the site. Dunegrass was planted along the property shoreline to provide erosion control and backshore habitat.
- Documentation sampling and analysis were conducted to characterize the concentration of dioxins/furans remaining in the sediment beneath the intertidal and subtidal sediment removal areas after dredging and excavation work was completed. Forty sediment sampling points were selected throughout the dredging and excavation areas. Dioxins/furans were detected in all of the samples collected, with TECs ranging from 0.120 ppt to 192 ppt.

Construction Completion Report

Phase II Interim Intertidal and Selected Subtidal Remedial Action

Custom Plywood Site
Anacortes, Washington

1.0 INTRODUCTION

This Construction Completion Report (CCR) summarizes and documents the environmental construction activities completed as part of the Phase II interim intertidal and selected subtidal remedial action at the Custom Plywood Site (site) in Anacortes, Washington. The work was completed following the provisions of the Washington State Model Toxics Control Act (MTCA) and its implementing regulations (Chapter 173-340 WAC), under the direction of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) and in accordance with an agreement with GBH Investments, LLC (GBH), for selected aquatic portions of the site. GBH is the current property owner and represents a potentially liable person per Chapter 173-340-200 WAC. Construction took place from July through December 2013 under the oversight of Hart Crowser.

Phase II construction described in this CCR involved:

- Demolition and removal of abandoned in-water concrete structures and debris;
- Removal and off-site disposal of timber piling from the intertidal and subtidal areas;
- Dredging, excavation, and off-site disposal of sediment containing wood waste and/or affected by dioxin/furan contamination;
- Backfilling of the excavated and dredged areas with clean fill material that is beneficial to aquatic habitat; and
- Constructing shoreline protection and habitat enhancement features.

The basis for the completed interim upland and aquatic remedial actions is documented in the MTCA Interim Action Work Plan (IAWP) that was prepared for the site. The IAWP consists of the following documents:

- Remedial Investigation (RI) Report for the Interim Action Work Plan prepared by AMEC Geomatrix for GBH, September 2011 (AMEC 2011);
- Feasibility Study (FS) Report for the Interim Action Work Plan prepared by Hart Crowser for Ecology, September 2011 (Hart Crowser 2011a);
- Phase I Cleanup Action Plan (CAP) prepared by Hart Crowser for Ecology, September 2011 (Hart Crowser 2011b);

- Phase I Engineering Design Report (EDR) prepared by Hart Crowser for Ecology, September 2011 (Hart Crowser 2011c); and
- Phase II CAP-EDR prepared by Hart Crowser for Ecology, February 2013 (Hart Crowser 2013a).

GBH completed the RI in response to Ecology Agreed Order DE 5235, dated March 17, 2008.

The overall interim cleanup actions at the site consist of both upland and in-water work. Three interim remedial actions were planned for the site, to be conducted in phases. Phase I consisted of the upland remediation that was completed in the summer of 2011 and described in the Phase I Construction Completion Report (Hart Crowser 2012b). The cleanup of in-water areas was planned to be completed in Phases II and III. Phase II, described herein, consisted of the intertidal and nearshore subtidal cleanup completed in 2013. Phase III involves cleanup of subtidal areas not addressed in Phase II.

1.1 Report Organization

This CCR is organized into the following primary report sections:

- Section 2.0 Site Background;
- Section 3.0 Cleanup Requirements;
- Section 4.0 Overview of the Phase II Interim Remedial Action;
- Section 5.0 Phase II Interim Action Construction Details;
- Section 6.0 Sediment Documentation Sampling and Analysis;
- Section 7.0 Post-Construction Activities;
- Section 8.0 Limitations; and
- Section 9.0 References.

Tables and figures are included at the end of the CCR to support the discussion in the sections outlined above. Table 1 summarizes the quantities of material imported to and exported from the site, and Table 2 presents the laboratory analytical results for the sediment documentation samples collected during the aquatic interim action. The location coordinates and depths of the documentation samples are provided in Table 3.

Figure 1 presents a vicinity map showing the location of the site, and Figure 2 shows pre-construction site features and conditions. Figures 3 through 5 are drawings from the Phase II project plans that show planned excavation and dredging locations, backfilling areas, and shoreline protection and enhancement features at the site. Figure 6 shows the locations of the sediment documentation samples and respective dioxin/furan laboratory analytical results.

The appendices found after the tables and figures in this CCR provide additional information on the completed aquatic interim remedial work. Appendix A contains contractor-provided pre-construction survey and post-construction survey and as-built drawings. Appendix B contains maps provided by the contractor that show timber pile removal locations. Appendix C presents selected representative photographs of the cleanup work. Appendix D includes Hart Crowser daily field reports submitted as part of construction observation. Appendix E contains summary tables of the scale tickets for material exported from the site for disposal and for construction materials imported to the site. Laboratory reports and chemical data quality reviews are provided in Appendix F. Appendix G presents the forage fish monitoring reports that were submitted during the Phase II construction work and for monitoring conducted during the winter months following the work. The Water Quality Monitoring Plan (Hart Crowser 2013b) implemented during the construction work is provided in Appendix H.

2.0 SITE BACKGROUND

2.1 Site Location and History

The Custom Plywood Site is one of several Anacortes-area bay-wide priority sites for Fidalgo/Padilla Bays being addressed by the TCP under the Puget Sound Initiative (PSI). The site includes property owned by GBH covering approximately 6.6 acres of upland and 34 acres of intertidal and subtidal areas.

As described in the RI and CAP-EDR, the Custom Plywood Site operated as a lumber and planing mill, beginning in about 1900 until it burned down sometime between 1925 and 1937. Through the years, the property changed hands several times and was rebuilt and expanded until Custom Plywood became the operating entity sometime before 1991. The facility was used as a sawmill and plywood manufacturing plant until most of the wooden structures in the main plant area were consumed in a fire on November 28, 1992. Milling activities produced wood waste and chemical contaminants that affected site soil, sediment, and groundwater.

2.2 Previous Cleanup Actions

Past limited interim remedial actions were conducted under WAC 173-340-515 (Independent Remedial Actions) on the upland portion of the site beginning in 1998. These interim actions included removal of soil impacted by hydraulic lube oil within the City of Anacortes right-of-way located immediately northwest of the GBH property in 1998 and removal of impacted soil from four areas where petroleum hydrocarbons and other constituents exceeded MTCA Method A cleanup levels in 2007.

The Phase I interim remedial action was completed in the upland area of the site in the summer of 2011. Before cleanup, the upland was characterized as heavily disturbed and containing abandoned foundations and structures, concrete and wood debris, native and non-native vegetation, and wetlands. The Phase I cleanup work involved demolishing remaining concrete structures in the uplands, removing wooden piles, excavating surface debris and contaminated soil and wood waste, backfilling with clean fill material, and constructing a wetland mitigation area with a vegetated buffer zone and a stormwater swale. Approximately 25,000 cubic yards (CY) of contaminated material was excavated and disposed of off site. Additional information on previous site investigations and remedial actions is presented in the RI and CAP-EDR. Details of the Phase I cleanup work are described in the Phase I CCR (Hart Crowser 2012b).

2.3 Site Environmental Conditions

Before completion of Phase II, the shoreline of the Custom Plywood property was undeveloped with significant quantities of industrial debris and concrete building foundations, wood piling, wood debris, and native and non-native grass and shrub vegetation. The near-shore subtidal portion of the site was described as a low-slope mudflat that also contained large amounts of wood piling and wood debris, and was partially covered by overwater structures. Wood waste ranged in size from sawdust to larger mill end remnants and logs, including naturally occurring large woody debris. Approximately 1,100 wooden piles were originally estimated to be present in the intertidal and nearshore subtidal portion of the site.

Former plywood milling operations produced a large amount of wood waste that was placed on upland and aquatic portions of the site over many years. Site fill consisted of a heterogeneous mixture of silt, sand, and gravel with abundant near-surface debris and intermixed wood waste over native clay deposits. Upland fill materials exceeded 15 feet in thickness in some areas and included general "upper" and "lower" fill units, which were identified in the RI. Concrete, brick, and other debris are the distinguishing components of the upper unit, while wood waste is more prevalent in the lower unit.

Site conditions showed an actively eroding shoreline. In 2011, Ecology blocks and rubble had been placed over time to help stabilize the shoreline and prevent or slow further erosion and to prevent inundation by extremely high tide events. The in-water structures and piling provided some protection from wind and wave energy. Coastal wave modeling for the property showed that most of the wave energy propagates from the northeast, which is aligned with the longest fetch, but differs from the predominant wind pattern (refer to Appendix B-2 of the FS and Appendix D of the CAP-EDR). This strongly suggests that the beach face has been subject to acute, episodic erosion events causing visible erosion along the shoreline. Although the predominant (more frequent) wave and wind conditions support a smaller stable grain size in the nearshore area, the stronger episodic storm events undermine the beach face and cause significant erosion.

Surf smelt spawning has been documented in very limited areas along the property shoreline. Given the shoreline and intertidal conditions and the presence of wood debris, it was questionable whether spawn was viable along the northern and central portions of the intertidal zone. Hydrogen sulfide odor has also been prevalent at times along portions of the shoreline.

Deeper in the subtidal zone, extensive eelgrass beds are documented on and adjacent to the Custom Plywood property. These beds are contiguous with the larger Fidalgo Bay eelgrass population. The eelgrass beds appeared in good condition where present but seemed limited in coverage due to previous site use in shallow subtidal areas. The shoreward extent of eelgrass coverage has been limited by the occurrence of wood waste, debris, and high-organic-content sediment within the project footprint.

Five wetland areas (Wetlands A through E) were historically located on the site. Wetlands A through D were removed during the Phase I remedial work and replaced with the wetland mitigation area in the southern portion of the site. Wetland E was removed during the Phase II work. The loss of Wetland E was accounted for in the design of the wetland mitigation area that was constructed during Phase I.

2.3.1 Contaminant Sources and Affected Media

Sediment containing wood waste has been an ongoing source of contamination in the aquatic environment at the site. Wood waste accumulation in nearshore areas and near former overwater structures exceeded 6 feet in places. In sufficient quantities, wood waste can represent an environmental pollutant and deleterious substance per criteria in the Sediment Management Standards (SMS) (WAC 173-240-200(17)). As part of the sediment profile, wood waste in the biologically active zone can adversely affect benthic habitat by potentially generating sulfide, ammonia, phenols, and related degradation products harmful to marine biota. The seaward extent and magnitude of wood waste in quantities sufficient to promote adverse impacts is uncertain. This was further addressed in the May 2011 supplemental sediment field investigation report (see FS Section 2.4 and FS Appendix E), and more recently in an investigation conducted in January 2012 to fill additional data gaps in the aquatic area at the site (see CAP-EDR Appendix A).

Dioxins/furans are the other notable contaminants in the aquatic environment. Near-surface sediment throughout the aquatic portion of the site has been impacted by dioxin/furan concentrations exceeding Fidalgo Bay background levels. Deeper portions of the sediment profile are also affected as shown in the May 2011 and January 2012 supplemental field investigations. Elevated dioxin/furan concentrations have been encountered in deeper sediment associated with relatively thick nearshore accumulations of wood waste. As the thickness and general quantity of wood waste decreases seaward, dioxins/furans are more likely restricted to surface sediment because of secondary redistribution following in-water fill placement or erosion of nearshore deposits.

3.0 CLEANUP REQUIREMENTS

The Phase II interim remedial action was designed to meet the remedial action objectives and cleanup standards for the site, which were developed in the FS and CAP-EDR and are summarized below. The remedial action objectives and cleanup standards were developed to address MTCA, SMS, and other applicable state and federal regulatory requirements for in-water cleanup efforts. These requirements address conditions relative to potential human and ecological receptor impacts. Requirements also consider related habitat, land use, and potential cultural resources issues.

3.1 Remedial Action Objectives

The primary objective for the Phase II interim remedial action at the site focused on substantially eliminating, reducing, and/or controlling unacceptable risks to the environment posed by constituents of concern (COCs) to the extent practicable. Applicable exposure pathways and receptors of interest for human health include current and future site users, including workers and visitors, potentially exposed to sediment via direct contact pathways and consumption of marine biota and marine waters. Additionally, the interim action described herein removed physical and navigational hazards at the site that are the result of decades of industrial use.

Applicable ecological exposure pathways and receptors include organisms in the biologically active zone exposed to sediment by direct contact and food chain uptake. Related ecologically focused cleanup objectives for bay-wide remediation also include providing suitable substrate for promoting recovery/recruitment of aquatic organisms in remediated areas, and minimizing habitat and water quality impacts during construction.

A key related objective was the construction of protective in-water features to prevent further shoreline erosion and migration/dispersion of deleterious sawdust and residual contaminated sediment from the site's intertidal areas. An additional key objective included the preservation and protection of cultural resources, should such objects be encountered during the remedial action.

3.2 Cleanup Standards

Under WAC 173-340-430, an interim action is a remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance; that corrects a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed; or that is needed to provide for completion of a site hazard assessment, remedial investigation/feasibility study, or design of a cleanup action. The "cleanup" criteria for this interim action were developed to eliminate or substantially remove the pathway(s) created by the wood debris and dioxins/furans at the site. The cleanup standards established for site sediment are summarized below.

3.2.1 Sediment Cleanup Levels

Cleanup levels for aquatic cleanup consist of applicable MTCA, SMS, and other protective regulatory concentration criteria for sediment. Cleanup levels for sediment are established through SMS criteria for chemical constituents and bioassay testing. Additional interim action cleanup criteria are established for wood waste and dioxins/furans in sediment.

Key indicator hazardous substances and COCs were identified based on their frequency of occurrence, mobility and persistence in the environment, and/or their toxicological characteristics (WAC 173-340-703) as identified in the RI. The point of compliance (POC) was identified in accordance with the SMS for affected sediment.

An interim action cleanup criterion for dioxins/furans of 10 parts per trillion (ppt) toxic equivalent concentration (TEC) was established as the minimum or lower action threshold to provide a practicable means to assess candidate remediation technologies, alternatives, and comparative costs in the FS. A higher action threshold of 25 ppt TEC was established as a trigger for considering more intensive remedial measures (e.g., dredging), given the greater relative risk to receptors at higher dioxin/furan concentrations.

Although wood waste is considered a deleterious substance under the SMS, there are no promulgated standards for cleanup. Previous investigations documented extensive and abundant wood waste from historical filling in nearshore areas and extending 50 feet or more waterward from mean higher high water (MHHW). Wood waste also spatially coincides with dioxin/furan TECs elevated above the 10-ppt lower action cleanup threshold established in this interim action.

3.2.2 Point of Compliance for Sediment

According to SMS requirements, the POC is represented by the biologically active sediment zone, which by default is considered to be the uppermost 10 centimeters (cm) below existing mudline. This includes protection from potential exposure to deeper contaminants or contaminant migration. The ultimate goal of any final remedy will include cleanup at the POC. However, COCs that are in excess of final cleanup criteria may remain following the interim action.

3.3 Definition of Aquatic Remediation Areas

This section describes aquatic areas of concern at the site where the concentration of COCs exceeded the cleanup levels identified in this section. The areas of concern were identified based on the known or inferred extent of contaminated media following review of historical and analytical data presented in the RI and further summarized in the FS and CAP-EDR.

3.3.1 Marine Sediment Management Areas

Wood waste and dioxins/furans are the identified COCs for defining sediment management areas (SMAs) for marine cleanup at the site. The overall extent of the aquatic interim action area was defined by the 10- and 25-ppt dioxin/furan TEC action thresholds described above. Two general SMAs were defined within this interim action area based on wood waste accumulation thickness, which were intended to distinguish wood waste accumulations of either greater than or less than 6 feet in thickness below the existing marine sediment surface. The intertidal and subtidal zones addressed in Phase II lie primarily in the nearshore SMA, where wood waste thickness has generally been greater than 6 feet. Additional rationale used to establish the aquatic SMAs based on dioxins/furans and wood waste can be found in the FS and CAP-EDR.

3.4 Applicable Permits

Necessary permits were obtained to facilitate the Phase II work. The US Army Corps of Engineers (Corps) issues nationwide permits to authorize certain activities that require Department of the Army permits under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899, which includes work in streams, wetlands, and other waters of the United States. The Corps authorized the Phase II work through Nationwide Permit 38 (NWP-38) for cleanup of hazardous and toxic waste, as proposed through the Joint Aquatic Resources Permit Application (JARPA) submitted by Hart Crowser on August 15, 2012, on behalf of Ecology.

Ecology acquired grading and right-of-way permits from the City of Anacortes. In addition, a noise variance was requested and received from the City of Anacortes to allow work to take place outside of normal working hours to accommodate the contractor’s schedule.

Given the project’s status as an Ecology priority cleanup site under an Agreed Order, the project was exempt from procedural requirements of certain state and local government laws and related permitting requirements and approvals. This included the Shoreline Management Act (SMA) (Chapter 90.58 RCW) and the City of Anacortes Shoreline Master Program (SMP). However, pertinent substantive compliance requirements remained applicable, including requirements outlined in Chapter 9 of the SMP. MTCA regulatory provisions formed the primary basis for evaluating and implementing in-water cleanup alternatives for remediation at the site.

3.5 Marine Habitat Improvements

Under the Puget Sound Initiative, MTCA cleanup actions are designed to coincidentally enhance and/or restore marine habitat. Although the selected alternative would impact existing marine habitat, much of the affected habitat was not optimal substrate because of the wood waste and surficial debris. Backfilling and capping materials with soft armor surfaces were selected to provide a permanent habitat enhancement measure that can be readily implemented as part of the site remediation. Other enhancements included creating a jetty extension and softening the existing jetty; creating a protective spit; removing the bulkhead at the north end of the property and enhancing shoreline substrate; and restoring wetland mitigated during the Phase I construction period. The enhancements will improve habitat for juvenile salmonids, forage fish spawning habitat, shorebirds and waterfowl, and other aquatic species on and adjacent to the site. The goal and function of these habitat improvement features are detailed in the CAP-EDR.

4.0 OVERVIEW OF THE PHASE II INTERIM REMEDIAL ACTION

The selected remedy for the intertidal and nearshore subtidal portion of the site, originally identified as Alternative A-3 in the FS, combined removal of structures, wooden piling, debris, and wood waste contaminated with dioxins/furans. In addition, the interim action was planned to include construction of shoreline protective features. A target volume of approximately 45,000 CY of contaminated sediment was planned to be excavated or dredged and disposed of at an upland landfill facility. The final combined excavation and dredging volume of impacted material was approximately 44,994 CY (51,591 tons). Approximately 96,697 tons of clean backfill materials (fish/habitat mix and sand backfill) were imported for placement in the excavated and dredged areas (Table 1).

The aquatic remedial alternative was selected based on MTCA evaluation criteria and compared with other potential remedial alternatives, as detailed in the FS and CAP-EDR. This alternative not only addressed protection of the human health direct contact and ecological exposure pathways, but also removed impacted sediment as a secondary source of contamination via consumption of marine biota and marine waters.

Consistent with Chapter 70.105D RCW, as implemented by Chapter 173-340 WAC, Ecology determined that the selected aquatic remedial action is protective of human health and the environment, will attain federal and state requirements that are applicable or relevant and appropriate, complies with cleanup standards, and provides for compliance monitoring.

A summary of the scope of work completed is summarized below.

4.1 Plans, Specifications, and Contractor Selection

Detailed plans and specifications were prepared to implement Phase II based on the information provided in the CAP-EDR. A bid package including the plans and specifications was prepared for selection of a contractor to complete the construction phase of the interim action. The contract was awarded to the lowest responsive bidder, Orion Marine Group, Inc. (Orion). Orion subcontracted with Scarsella Brothers, Inc. (Scarsella), to perform the earthwork portions of the project and to provide land-based support for the in-water work.

4.2 Summary of the Completed Scope of Work

The overall scope of work completed for the Phase II interim remedial action is summarized below.

- Abandoned in-water concrete structures in the intertidal and subtidal areas were demolished and crushed on site for use as fill in the upland portions of the site. Near-surface debris generally consisting of concrete, brick, wood, and other materials was removed as part of the planned excavation and dredging work completed in the intertidal and subtidal areas.
- Wood piling that remained in the intertidal and subtidal areas was removed. Most piles were completely extracted; however, where means of extraction were not successful at extracting a pile, it was broken off below the mudline. A site map showing extracted and broken pile locations is provided in Appendix B. The piles along with other wood waste were disposed of off site at a permitted Subtitle D landfill facility (Republic Services Roosevelt Regional Landfill, 500 Roosevelt Grade Road, Roosevelt, Washington).
- Nearshore subtidal areas containing wood waste and/or affected by dioxin/furan contamination were dredged to native material or to the prescribed design depth, whichever was reached first (Figure 3). The extent of wood waste and historical dioxin/furan TECs measured in this area served as the basis for determining the design excavation and dredging depths.
- Sediment dredged from the subtidal areas was loaded directly onto barges and transported to the transloading facility operated by Lafarge North America at 5400 West Marginal Way SW, Seattle, Washington. From the transloading facility, the material was transported to the Roosevelt Regional Landfill by rail for off-site disposal.
- Material excavated from the intertidal area was temporarily stockpiled on site, allowed to drain, and was shipped off site for disposal at the Roosevelt Regional Landfill. Most of this material was transloaded to barges for shipment; however, a small portion was transported via truck and trailer.
- The excavated and dredged areas were backfilled with clean fill materials that are beneficial to aquatic habitat and provide a cap to isolate any remaining impacted sediment from potential receptors (Figure 4).
- Shoreline protection features, including an extension of the jetty at the north end of the site and a protective spit at the wetland mitigation complex (constructed in Phase I), were constructed as part of Phase II (Figure 5). In addition, the cobble berm constructed in Phase I to protect the

wetland area was partially breached to connect the wetland area to Fidalgo Bay. At the southern end of the site, shoreline armoring was constructed to provide protection against erosion.

- The interim remedial action provided shoreline enhancements intended to improve habitat for juvenile salmonids, forage fish spawning habitat, shorebirds and waterfowl, and other aquatic species on and adjacent to the site. This included placement of sandy substrate along the shoreline suitable for forage fish spawning habitat, and to support epibenthic crustaceans and other fauna beneficial to foraging juvenile salmonids. Dunegrass was planted along the property shoreline to provide erosion control and backshore habitat.

4.3 Construction Management

Ecology retained Hart Crowser to serve as construction manager during implementation of Phase II to ensure execution of the project in accordance with the contract documents and the plans and specifications, and to document and verify the construction work. Construction management involved both on-site and off-site duties, consisting of daily construction observation and off-site engineering and managerial support. Specific construction management tasks included:

- Monitoring construction performance and documenting field observations, which included keeping a daily log of field activities, taking photographs, and completing daily field reports. Selected representative photographs are shown in Appendix C, and Hart Crowser daily field reports are provided in Appendix D.
- Tracking contractor construction quality assurance and quality control (CQA/QC) to ensure compliance with the plans and specifications.
- Communicating and coordinating with Ecology and the contractor, serving as Ecology's representative in the field. This included communication of all deviations from the contract documents, change requests, field directives, and information requests from the contractor to Ecology.
- Providing recommendations to Ecology on contractor submittals, contractor pay applications, requests for information, and change requests.

5.0 PHASE II INTERIM ACTION CONSTRUCTION DETAILS

Specific details of the Phase II interim remedial action are described in this section. The work was completed by Orion and its subcontractor Scarsella. Hart Crowser was present on site as Ecology's representative during construction (see Section 4.3).

Contractor mobilization and setup at the site began in late June 2013. The in-water construction work was permitted to begin on July 16, 2013, in observance of the fish window requirement of the NWP-38 authorization for the project. Ecology deemed the construction work substantially complete as of December 23, 2013, per contract requirements.

5.1 Mobilization, Site Preparation, and Demobilization

Contractor mobilization and site preparation activities included:

- Surveying pre-construction site elevations, subcontracted to and completed by eTrac Inc.;
- Installing temporary site fencing, high-visibility fencing, and temporary erosion and sediment controls (TESC);
- Installing on-site office and equipment trailers; electrical, water, and communications utilities; and sanitary facilities;
- Establishing necessary traffic control, construction entrance/exit points, and a temporary haul route through the site;
- Designating staging and laydown areas for excavated soil, extracted piles, and equipment;
- Placing mooring and anchoring systems for the in-water vessels and installing a skiff launch at the bulkhead area;
- Preparing the bulkhead area for bulk material transloading;
- Mobilizing in-water and land-based construction equipment to the site;
- Preparing the barges for material transport and for managing water drained from dredged sediment;
- Preparing the derrick barges for dredging and pile pulling operations;
- Staging turbidity curtains and debris booms for deployment when needed; and
- Installing and configuring the water quality monitoring system.

Contractor demobilization after construction consisted of removing all temporary facilities and equipment from the site and cleaning the site of any remaining construction materials, debris, scrap, or waste.

5.1.1 Site Preparation Work Performed by GBH

In an effort to reduce overall costs for the interim action, GBH agreed to perform certain site preparation activities before the contractor mobilized to the site. In general, GBH assisted by removing concrete debris and ecology blocks from upland areas adjacent to the planned work area. GBH stockpiled and/or reused the ecology blocks to delineate the concrete processing area adjacent to and along the Phase I stormwater swale and constructed wetland complex. Concrete debris that was removed and stockpiled by GBH was processed or reused by Orion during construction.

As designated on the plan drawings as work to be completed “by others,” specific task items that were completed included:

- The top section of the deteriorated concrete bulkhead wall along the northern property boundary was removed. The section was removed from the western portion of the wall, extending from the shoreline to a large intact concrete structure just past the midpoint of the wall.
- Before removing the bulkhead wall section, a row of ecology blocks that had been placed on the upland side of the bulkhead area was removed. The upland soil along the section of wall to be

removed was graded to a 2H:1V (horizontal to vertical) slope from the top of the remaining wall section to prevent sloughing of soil into the bay during the work.

- Ecology blocks that had been placed along the ordinary high water (OHW) line in the central portion of the site shoreline were relocated.
- Crushed concrete that had been placed on geotextile along the OHW line at the northern end of the property was removed and stockpiled.

This work was restricted to the upland side of the OHW line, as no work waterward of the OHW line was permitted until July 16, 2013, in observance of the NWP-38 granted for the interim cleanup action.

5.1.2 Temporary Erosion and Sedimentation Controls

TESC measures included best management practices (BMPs) to prevent pollution of air and water and to control erosion and turbid water during construction at the site. Orion was required to implement a stormwater pollution prevention plan (SWPPP) and to follow the substantive requirements of the Construction Stormwater General Permit (CSWGP).

BMPs that were employed included filtering methods for water draining from stockpiled sediment on land and on the barges to reduce suspended solids content (Section 5.6.1). Dust suppression measures were employed during dry weather, which consisted of regularly spraying upland work areas with water.

Measures to reduce tracking of dirt from the site onto the street initially consisted of street sweeping on an as-needed basis. Once wetter weather conditions began occurring more frequently, increased tracking of dirt and mud onto 34th Street was observed, and more stringent measures were required by the City of Anacortes and Ecology to control tracking of material from the site. BMPs were enhanced to include placement of fresh quarry spalls at the construction entrance and exit, manually washing the tires of trucks leaving the site, daily street sweeping, and manual sweeping as needed.

5.2 Demolition and Piling Removal

The Phase II work included demolition of remaining concrete structures on the site and removal of surface debris and wooden piling from the intertidal and subtidal areas. Demolition included legacy structures from the former plywood mill facility, including the bulkhead at the northern end of the property and the large L-shaped pier near the central portion of the shoreline.

5.2.1 Wooden Piling Removal

Aquatic and nearshore pile pulling operations began concurrently on July 16, 2013, when the in-water work window opened per the NWP-38 for the project. Based on previous work done at the site, it was assumed that piles would be extracted in their entirety. Extraction using vibratory hammer attachments on land-based and water-based equipment was the primary method used for pulling piles, which was effective for removing most of the piles. If this approach proved problematic, then removal was attempted by using the dredge’s clamshell bucket or by pulling with the excavator bucket. Some piles that had become damaged or had deteriorated over time broke when extraction was attempted; other piles were deliberately broken off when all other means of extraction failed. However, every effort was made to pull entire piles before resorting to breaking or cutting. Orion attempted to recover broken piles that remained in the subtidal area with the barge during dredging operations, but were not successful at all locations.

A wide variety of piling was encountered, some deteriorated/damaged and others well preserved, with lengths ranging up to about 70 feet. A portion of the removed piles were creosote-treated, and a small fraction of the piles were encased in concrete jackets. A total of 1,465 piles were removed, of which 99 were broken below the mudline and were not recoverable (approximately 93 percent complete extraction rate). A map showing piling removal locations is provided in Appendix B.

Pulled timber piles were transported by an off-road dump truck or barge to an upland pile processing area established at the north end of the property, next to the bulkhead area. Here, the piles were cut into shorter lengths (approximately 4 feet long) and loaded into high-capacity trailer-mounted containers for off-site transport by truck. Piles were cut using a mechanical timber processor attachment mounted on an excavator arm, which allowed for simultaneous cutting and loading of the piles. When equipment maintenance was being performed, piles were cut by hand using chainsaws.

After removal of the timber piles, the pile holes within state-owned aquatic land (located seaward of the outer harbor line; see Appendix B) were to be filled with sand per the specifications. However, DNR ultimately requested that the pile holes found on state-owned aquatic land not be filled.

5.2.2 Demolition of Remaining Concrete Structures

The Phase II work included demolition of all over-water concrete structures (approximately 13,500 square feet or 0.3 acre) remaining along the property shoreline. This included the large L-shaped pier in the central shoreline area and the concrete bulkhead at the northern end of the property.

Demolition of the L-shaped pier began in mid July, which was completed as a multi-step process. First, the structure was weakened by saw-cutting the concrete deck on top and by cutting notches into selected timber piles supporting the structure. Next, Orion and Scarsella attempted to pull the structure over toward the shoreline by attaching rigging to the concrete deck and pulling with multiple pieces of land-based equipment. Because the structure resisted the pulling attempts, this was followed by pulling selected piles from under the concrete deck using rigging and land-based equipment to undermine and further weaken the structure. The structure ultimately did not topple shoreward but, rather, partially collapsed in place, which was enough to allow excavators to access the concrete deck and begin concrete demolition and removal.

Because of its proximity to the water and accessibility, Orion used the bulkhead area for staging and transloading materials to and from in-water equipment. Demolition of the bulkhead did not commence until it was no longer needed to support in-water construction activities. Scarsella began the bulkhead demolition work in mid to late November 2013. The bulkhead area consisted of a degrading concrete seawall enclosing an upland area containing remnant concrete foundations and piling.

Concrete removed from the bulkhead area was broken down to be used as fill material as part of raising the upland grade (see Section 7.1). The concrete (approximately 800 CY) was placed in the depression that had formed in the footprint of the temporary stockpiling area in the vicinity of former Wetland E. The size of broken concrete used for fill was not to be greater than one half of the placement layer thickness. Where broken concrete was used as fill, the concrete layer was to be covered with imported fill, leaving no voids. The concrete layer was not to be thicker than 50 percent of the total layer thickness.

In addition to the bulkhead and L-shaped pier, the other remaining concrete structures along the property shoreline were demolished and removed. As the concrete was broken apart, scrap iron (such as reinforcement bar and other metal objects embedded in the concrete) was removed and segregated from the concrete, to be managed separately. Scrap metal was shipped off site for recycling, and the processed concrete remained on site to be used as upland fill material later in the work.

5.3 Subtidal Dredging and Intertidal Excavation

Dredging and excavation were performed in the subtidal and intertidal areas at the site to remove sediment affected by wood waste and dioxins/furans. A total of 44,994 CY of sediment were dredged and excavated (Table 1). The planned extents and target depths for dredging and excavation are shown on Figure 3, and post-construction as-built drawings are provided in Appendix A.

Dredging was performed using a derrick barge equipped with either a clamshell bucket (approximate capacity of 5 CY) or an enclosed environmental bucket (approximate capacity of 7.5 CY). Bucket selection depended on sediment and debris conditions in the dredging area. A separate barge was used for receiving dredged sediment, draining and managing water from the sediment, and transporting sediment off site to the transloading facility for disposal.

Orion’s derrick barge was equipped with a differential global positioning system (DGPS) to position the vessel in the dredging area (Figure 3). Software was used that allowed real-time tracking of the horizontal position of the barge and dredging bucket. Background templates and overlays were uploaded to the software that allowed the dredge operator to see the position of the equipment relative to the planned dredging extent, shoreline, and proposed sediment sampling points. The software was also used to track dredging progress, designating areas that had been completed as the work progressed. During dredging, the depth of the cut relative to target depth was tracked by the dredge operator using a combination of bucket wire marks, a physical tide board, and an electronic tide gauge. The same systems were used to track the placement of backfill material (Section 5.4).

The quantity of dredged material was determined by a combination of techniques. Barge draft was measured using an engineered displacement chart to estimate the tonnage of material dredged per barge load. A 1-cubic-foot (CF) standardized volume of dredged material was periodically collected and weighed for each barge load to determine the density of the material, which was used to convert tonnage to volume of material per barge load.

Additionally, Orion conducted hydrographic surveys in the completed dredged areas to verify whether target depths had been attained, which were submitted as progress surveys to Ecology for review and approval.

Intertidal excavation was performed using land-based earthwork equipment. Planned excavation boundaries (Figure 3) were located and staked by Orion's subcontracted surveyor, Pacific Survey and Engineering (PSE). Excavated depths were estimated during digging and subsequently verified through topographic surveys conducted by PSE, which were submitted as progress surveys to Ecology for review and approval. The final disposed tonnage of excavated and dredged material was determined through the scale tickets received for the loads received at the disposal facility.

Dredging and excavation reached native material in several locations at depths less than the 6-foot target depth. In the southernmost extent of dredging and excavation at the south end of the site (Figure 3), the native clay layer was encountered at depths of approximately 4 feet below existing grades. Similar conditions were encountered in the region north of the protective spit, where the native clay layer was encountered at less than 6 feet deep. Near the bulkhead area at the north end of the site, native clay was detected at approximately the 6-foot target depth. The final excavation and dredging elevations that were attained and documented in progress surveys are provided in Appendix A.

5.3.1 Dredging/Excavation General Sequencing and Schedule

In the overall sequencing of the construction work, dredging and excavation commenced near the beginning of the scheduled work, after mobilization to the site was completed. In accordance with the NWP-38, in-water work was permitted to begin on July 16, 2013. After preparing the barges and initiating pile pulling operations, dredging work commenced on July 19. Dredging and in-water pile pulling continued simultaneously, using one derrick barge for dredging and one crawler crane mounted on a flat-deck barge to pull piles. Orion began dredging and pile pulling operations generally at the north end of the site and progressed southward.

Intertidal excavation work began on August 2. Before starting to excavate the intertidal area, Scarsella performed demolition work and piling removal south of former Wetland E, working south along the cobble berm constructed in Phase I to create a haul route for removing excavated material from the south end of the site. Once the haul route was in place and the south end was accessible to heavy equipment, intertidal excavation commenced at the southernmost end of the site and progressed northward.

Orion scheduled construction work based on a 6-day workweek, with daily work scheduled around favorable tides. Because of the overall shallowness of the bay at the site, observation of high tide schedules was critical to ensuring accessibility to in-water work areas, to accommodate the draft of the work vessels. Similarly, access to the intertidal area by land-based equipment depended on low tides.

Some in-water work delays occurred due to potentially hazardous weather events (e.g., lightning or excessively high winds) and by the limited capacity of the transloading facility that was receiving the sediment from the Custom Plywood Site in addition to several other sources (see Section 5.3.2). During periods when the transloading facility was at maximum capacity, loaded barges were required to wait on standby until unloading capacity became available.

5.3.2 Sediment and Debris Management and Disposal

Excavation and dredging during Phase II removed approximately 51,591 tons of dioxin/furan-contaminated sediment and debris, which was disposed of off site at a Subtitle D landfill facility (Republic Services Roosevelt Regional Landfill, 500 Roosevelt Grade Road, Roosevelt, Washington). Most of the material was transported off site by barge, but approximately 3,863 tons (7.5 percent) were transported by truck. Material transported by barge was received at the Lafarge North America transloading facility in Seattle (5400 West Marginal Way SW, Seattle, Washington), where it was transferred to a 6,000-CY holding vault to await loading into lined containers and transport by rail to the Roosevelt Regional Landfill. The sediment remained in the holding vault to allow excess water to drain until it was dry enough to meet rail transport requirements.

The sediment removed from the excavation and dredging areas consisted primarily of wood waste containing a mixture of sawdust (degraded as well as relatively fresh at greater depths along the shoreline), a range of small to large woody debris, dimensional lumber and logs, and entire wood piles. Hydrogen sulfide gas was detected emanating from the material removed from some of the nearshore as well as offshore sediment removal areas, mainly where degrading sawdust was encountered. Surficial debris in the nearshore area generally consisted of building material remnants such as brick, concrete fragments, and scrap metal.

Sediment excavated from the intertidal area with land-based equipment was temporarily stockpiled on site in a designated area to await transport off site. Near-shore excavation was conducted during low tide to allow access to the excavation area, which resulted in excavated material that contained less free water and thus required less draining. Per the project Water Quality Monitoring Plan (Appendix H; Hart Crowser 2013b), water drained from the temporary stockpile area was allowed to drain back to the bay as long as it satisfied water quality criteria. The shoreward side of the stockpile area was bermed with ecology blocks, which was lined with straw wattles placed along blocks as a TESC measure. The majority of this material was transloaded to barges and shipped off site.

Dredging activities were performed using water-based equipment during high tides. Therefore, the dredged material was saturated when it was placed on the transport barge. Water was allowed to drain from the material on the barge back to the bay. The material barges were equipped with filtration systems to reduce the suspended solids content of the discharging water (Section 5.6.1). Before leaving the site, the drain outlets on the barges were sealed to prevent any remaining water from discharging during travel from the site to the transloading facility. After the dredged material was transloaded to the holding vault at the facility, additional water drainage and drying occurred, as needed, before loading and transporting the material to the landfill by rail.

Transportation and disposal costs were based on the tonnage of material received at the landfill. Appendix E provides a summary of scale tickets for the material that was transported off site.

5.4 Subtidal and Intertidal Backfilling

As the planned dredging and excavation were completed and progress surveys were approved, backfill materials were placed in the subtidal and intertidal sediment removal areas to attain approximate pre-construction grades, which had been measured as part of the pre-construction survey completed before mobilization to the site. The site was backfilled incrementally as the completed dredging and excavation areas became available for filling, resulting in periods of simultaneous backfilling and dredging/excavation but in different locations at the site. A total of 63,522 tons of fish/habitat mix and 33,175 tons of sand backfill were placed as backfill material (Table 1).

5.4.1 Backfill Material Descriptions

Two types of backfill material were placed, specifically named fish/habitat mix and sand backfill. Fish/habitat mix is a rounded aggregate that conforms to Washington State Department of Transportation (WSDOT) Standard Specification Section 9-03.11(1) for streambed sediment with a modified gradation. The material gradation was designed to provide suitable forage fish habitat and to meet hydrodynamic stability requirements for areas subject to greater erosive forces, such as the site's intertidal area. This material is generally described as a poorly graded sandy gravel with a maximum particle size of 2 inches.

Sand backfill was specified to conform to WSDOT Standard Specification Section 9-03.14(1) for imported gravel borrow with a modified gradation. Sand backfill consisted of slightly finer aggregate than the fish/habitat mix, to be placed in areas that would be subject to lesser erosive forces, such as within the dredged areas protected by the jetty extension and protective spit (see Sections 5.5.1 and 5.5.2). Similarly to fish/habitat mix, sand backfill was intended to provide suitable aquatic habitat. This material is generally described as a well-graded gravelly sand with a maximum particle size of 1.25 inches and minimum median particle size of 2 millimeters.

The fish/habitat mix and sand backfill materials received at the site contained a small percentage of fine particles. During in-water placement of these materials, localized turbidity was generated, but water quality criteria were not exceeded at the point of compliance. Similarly, material placed in the intertidal area released fines during the first several tide cycles after placement, but water quality criteria remained in compliance, and the turbidity released diminished over time with subsequent tide cycles washing over the material.

5.4.2 Backfilling Methods and Locations

Planned locations for placement of fish/habitat mix and sand backfill are shown on Figure 4. These locations were determined through hydrodynamic modeling and coastal engineering design. Post-construction elevations of the backfilled areas are shown on the as-built drawings provided in Appendix A. Other material types were placed to fill more localized areas and to build in-water shoreline protection features, which are discussed in Section 5.5.

Two general methods were employed to backfill the dredged and excavated areas. Nearshore areas were filled by pushing material seaward from the shoreline using land-based equipment, and offshore areas were filled using the dredging barge. The extent of backfill placement was monitored to assure the continuity of backfill from the nearshore to offshore placement areas. The placement of offshore material from the barge was tracked using the same positioning system and software as was used for dredging operations (see Section 5.3). As backfill material was placed in the nearshore areas, flagged grade stakes were used as a visual indicator of target elevations for fill placement, which were measured from on-site survey control points established by PSE. Both offshore and nearshore areas were hydrographically or topographically surveyed by Orion and PSE, the results of which were submitted as progress surveys to Ecology for review and approval.

After completion and approval of backfill material placement in the intertidal area, a surficial layer of sand backfill (6 inches thick) was placed along the shoreline between elevations of +4 and +9 feet MLLW (mean lower low water) to support forage fish spawning habitat.

5.4.3 Backfilling Challenges

The backfilling work experienced limited challenges arising from placement of backfill material over soft sediment and wood waste remaining in the dredged and excavated areas. Specific challenges included difficult accessibility for equipment, mud wave formation during filling, and suspected subsidence of certain backfilled areas.

A localized area in the southern portion of the site was not completely backfilled because of difficult accessibility. This area measured approximately 60 feet by 15 feet and was located in the easternmost extent of the dredged area south of the protective spit. The location proved difficult to access using land-based equipment due to underlying soft substrate, creating the potential for equipment instability and unsafe operation. From the water, the location was difficult to access with the dredging barge because of its proximity to the protective spit and Ecology's thin-layer capping study area. To access the location, the barge would have had to pass over the capping study area, potentially risking damage to the test plot. Ecology authorized Orion to leave the section unfilled, anticipating that it would fill naturally over time from the redistribution of nearshore backfill material from the intertidal area, which had been locally placed slightly higher than design.

Limited mud wave formation occurred during backfill placement at the south end of the site, specifically in one area where soft substrate remained in the floor of the shallow dredging prism being filled. Backfill material in this area was placed using land-based equipment pushing waterward from the shoreline in a series of adjacent tracks roughly perpendicular to the shoreline. As backfill material was being placed at the location of the mud wave, the soft substrate (consisting of wood waste and small wood debris) welled up and washed over the surface of backfill material that had already been placed. After finishing backfilling this part of the site, Scarsella removed the mud wave remnants from the backfill surface and replaced fresh backfill material at the mud wave location. A similar but more extensive mud wave formed during construction of the protective spit, along its northern toe (see Section 5.5.2).

Reviews of the initial backfilling progress surveys indicated that some of the nearshore backfilled area between the protective spit and the bulkhead area was below the target pre-construction grade by more than 0.5 feet. Because this area had been backfilled before the neighboring offshore area was backfilled, it was suspected that the nearshore backfill material may have been partially washed offshore into the neighboring unfilled dredged area before the survey was completed, resulting in lower measured elevations. Additional fish/habitat mix was placed in the nearshore area to attain target grades after backfilling of the offshore area.

The subsequent progress survey revealed that some nearshore areas were still below target grades, including portions of the offshore area that had been filled. The observed low grades may have been the result of settlement of the backfill material, which had been placed over the soft substrate remaining in the floor of the excavated and dredged areas. Ecology requested that a third-party review be completed to compare the backfilling progress survey results against the pre-construction survey data to determine the extent of the elevation discrepancies. As a result of this evaluation, approximately 1,000 tons of additional fish/habitat mix were placed on about 1/4 acre of the nearshore area residing at elevations higher than –1 feet and 0 feet MLLW south of the bulkhead area. Backfilling in the nearshore area was approved after this work was completed.

5.5 Site Restoration, Habitat Improvements, and Engineering Controls for Shoreline Protection

Under the Puget Sound Initiative, MTCA cleanup actions are designed to coincidentally enhance and/or restore marine habitat. The site restoration work that was completed as part of the Phase II interim remedial action included construction of habitat improvements and features designed to mitigate shoreline erosion. These enhancements included creating a jetty extension and softening the existing jetty; creating a protective spit; removing a bulkhead and improving shoreline; bank stabilization; and establishing wetland connectivity with the bay. The enhancements will improve habitat for juvenile salmonids, forage fish spawning, shorebirds and waterfowl, and other aquatic species on and adjacent to the site.

5.5.1 Jetty Extension and Softening

The jetty extension, on the northern edge of the site, was designed to attenuate the predominant wave energy from the north/northeast. Attenuation of the long-fetch waves from the north allows for the placement of armoring material of a smaller particle size along the site shoreline that will support foraging habitat for migrating juvenile salmonids. In addition to protecting the mainland shoreline to the south, installation of the jetty extension included the placement of habitat-friendly substrate in-fill along the southern face of the existing jetty. The sandy substrate creates forage fish spawning habitat and supports foraging juvenile salmonids. A narrow gap between the existing jetty and the extension provides a migratory corridor for juvenile salmonids while still maintaining the protective nature of the feature.

Constructing the Jetty Extension

The jetty extension was constructed using two types of material: bedding stone and armor stone. An initial 3-foot-thick layer of bedding stone was first placed on the seabed in the extension footprint per the plan drawings using water-based equipment. Once the progress survey confirmed the bedding layer location and elevations, armor stone was placed on the bedding layer to the design elevations and profile.

The placement methodology for the armor stone was modified with approval of the jetty extension designer, Coast & Harbor Engineering (CHE), per Orion's request. Following bedding stone placement, armor stone for the core of the extension was placed using a "bomb bay box," which consisted of an open-top box structure with a gated floor that could be opened and closed by the derrick operator. The bomb bay box was designed to be suspended and operated from the dredging derrick. Material was selectively loaded into the bomb bay box on the material barge and then was maneuvered into the desired placement area by the derrick operator using the same positioning software that was used to track dredging location and progress. The bomb bay box could be placed close enough to the target surface to minimize the dropping of stone, as required by the specifications. Once the core structure broke the water's surface, the loaded bomb bay box was used to tamp previously placed material before placing the loaded batch of stone. Use of the bomb bay box allowed for more efficient placement of stone to meet the specification requirements.

At the recommendation of CHE, the outer surface of the jetty extension was constructed by selectively placing individual stones using an excavator mounted on the crest of the extension. Stone was delivered to the jetty using the derrick barge mounted with a skip box, which was loaded on the neighboring material barge. Single loads were transferred to the jetty extension's crest, from where the excavator could place single stones at the desired locations. This allowed for achievement of a high degree of interlocking and stability between stones, per specification requirements.

The design required that the jetty extension be constructed to a finish height that would allow settling over time to the desired height. The design assumed that the jetty extension would settle approximately 4 feet to attain a finish elevation of approximately 12 feet MLLW (Hart Crowser 2013c). Two survey markers were installed on the jetty extension, at locations at approximately one third and two thirds of its length, to allow for settlement monitoring over time. Orion's surveyor (PSE) recommended using 1/2-inch reinforcement bar for the markers to provide a stable marker, considering the material type of the extension. This alternate marker type was approved by Ecology's representative.

Jetty Extension Material and Construction Quality

Detailed observation of jetty extension material quality and construction progress was intermittently performed on site by CHE representatives. The completed jetty extension was approved by CHE and Ecology when design requirements were met.

The bedding stone met the specified material requirements, which consisted of WSDOT Standard Specification Section 9-03.6 for quarry spalls with a modified gradation. Approximately 4,131 tons of bedding stone were placed (Table 1).

The armor stone met specified material requirements, which consisted of WSDOT Standard Specification Section 9-13.4 for rock for erosion or scour protection with a modified gradation. Approximately 9,875 tons of armor stone were placed (Table 1). Per specification requirements, armor stone gradation was tested at the quarry (Lakeside Industries, Anacortes, Washington) for every 5,000 tons of stone shipped to the site.

Jetty Softening to Enhance Habitat

The southern face of the existing jetty was softened through placement of a sandy substrate to provide aquatic habitat enhancement. Fish/habitat mix was placed on the southern face to fill the voids of and cover the boulder-constructed surface of the jetty. Per design, material was to be placed on the jetty up to elevation +8.2 feet MLLW at about a 5H:1V slope, which was selected as being capable of sustaining fish/habitat mix material under local hydrodynamic conditions. Due to the surface irregularities of the jetty, the top elevation of the slope as constructed varied between approximately +7 and +9 feet MLLW. It is anticipated that the placed fish/habitat mix will be naturally distributed and graded by local wave and tide conditions. Fish/habitat mix was also placed on the landward (southwestern) face of the jetty extension to fill voids below +8.2 feet MLLW, as specified per design.

5.5.2 Protective Spit

The jetty extension described above provides shoreline protection for only the northern portion of the shoreline. A second in-water protective feature was needed to protect the remainder of the shoreline. The protective spit (Figure 5) was designed to maximize shoreline protection from erosive wave action for the southern portion of the shoreline. Configuration of the protective spit was based on modeled wave and wind energy along the site's shoreline before and after in-water structure removal. Hydrodynamic modeling indicated that the already eroding southern portion of shoreline would be subject to increased wave energy once the in-water structures were removed. The spit offers an adequate level of protection while also protecting capped contaminated substrate beneath its footprint. For added protection against erosive forces, a portion of the shoreline south of the protective spit was stabilized (see Figure 5 and Section 5.5.5). These structures were designed to include habitat enhancement features, such as forage fish spawning habitat and habitat that supports juvenile salmonids along the shoreward extent of the site.

Protective Spit Construction Material

The protective spit was constructed from cobble/gravel mix, which met specification requirements to conform with WSDOT Standard Specification Section 9-03.11(2) for 8-inch streambed cobble with a modified gradation, except for rock cleanliness. Approximately 11,962 tons of cobble/gravel mix were used to construct the protective spit, with the remainder (2,051 tons) used for shoreline reconstruction in the bulkhead area (Section 5.5.3).

The cobbles had a thin coating of dirt and small particulates that did not disperse during handling and transport to the site. Turbidity was a concern and monitored where this material contacted water of the bay. Turbidity did occur during placement and subsequently when high tides washed over the structure, but water quality criteria were not exceeded at the point of compliance.

The cobble/gravel mix was delivered to the site as two separate components (8-inch minus cobble and rounded gravel) and staged in separate stockpiles. The components were blended at the site at a predetermined proportion to attain the specified gradation, which consisted of two parts cobble to one part gravel. Scarsella blended the component materials using a loader or excavator to create a single stockpile of cobble/gravel mix.

The bulk of the protective spit was constructed of cobble/gravel mix. Additional materials were placed on the landward (southwestern) face of the spit to provide habitat enhancement. A layer of fish/habitat mix (1 foot thick) was placed to cover the entire landward face from the toe to the top of the spit. The fish/habitat mix layer was topped with a surficial layer of sand backfill between elevations +4 and +9 feet MLLW (1 foot thick).

Constructing the Protective Spit

The protective spit was constructed by pushing material outward from the shoreline using land-based equipment. Control points for the spit were marked in the field by Orion's subcontracted surveyor (PSE), and material was placed to follow the marked locations. After placement of most of the material, the surfaces of the spit were graded to attain specified slopes. As with the jetty extension, settlement over time was considered in the design of the protective spit's constructed elevation and slopes. The spit was overbuilt to allow for an anticipated 3 feet of settlement at its heaviest point (Hart Crowser 2013c). Target construction slopes were 7H:1V on the seaward side of the spit and 3.6H:1V on the landward face. After approximately 3 feet of settlement, these grades are anticipated to attain 9H:1V and 5H:1V, respectively. The more gradual slope on the seaward side of the protective spit is intended to dissipate wave energy and minimize the size of material needed to build the structure.

Two survey markers were installed on the jetty extension, at locations approximately one third and two thirds of its length, to allow for settlement monitoring over time. Orion's surveyor recommended using 1/2-inch reinforcement bar as an alternate marker type to provide a stable point for surveying, considering the material type of the extension. Ecology's representative approved this alternate for use.

Protective Spit Construction Quality and Modifications

The progress survey results for the protective spit indicated that the toe of the spit along its northern edge did not meet the design specifications, being steeper than the design slope. Because land-based equipment was required to maintain a minimum buffer zone of 1 foot from the water's edge (see Section 5.6.1) to avoid any potential non-compliance with water quality criteria, equipment was not able to reach portions of the lower extremity of the spit during work performed at low tide. Ecology deemed the construction of the protective spit complete and notified Orion that no further action was needed.

The design specifications of the protective spit originally did not include placement of beach sand and dunegrass planting. However, Ecology modified the design during construction and directed Orion to install a planting strip along the length of the spit. Beach sand was first added from approximately +8 feet MLLW to the crest of the spit for dunegrass planting along its landward side (see Section 5.5.6). Subsequently, before planting began, additional beach sand was placed on the crest of the spit to allow planting at higher elevation to protect the dunegrass plantings from high tides and storm surge during winter storms. The beach sand placement for the planting strip is 4 feet wide, 1.5 feet thick, and runs the length of the spit's crest, centered on the crest's centerline. Where the protective spit structure meets the existing shoreline, the planting strip is tied into the existing planting area on top of the wetland berm.

After construction of the spit was completed, it was noted that a mud wave may have formed immediately north of the protective spit, consisting of debris and sediment residing along the northern toe of the spit. Debris ranged from fine material (sawdust, silt) to large woody debris and scrap metal. At Ecology's request, Orion swept the area with the dredge to remove the debris. When the removal was determined to be adequate, Ecology approved the sweep area to be backfilled with fish/habitat mix. The debris and sediment removed during the sweep was disposed of off site at the Roosevelt Regional Landfill.

5.5.3 Bulkhead Shoreline Softening

This shoreline softening feature at the northern property boundary replaced the former deteriorated bulkhead (Figure 5). The bulkhead replacement is intended to reduce erosion of the northern shoreline while occupying a smaller footprint than the existing bulkhead.

The softening of the shoreline in the bulkhead area was completed as part of the backfilling work there, which commenced once the concrete demolition (Section 5.2.2) and remedial intertidal excavation were completed in this area (Section 5.3). The bulkhead demolition and subsequent restoration were completed near the end of the construction schedule, when Orion no longer needed the bulkhead area to support in-water construction activities (staging and transloading materials in addition to boat launch use).

The shoreline softening consisted of placing cobble/gravel mix and fish/habitat mix on the southern, eastern, and northern sides of the bulkhead area, to form a rounded feature at a consistent 5H:1V design slope. Cobble/gravel mix was placed primarily along the eastern extent of the former bulkhead, and fish/habitat mix along the southern and northern sides. A minimum thickness of 2 feet was required for the cobble/gravel mix layer. Sand backfill was not placed on the softened bulkhead area. The sand backfill layer placed between +4 and +9 feet MLLW along the rest of the shoreline terminated where the fish/habitat mix overlaps with the cobble/gravel mix on the south side of the bulkhead area.

The backfilling progress survey completed in the softened bulkhead area indicated that some deviations from design existed, some elevations being higher or lower than design, and a toe that was steeper than design slope. Ecology directed Orion to move excess material on the bulkhead to the sections of the toe that are steeper than design, and to add additional fish/habitat mix where elevations were lower than design during low tide. This was completed within the limits of permit restrictions, maintaining a 1-foot minimum buffer zone between the water's edge and the upland work. Ecology indicated that Scarsella should perform the corrections to the best of their abilities within safety and permit limitations during low tide, and then the bulkhead softening construction would be considered complete.

The bulkhead softening was constructed near City of Anacortes Outfall 003, which terminates near the western end of the bulkhead area, just north of the property boundary. The placement of material in the bulkhead area was a sufficient distance from the outfall discharge to not impede its operation, as observed by the City of Anacortes and Ecology.

5.5.4 Wetland Area Berm Grading and Breach

During upland remediation activities completed in Phase I, a wetland mitigation area was constructed in the southern portion of the site's uplands to restore and consolidate smaller individual wetlands that were removed during Phase I, providing higher quality habitat. Wetland area construction included creating a protective cobble berm at and landward of the OHW line to prevent contaminant migration into the restored wetland during in-water construction. As part of Phase II, the protective berm was breached to tidally connect the restored wetland with Fidalgo Bay (see Figure 5).

The berm was breached at the approximate midpoint of its length. The floor of the breach was cut 5 feet wide, from which the sides of the breach were graded at a 5H:1V slope to a design elevation of +9.2 feet MLLW at the top of the breach. To attain the target floor elevation, the cut for the breach extended eastward beyond the berm through the fish/habitat mix material that was placed to backfill the intertidal excavation completed along the berm.

In addition to cutting the breach through the cobble berm, the top of the berm was regraded, lowering its elevation by approximately 1 foot, which varied by location. The target elevation for regrading the berm was set at a constant +9.2 feet MLLW at the top of the breach, from where the regraded surface of the berm maintained straight-line slopes to tie in with existing grades at its northern and southern ends. The large cobble material that was removed from the berm was reused to construct the shoreline armoring area immediately south of the berm (see Section 5.5.5 and Figure 5).

After the breach was cut, material was added to completely cover the sloped sides of the breach. Cobble/gravel mix was placed on the north slope of the breach, and fish/habitat mix was placed on the south side. The heavier material was placed on the northern side of the breach to withstand wave propagation from the south and prevent potential erosion. After regrading the berm, the entire top of the berm was covered with a layer of beach sand 1.5 feet thick for dunegrass planting.

The elevation of the wetland area constructed in Phase I resides within the range of local low and high tide elevations. As such, the wetland pond is not continuously full of water, but rather fills and drains with the incoming and outgoing tides. To assure that the pond drains completely at low tide to prevent the stranding of fish in shallow, isolated water in the pond area, which may be potentially harmful, Ecology directed Orion and Scarsella to deepen the channel of the breach. The channel was deepened by approximately 1 foot, based on a visual estimate.

5.5.5 Bank Stabilization and Shoreline Armoring

Significant erosion of the shoreline had been observed over time at the southern end of the site. The installation of the protective spit, discussed in Section 5.5.2, is intended to protect the southern portion of the site shoreline against erosion caused by wave propagation from the north. To provide added protection, armoring material was installed at the southern end of the site, southward from the wetland area cobble berm and along Rotary Park (Figure 5).

During Phase II construction, field observation of the shoreline condition along Rotary Park and the southern point of the wetland buffer zone indicated that shoreline erosion might continue to be a concern south of the armoring area if constructed as designed. These observations considered the degree to which the shoreline had changed since the design was prepared. Following consultation with the coastal engineer (CHE), and with Ecology's approval, the armoring area was extended approximately 24 feet farther south than the design extent, abutting the boulders that were placed along the north side of the designated public beach access point (Section 7.2).

The installation of shoreline armoring was completed after the intertidal excavation area had been backfilled with fish/habitat mix, but before placement of sand backfill on the shoreline between +4 and +9 feet MLLW, and before placement of beach sand for the planting area south of the regraded cobble berm. The armoring material consisted of the large cobbles that were removed from the berm during regrading. The footprint of the armoring area was excavated to allow for placement of a 3-foot-thick layer of large cobbles to surrounding grade. The large cobble material was installed from the toe that was marked per the revised design up to a top elevation that was determined based on observed shoreline conditions at the time of construction. Because of localized irregularities in the escarpment that ran along the upper reach of the planned armoring area, the armoring material was placed to where it reached the escarpment and could tie in with the existing grade, with the upper extent of armoring reaching a minimum elevation of +11 feet MLLW.

5.5.6 Landscaping and Planting

The Phase II interim action design included landscaping and planting features as part of the restoration of the site's shoreline, which included:

- Salvaging plants from Wetland E and transplanting them in the wetland mitigation area before Wetland E was removed;
- Preserving the large woody debris found on the shoreline before construction began and then returning the large woody debris to the shoreline as part of site restoration; and
- Placing a beach sand strip and planting dunegrass along the entire length of the site's shoreline.

Salvaging Wetland E Plants

Wetland flora that was determined to be recoverable was salvaged from Wetland E and transplanted in the wetland mitigation complex at the south end of the site. Wetland E was included in the intertidal excavation area. Mitigation for the removal of this wetland was already accounted for in the design of the wetland mitigation complex installed in Phase I.

Preserving Large Woody Debris

Large woody debris (LWD) that was present on the site's shoreline at the start of work was marked to be preserved and returned to the shoreline after construction was completed. LWD consisted of driftwood that was selected according to the criteria that it be at least 12 inches in diameter (at breast height) and 3 feet long or greater. Additional pieces that were selected by Ecology and Ecology's representative were also marked for preservation. The contractor removed the selected LWD from the work area and stored it where it would be out of the way during the work. After the shoreline backfill material had been placed, the contractor replaced the LWD in the general area where it was located before the work started.

Beach Sand Placement and Dunegrass Planting

A beach sand strip was installed along the entire length of the site's shoreline for planting dunegrass. During Phase II construction, the planting area design was modified to expand the area to be planted and to raise its elevation in some locations to reduce the risk of washout during winter storms and high tides. The location of the planted area is shown on the post-construction as-built drawings provided in Appendix A.

The planting area extends from the north property boundary at the bulkhead area to Rotary Park at the south end of the site. The design was modified to add an extended planting strip along the length of the protective spit. The planting strip consisted of a beach sand layer placed 1.5 feet thick and 4 feet wide, except on the regraded berm at the wetland area, the top of which was completely covered with beach sand for dunegrass planting. The beach sand layer placed on the protective spit was 1 foot thick.

The planting area design was modified to raise its elevation on the protective spit and along the shoreline between the protective spit and bulkhead area, where the upland area was to be filled to raise the grade elevation (see Section 7.1). On the protective spit, the beach sand planting strip was first to be placed along the upper section of the landward side of the spit at a thickness of 1 foot. However, this was subsequently changed to place the planting strip on the crest of the spit, along its centerline. With the elevation modification, the width and thickness of the planting strip were altered to 4 feet and 1.5 feet, respectively.

The upland area landward of the OHW line, north of the wetland buffer area fence, was filled to raise the grade to approximately +12 to +12.5 feet NAVD88 (North American vertical datum of 1988). The fill material was to be transitioned up from the OHW line at a 3H:1V or 4H:1V slope to the target elevation. The planting strip design was modified to place beach sand at the top of the transition instead of centered on the OHW line per the original design. With this modification, the planted area would reside in the elevation range of approximately +11 to +12 feet NAVD88. The as-built planted area is shown on the post-construction survey (see Appendix A).

The planting areas were constructed incrementally. Beach sand placement on the wetland cobble berm and to the south was completed in early to mid October, and dunegrass planting was completed in these areas in late October. Following the design modification, the beach sand strip was placed on top of the protective spit in mid November, but beach sand north of the spit was not placed until mid December, when the upland grading work was completed. Dunegrass planting on the protective spit and along the shoreline to the north was completed in mid December, at the very end of the construction schedule.

In total, approximately 22,000 dunegrass plants were delivered to the site and planted along the site's shoreline. In consultation with Ecology's representative, the plant grouping and spacing was modified. Of the total quantity, 5,000 dunegrass plants were installed in the planting strips on the protective spit and along the shoreline north of the spit. The remainder was installed on the wetland berm and south to Rotary Park. Installation was limited to no more than 2 to 3 plants per hole, and plant groups were to be no less than 2 to 3 inches apart (actual group spacing was approximately 3 to 4 times the minimum criterion).

5.6 Construction Performance and Habitat Monitoring during Construction

Monitoring of the Phase II implementation work was conducted by Ecology's representative and the contractor. This included construction performance monitoring in addition to monitoring the effects of the construction work on the environment in the project area, such as on water quality and forage fish spawning activity. Construction performance monitoring included observing and documenting the work performed and verifying compliance with the project plans, specifications, and permit requirements. As part of construction quality control, Orion provided progress surveys at certain milestones during the work for Ecology's review and approval before proceeding to subsequent stages of work. The following sections summarize the water quality monitoring, progress survey review, and forage fish monitoring activities that were performed during Phase II construction.

5.6.1 Water Quality Monitoring and Controls

The Phase II construction work could potentially have detrimental effects on the surrounding waters of Fidalgo Bay. Disturbance of sediment and in-water filling could potentially create turbidity that exceeds water quality criteria. Turbidity monitoring was performed to assure that compliance with water quality criteria was maintained. BMPs were employed to mitigate the risk of an exceedance, and controls were in place and ready to deploy in the event that an exceedance was detected.

The Phase II contract documents included a Water Quality Monitoring Plan (WQMP) (Appendix H; Hart Crowser 2013b), which described the objectives and procedures of the water quality monitoring program to be implemented during construction. The WQMP was designed to gather information to assess potential impacts on water quality during the execution of this work.

The objectives of the water quality monitoring program were to:

- Assess potential impacts on water quality caused by in-water demolition, excavation, and dredging;
- Help the contractor ensure compliance with water quality criteria;

- Provide information to evaluate the effectiveness of operational controls to achieve compliance with water quality criteria during demolition, excavation, and dredging; and
- Document the monitoring activities and sampling results in a final report.

Water quality criteria from WAC 173-201A-210 for marine surface waters applied to the Phase II in-water work, which are shown in the table below.

Parameter	Criteria
Turbidity (1-day maximum)	5 NTU over background when background is 50 NTU or less; or A 10% increase in turbidity when background turbidity is more than 50 NTU

Notes:

NTU – Nephelometric Turbidity Unit

The point of compliance for water column monitoring during in-water work was a maximum distance of 150 feet from the point of disturbance or work activity that may create turbidity.

Per the WQMP, the water drained from temporary stockpiles during intertidal excavation was to be collected and monitored before it discharged to the bay. The collected water was required to meet the criteria before it could be discharged. Because much of the intertidal excavation was conducted during low tide (Section 5.3), the excavated material contained relatively less free water that drained from the temporary stockpile. Due to this relatively small volume of water, stockpile BMPs, and combined with field observations, the water that drained from temporary stockpiles was allowed to drain back to the bay. In addition to drainage from the stockpiles, Ecology required additional monitoring of the water being discharged from the material barges during dredging operations.

Monitoring Methodology

To monitor water quality during in-water work activities, Orion utilized two automated turbidity monitoring buoys to monitor turbidity. Each monitoring buoy included a single turbidity sensor and wireless telemetry. The buoys were anchored near in-water work areas, within the compliance boundary. As the work moved to different parts of the site, Orion could move the buoys and re-anchor them at the desired locations. The buoys were equipped with wireless communications to transmit turbidity data at a set interval to an onshore data collection terminal. The collected data were accessible by both Orion and Ecology at remote terminals and could be monitored in real time. The initial sampling interval was set at 15 minutes but later was increased to 1 hour. Orion supplemented the automated turbidity monitoring with manual measurement as needed and to monitor turbidity at a reference location. In addition to turbidity measurement, the in-water work areas were visually observed for indications of potential turbidity issues.

The monitoring buoys presented occasional operational difficulties. They required frequent battery replacement by the contractor. When power supply ran low, the buoys could no longer transmit data. At times, telemetry issues resulted in inconsistent transmittal or none at all. One buoy was temporarily decommissioned to allow for repair by the manufacturer. Because of the shallow water at the site, the turbidity sensors became fouled with sediment during low tides because the buoy/sensor was resting on the seabed, which resulted in anomalous turbidity readings. The buoys were equipped with self-cleaning functionality, but these could not operate until the rising tide pulled the sensor above the mudline.

Orion's contract for the monitoring buoys expired in November, after which the buoys were decommissioned, and turbidity monitoring continued using manual measurement and visual observation.

Water Quality Controls

To help Orion work more efficiently, Ecology initially authorized the in-water work to proceed without deploying turbidity curtains. The contractor was required to have turbidity curtains on site and ready for immediate deployment if water quality monitoring indicated a potential turbidity issue or exceedance. The WQMP included specific protocol for responding to and controlling water quality criteria exceedances. As the work progressed, localized turbidity was generated within work areas, but water quality criteria were not exceeded at the point of compliance.

Turbidity controls were installed on the material barges to remove suspended solids from the water draining from the dredged sediment before it discharged to the bay. These controls initially consisted of straw wattles and filter fabric but were later modified to a weir and hay bale system for increased capacity. The water discharging from the material barges while being loaded with dredged sediment was observed to be turbid, but measurement near the discharge indicated low turbidity.

Other potential water quality concerns were observed and controlled during construction. During demolition and dredging work, various forms of floating wood debris occasionally appeared off of the site's shoreline, ranging from wood fragments and scrap to timber pile sections and small logs. Wood debris may have been released from the demolition of in-water structures, fragmented from piles being extracted or broken, or when material trapped below the surface was released when dredging or pile pulling disturbed the floor of the in-water work area. Orion used debris booms to corral floating wood debris and collected the debris on regular basis, which was disposed of off site with other debris that was removed during the work.

During the latter portion of the construction schedule, in response to concerns raised by the Tribes regarding work activities potentially impacting water quality, Ecology directed Orion to observe more stringent requirements to implement protective measures. These included: (1) Turbidity curtains were to be deployed continuously, regardless of water quality; (2) If winds were blowing from the north (strong northerly winds could cause turbidity to migrate from the site, which turbidity curtains might not fully manage in certain conditions), the effect on water quality needed to be evaluated and additional measures had to be taken to ensure water quality, stopping work if necessary; (3) Land-based equipment was not allowed to contact waters of the bay; at a minimum, a 1-foot buffer zone was to be maintained between the edge of the water and land-based work; and (4) Construction of the protective spit was to take place only at low tide. These measures were employed through the completion of construction.

5.6.2 Construction Progress Surveys

The contractor was required to perform progress surveys at specific stages of the work for Ecology's review and approval. Topographic and hydrographic surveys were completed to control the work, verify compliance with contract documents, and to accompany contractor payment requests. At a minimum, progress surveys were to be completed at these stages of work:

- Before construction to confirm baseline conditions.
- After completion of excavation and dredging but before backfilling. These surveys were used to confirm that specified target depths had been achieved.
- After placement of backfill material but before construction of any in-water improvements.
- After completion of placement of fill material for the jetty softening, jetty extension, protective spit, and any other offshore areas where fill was placed waterward of the OHW line up to the water surface elevation. These surveys were used to confirm that specified grades and layer thicknesses had been achieved.

Specific progress survey results are discussed in the construction detail sections above. The pre-construction survey, post-excavation/dredging progress surveys, and post-construction survey and as-built drawings are provided in Appendix A.

5.6.3 Forage Fish Monitoring

In accordance with the NWP-38 granted for the Phase II work, Hart Crowser monitored forage fish activity along the site's shoreline weekly during construction. In order to meet the requirements of the Endangered Species Act and for the protection of surf smelt, a qualified biologist had to confirm that no surf smelt were spawning in the project area. If no spawning activity was observed, then the work could continue unrestricted for the week. However, if viable surf smelt eggs were found, the spawning area would be off limits to any work between +4 and +9 feet MLLW and generally the length of the monitoring transect. Monitoring results are summarized in the Hart Crowser forage fish monitoring reports provided in Appendix G.

Five monitoring transects were established along the site's shoreline, which were monitored weekly. Surf smelt eggs were frequently observed, but typically varied in condition. Viable eggs were detected soon after in-water construction began in mid-July and, therefore, work was temporarily prohibited in those sections of the shoreline.

In late July, the Washington State Department of Fish and Wildlife (WDFW) visited the site to observe the surf smelt spawning areas. Based on the observations made and considering the habitat benefits that the remedial action would provide, WDFW granted full shoreline access to allow efficient and timely completion of the construction work. However, WDFW required that a highly viable spawning area just outside of the project limit at the south end of the site be protected and monitored. Forage fish monitoring along the site's shoreline continued through the construction period to observe and document spawning activity. With the authorization of WDFW, work would not be restricted regardless of whether spawning was occurring.

5.7 Deviations from Plans and Specifications

Several design modifications that deviated from the plans and specifications were made as the work progressed during Phase II construction. These design modifications were made to adapt design elements to existing or unanticipated conditions, to increase efficiency, or to improve construction methodology. The deviations from plans and specifications are discussed in detail in the respective construction element sections above and are summarized as follows:

- **Excavation Boundary Changes.** The excavation extent along the wetland mitigation area was adjusted eastward to protect the structural integrity of the cobble berm and was straightened south of the berm to accommodate changes in topography. In addition, a portion of the excavation extent north of the former Wetland E excavation area was extended westward to allow for additional removal of wood waste and timber piling. (See Section 5.3 and the as-built drawings in Appendix A.)
- **Jetty Extension Construction Methodology.** With conditional approval from CHE, Orion used a "bomb bay box" to construct the interior of the jetty extension (Section 5.5.1). Use of the bomb bay box allowed for bulk placement of armor stone to construct the core of the jetty extensions, which was a more efficient method than selective single stone placement. The exterior of the jetty extension was still constructed using selective placement of armor stone to achieve specified requirements.
- **Slope of the Protective Spit.** The progress survey results for the protective spit indicated that the toe of the spit along its northern edge did not meet the design specifications, being steeper than the design slope (Section 5.5.2). Because land-based equipment was required to maintain a minimum buffer zone of 1 foot from the water's edge (Section 5.6.1), equipment was not able to reach portions of the lower extremity of the spit during work performed at low tide. Ecology deemed the construction of the protective spit complete and informed Orion that no further action was needed.
- **Additional Material for the Protective Spit.** Additional fill material (fish/habitat mix and cobble/gravel mix) was added to the low-elevation area where the protective spit meets the shoreline, per Ecology's request (Section 5.5.2). This was done to raise the spit's elevation at that location to prevent potential washout during high tides or winter storms.
- **Cobble/Gravel Mix Cleanliness.** The cobble/gravel mix used to construct the protective spit did not meet specified requirements for cleanliness (a thin layer of fines coated the cobble surfaces) (Section 5.5.2). The material was accepted for use with the requirement that turbidity be closely monitored during material placement to ensure compliance with water quality criteria.
- **Southern Backfilling Extent.** A localized area in the southern portion of the site was not completely backfilled because of difficult accessibility, which measured approximately 60 feet by 15 feet and was located in the easternmost extent of the dredged area south of the protective spit (Section 5.4.3). The location proved difficult to access using land-based equipment due to underlying unstable substrate. From the water, the location was difficult to access by barge because of its proximity to the protective spit and Ecology's thin-layer capping study area. Ecology

authorized Orion to leave the section unfilled, anticipating that it will become filled over time from the natural redistribution of the placed backfill material.

- **Southern Shoreline Armoring Expanded.** Based on field observations during construction, CHE modified the design of the shoreline armoring area south of the cobble berm to extend erosion protection approximately 24 feet farther to the south (Section 5.5.5). Additionally, the upper extent of the armored area was modified during construction to fit existing topographic conditions. Because of localized irregularities in the escarpment that ran along the upper reach of the planned armoring area, the armoring material was placed to where it reached the escarpment and could tie in with the existing grade, with the upper extent of armoring reaching a minimum upper elevation of 11 feet MLLW.
- **Dunegrass Planting Areas.** Several modifications were made to the location and extent of the dunegrass planting area along the site's shoreline (Section 5.5.6). A beach sand planting strip and dunegrass were added to the protective spit, which were not included in the original design (Section 5.5.2). The planting strip between the protective spit and the bulkhead area to the north was moved to higher elevation for protection from high tides and storm surge. The planting area on the cobble berm at the wetland mitigation area was modified to not extend beyond the footprint of the berm (Section 5.5.4).
- **Berm Breach Channel.** Ecology directed Orion and Scarsella to deepen the channel of the breach that was cut through the cobble berm at the wetland mitigation area. The channel was cut below the design depth to assure that the wetland area pond drains completely at low tide to prevent stranding fish in shallow, isolated water in the pond area (Section 5.5.4).
- **Settlement Survey Markers.** Orion's surveyor (PSE) recommended an alternative survey marker type (1/2-inch reinforcement bar) for installation on the jetty extension and protective spit for monitoring settlement (Sections 5.5.1 and 5.5.2). The recommended marker type was accepted as a suitable alternative.
- **Bulkhead Area Excavation.** Review of the excavation progress survey for the bulkhead area indicated that much of the excavation on the bulkhead had not attained the specified target depth of 6 feet. Approximately 1 to 2 feet of additional material needed removal to attain target depth, which varied by location on the bulkhead area. Ecology deemed that the current excavation depth was sufficient, stipulating that the excavated area had to be able to accommodate placement of clean materials with a minimum layer thickness of 2 feet to attain design grades for softening the bulkhead area shoreline (Section 5.5.3).
- **Bulkhead Area Backfilling and Shoreline Softening.** The backfilling progress survey completed in the softened bulkhead area indicated that elevations in certain areas and the slope at the toe of the structure did not meet design specifications (Section 5.5.3). Ecology directed Orion to move excess material on the bulkhead to the sections of the toe that were steeper than design, and to add additional fish/habitat mix where elevations were lower than design. Ecology indicated that Scarsella should perform the corrections to the best of their abilities within safety and permit limitations during low tide, and then the bulkhead softening construction would be considered complete.

6.0 SEDIMENT DOCUMENTATION SAMPLING AND ANALYSIS

The purpose of documentation sampling and analysis was to characterize the concentration of dioxins/furans (polychlorinated dibenzodioxin/furan congeners) remaining in the sediment beneath the intertidal and subtidal sediment removal areas after dredging and excavation work was completed. Dioxins/furans were detected in all of the samples collected, with TECs ranging from 0.120 pg/g (picograms per gram or parts per trillion) at sample location SS-36 to 192 pg/g at location SS-17.

Table 2 summarizes the laboratory analytical results for the collected samples, and Figure 6 shows the final sample locations. Sample location coordinates and depths are provided in Table 3. The chemical data quality review and full laboratory report packages are provided in Appendix F. The laboratory report packages are provided only on compact disc due to large file size and high page count.

Forty sediment sampling points were selected throughout the dredging and excavation areas for analysis of polychlorinated dioxin/furan congeners, as outlined in the Sampling and Analysis Plan (SAP) (Hart Crowser 2013d). Hart Crowser provided sample coordinates to Orion before dredging and excavation work began. Orion uploaded the subtidal coordinates to their dredge tracking software, which allowed the dredge operator to see the sample point locations in real time on an onboard display. Orion's surveyor (Pacific Surveying & Engineering, Inc.) located and marked the intertidal excavation area sample points with survey stakes.

Orion accommodated sediment sampling in the aquatic area by providing transport and access to the dredging barge and using the barge to collect sediment for sampling from the target location in the dredging prism floor. Sediment was collected using the dredging bucket (either a clamshell or enclosed environmental bucket). The sediment was either deposited on the barge's deck or a crewmember pulled a small volume of sediment from the dredging bucket using a shovel, from which Ecology's representative processed and collected the sample for laboratory analysis. Where target depths had been achieved in the intertidal excavation area, Ecology's representative collected sediment samples either directly from the excavation floor or from the excavator bucket. Sediment samples were collected and processed using a decontaminated stainless steel spoon and bowl. Non-disposable sampling equipment was decontaminated after each sampling event.

Most of the samples were collected at the locations proposed in the SAP (see Table 3). However, two of the sample point locations (SS-27 and SS-37) in the intertidal area were modified in the field due to missing stakes and limited accessibility due to the conditions at the time of sampling. Efforts were made in the field to relocate the sample points as close as possible to the original locations.

7.0 POST-CONSTRUCTION ACTIVITIES

7.1 Upland Grading

A portion of the upland area that resided at lower elevation was filled to raise the grade to prevent inundation during high tides or storm surges. This work was performed as an add-on to the Phase II construction work, authorized by Ecology through a change order from Orion, and completed near the end of the Phase II construction schedule. The fill placement design was provided from GBH and approved by the City of Anacortes.

The planned target elevation for the upland fill area was approximately +12 to +12.5 feet NAVD88. The low-elevation area that was raised was bounded by the wetland buffer area fence at its south end and by the stormwater swale constructed in Phase I on its west side. Because the existing upland grade climbed toward the north, fill was placed northward until it tied in with surrounding grade at the target elevation. Along the shoreline, fill material was transitioned up from the OHW line at a slope of approximately 3H:1V to 4H:1V until it attained target elevation. The dunegrass planting strip was installed at the top of the transition (see Section 5.5.6). Finished elevations are shown in the post-construction as-built drawings in Appendix A.

Approximately 8,702 tons of gravel borrow were imported, placed, and roller compacted in the upland fill area (Table 1). Additionally, concrete removed from the bulkhead area (Section 5.2.2) was reused as fill material in the upland area (approximately 800 CY). The concrete was broken into smaller chunks and placed in the depression of the former temporary stockpile area, which appeared to be the lowest part of the upland area to be filled. The size of the broken concrete was not to be greater than one half of the placement layer thickness. Where broken concrete was used, the concrete layer was to be completely covered with imported fill, leaving no voids, and no thicker than 50 percent of the total fill layer thickness.

7.2 Status of Public Site Access

A public access point to the shoreline was established at Rotary Park during Phase II construction. At Ecology's request, however, beach access will remain temporarily closed to the public as a precaution to protect the new dunegrass plantings and to allow the planted areas to establish and stabilize.

The access point was constructed at the direction of the City of Anacortes over a former access location at the park by rearranging existing boulders and filling with fish/habitat mix. The fill material was sloped up from the beach to the existing grade at the park to create an even, accessible slope. The shoreline armoring area (Section 5.5.5) and beach sand planting strip (Section 5.5.6) terminate immediately north of the access point.

Chain-link fencing will be temporarily installed to restrict public access at the south end of the site, extending southward from the existing site fence and running along Rotary Park and the Tommy Thompson Trail. Ecology estimates that the temporary fencing will be in place for approximately 2 years. GBH and the City of Anacortes will coordinate the installation of the temporary fencing.

7.3 Post-Construction Monitoring

Following completion of the Phase II interim remedial action, post-construction monitoring will be conducted per the Conservation Measures and Monitoring Plan (CMMP; Hart Crowser 2012a) prepared for the Custom Plywood Site to satisfy the requirements of the NWP-38. The monitoring effort was designed to evaluate the effectiveness of the interim action at protecting, restoring, and enhancing the shoreline, including intertidal and subtidal habitats, eelgrass habitat, wetland habitat, and ecological functions. In addition, groundwater will be monitored in the six wells (MW-1 through MW-6) installed during the Phase I upland interim action to satisfy MTCA compliance monitoring requirements. Performance monitoring will be conducted for a minimum of 10 years after remediation is completed; however, the current schedule has been establish only through June 2016 because of contract limitations.

Specific monitoring tasks include:

- Physical monitoring consisting of topographic surveying and visual observation of the jetty extension, protective spit, and beach profiles, conducted annually.
- Epibenthic zooplankton and juvenile salmonid surveys and grain size analysis, conducted annually.
- Continued forage fish surveys for sand lances and surf smelt, with increased monitoring during peak spawning periods.
- Wetland monitoring for all vegetation within the buffer zones and monitoring of newly planted dunegrass along the beach, conducted annually.
- Eelgrass monitoring in the planned planting area and the thin-layer cap pilot study area, conducted annually. Advanced eelgrass planting (approximately 2,000 square feet) in the dredged/backfilled area will be conducted in June 2014.
- Groundwater monitoring of the six upland wells for diesel- and heavy-oil-range petroleum hydrocarbons, dissolved metals (arsenic, cadmium, copper, lead, nickel, and zinc), total mercury, and carcinogenic polycyclic aromatic hydrocarbons, conducted semiannually in 2014 and annually thereafter.

Forage fish monitoring along the site's shoreline continued after completing Phase II construction but on a less frequent basis. The monitoring frequency from November 2013 through February 2014 was reduced to a monthly schedule. Forage fish monitoring reports through February 2014 are provided in Appendix G.

8.0 LIMITATIONS

Work for this project was performed, and this report prepared, in general accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of the Washington State Department of Ecology for specific application to the Custom Plywood Site. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

9.0 REFERENCES

AMEC 2011. Remedial Investigation Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by AMEC Geomatrix, Inc., for GBH Investments and Washington State Department of Ecology. September 2011.

Hart Crowser 2011a. Feasibility Study Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. September 2011.

Hart Crowser 2011b. Upland Remediation (Phase I) Cleanup Action Plan for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. September 2011.

Hart Crowser 2011c. Upland Remediation (Phase I) Engineering Design Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. September 2011.

Hart Crowser 2012a. Final Conservation Measures and Monitoring Plan, Custom Plywood Interim Action Phase II, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. August 15, 2012.

Hart Crowser 2012b. Final Construction Completion Report, Phase I Upland Interim Remedial Action, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. October 22, 2012.

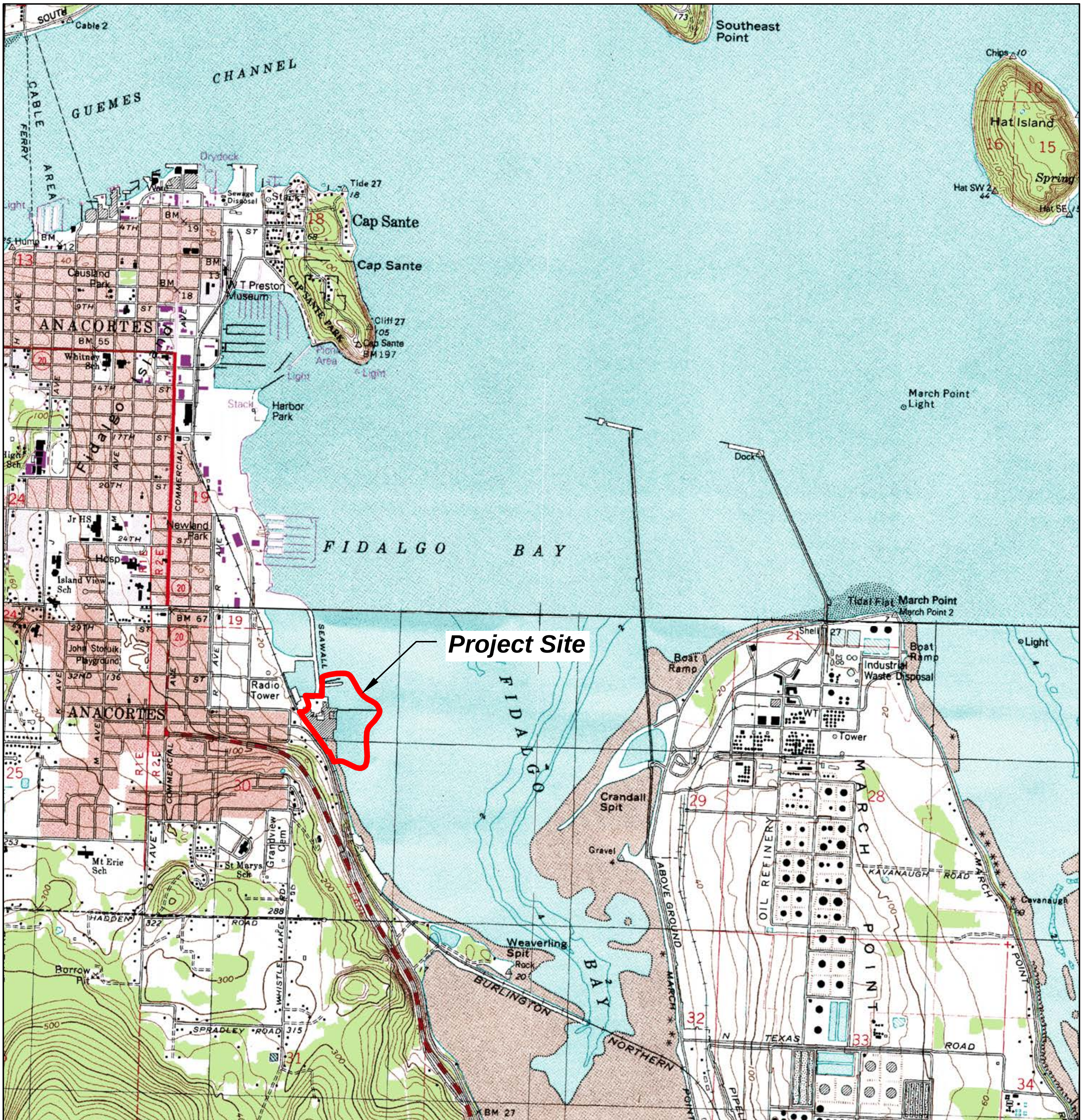
Hart Crowser 2013a. Final Phase II Interim Intertidal and Selected Subtidal Remedial Action, Interim Action Work Plan, Cleanup Action Plan and Engineering Design Report, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. February 2013.

Hart Crowser 2013b. Phase II Interim Intertidal and Selected Subtidal Remedial Action, Water Quality Monitoring Plan, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. March 2013.

Hart Crowser 2013c. Interim Action – Phase II Remediation Geotechnical Recommendations, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. March 7, 2013.

Hart Crowser 2013d. Sampling and Analysis Plan, Phase II Interim Remedial Action, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser, Inc., for the Washington State Department of Ecology. July 25, 2013.

L:\Jobs\1780040\CCR\Final\Final CCR.docx



Source: Base map prepared from USGS 7.5-Minute Series Topographic Map, Anacortes North and Anacortes South Quadrangles.

N

0 0.5 1

Scale in Miles

Custom Plywood Site
Anacortes, Washington

Vicinity Map

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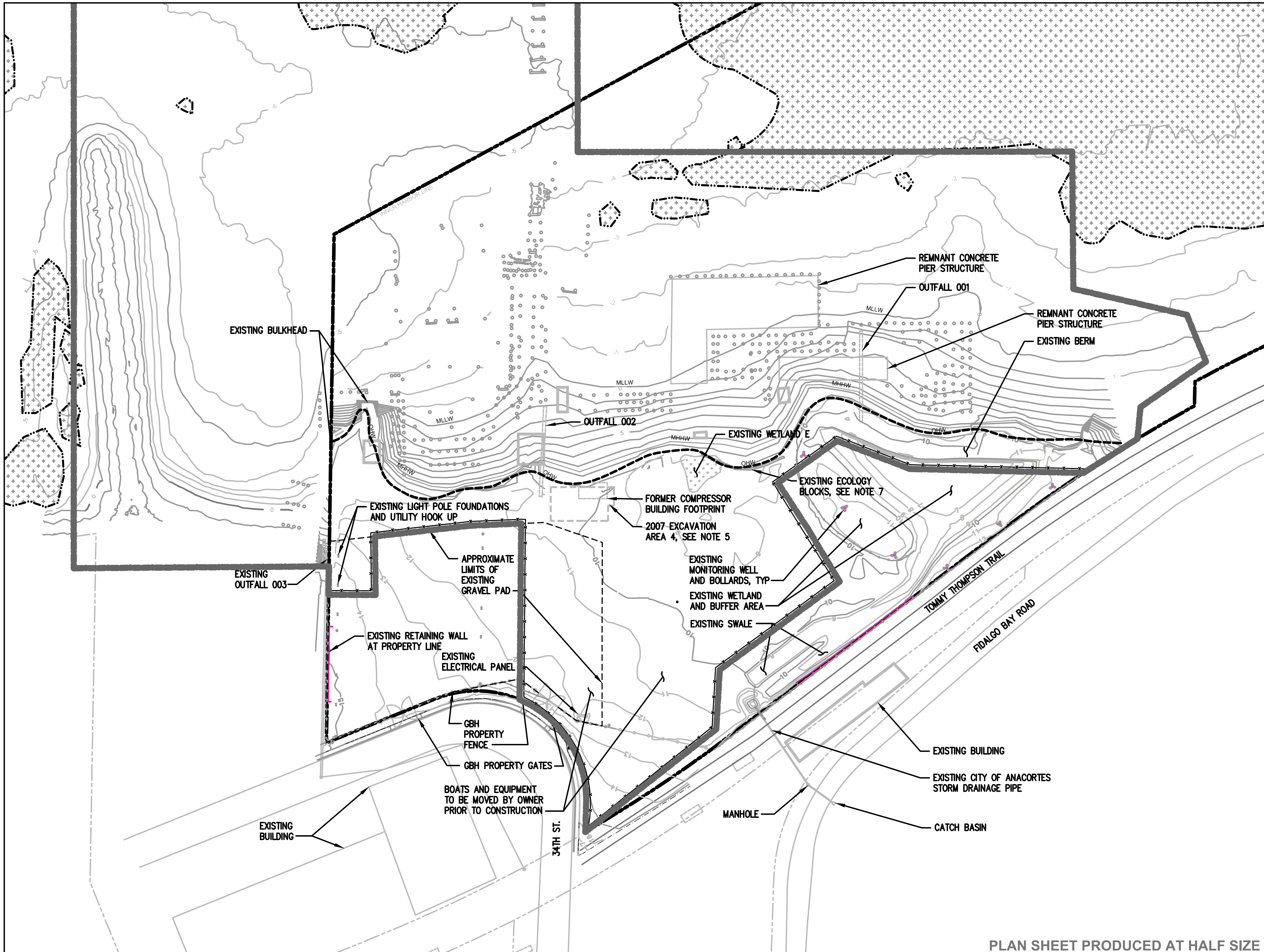
Figure

1

JAB 05/7/14 1780040-001 (Vicinity Map).dwg



NOTES:

1. THIS PLAN IS INTENDED TO ILLUSTRATE THE EXISTING CONDITIONS ON THIS PROPERTY THAT WAS PART OF THE FORMER CUSTOM PLYWOOD MILL WHICH WAS DESTROYED BY FIRE IN 1992. HISTORICAL FEATURES, FORMER TANK LOCATIONS AND REMNANT CONCRETE FOUNDATIONS & STRUCTURES REMAINING AFTER PHASE I ACTIVITIES ARE SHOWN FOR REFERENCE. A PREVIOUS EXCAVATION AREA FROM 2007 IS ALSO SHOWN. FOR FURTHER INFORMATION ON THESE FEATURES, SEE AMEC GEOMATRIX (2010) FIRST DRAFT REMEDIAL INVESTIGATION (RI) REPORT AND OTHER INFORMATION AVAILABLE AS AN APPENDIX TO THE SPECIFICATIONS.
2. PROJECT LIMITS FOR THIS PROJECT ARE AS SHOWN ON DRAWING G1.1. GENERALLY ALL EXCAVATION AND DREDGING WILL OCCUR BELOW THE ORDINARY HIGH WATER (OHW).
3. OHW LINE, MHHW LINE AND MLLW LINE SHOWN ARE APPROXIMATE. SEE DRAWING C1.0 FOR OHW LINE WORK RESTRICTIONS.
4. PILES SHOWN IN THESE DRAWINGS WERE LOCATED FROM AN AERIAL PHOTOGRAPH. LOCATIONS ARE APPROXIMATE. CONTRACTOR SHOULD EXPECT TO ENCOUNTER ADDITIONAL PILES THROUGHOUT THE SITE.
5. PREVIOUS 2007 EXCAVATION DEPTH WAS APPROXIMATELY 9.0'. BACKFILLED WITH BANK RUN AND 6" OF ROAD BALLAST.
6. SEE DRAWING G1.5 FOR APPROXIMATE LIMITS OF PHASE 1 – UPLAND REMEDIATION EXCAVATION PERFORMED IN FALL 2011.
7. ECOLOGY BLOCKS MAY BE FOUND ELSEWHERE ALONG THE OHW LINE. BLOCKS TO BE REMOVED BY OTHERS PRIOR TO CONSTRUCTION.

LEGEND:

- PROPERTY LINE
- PROJECT LIMIT LINE
- OHW — ORDINARY HIGH WATER (SEE NOTE 6)
- MHHW — MEAN HIGHER HIGH WATER
- MLLW — MEAN LOWER LOW WATER
- EXISTING FENCE
- STORM DRAIN LINE
- HISTORICAL FEATURE (SEE NOTE 1)
- HISTORICAL CONCRETE FOUNDATION (SEE NOTE 1)
- EXISTING WETLAND
- APPROX LIMITS OF 2007 EXCAVATIONS (SEE NOTE 5)
- MONITORING WELL AND BOLLARDS
- EXISTING EELGRASS
- EXISTING PILE/STRUCTURE

PLAN SHEET PRODUCED AT HALF SIZE

N

60' 0 60' 120'

SCALE: 1"=60'

PRE-CONSTRUCTION CONDITIONS

1"=60'

Source: Drawing No. G1.3 Existing Conditions Plan prepared by KPFF Consulting Engineers, dated 3/4/13.

Custom Plywood Site
Anacortes, Washington

Pre-Construction Conditions

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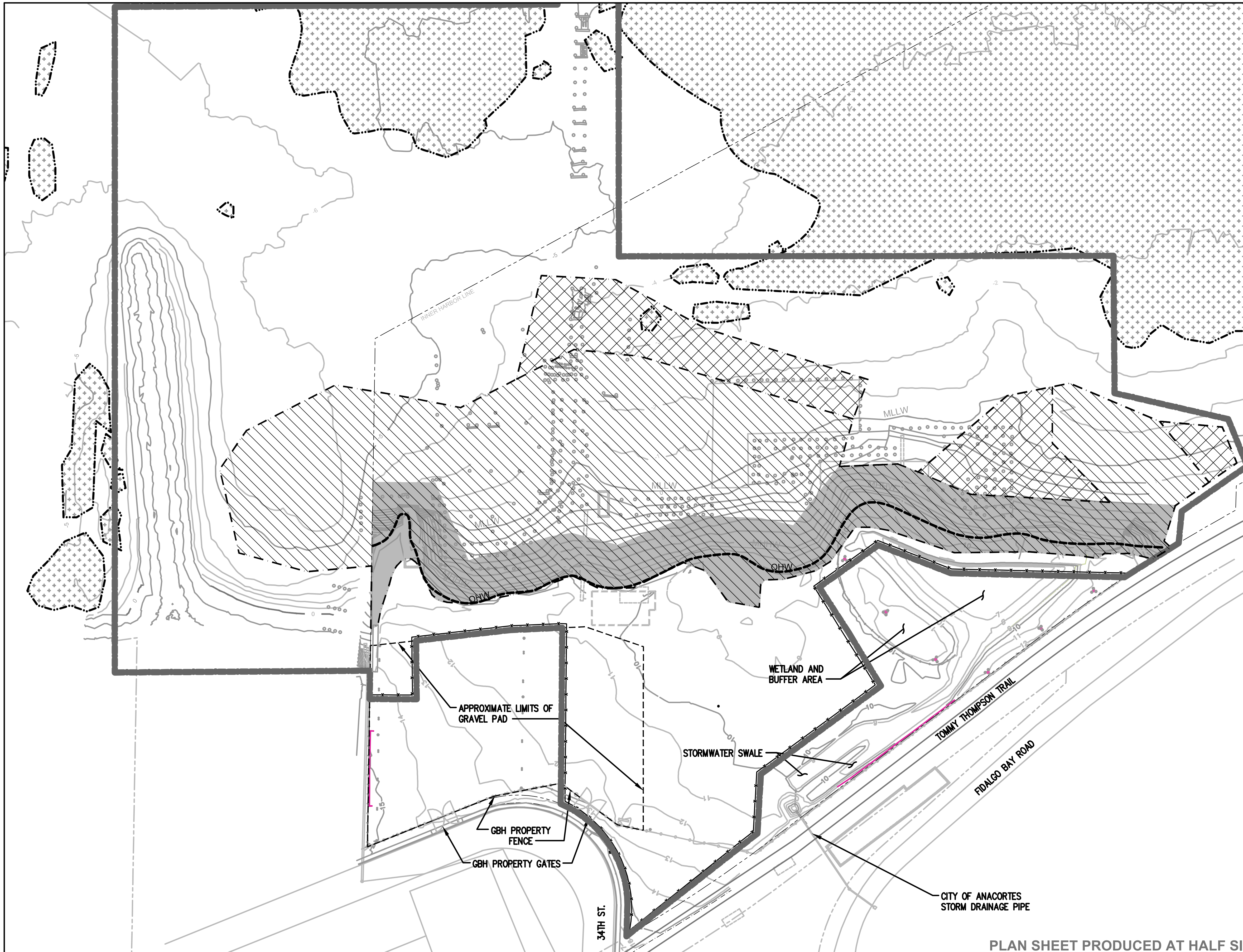
Figure **2**

JAB 05/7/14 1780040-002 (Pre-Construction).dwg



NOTES:

1. THIS PLAN IS INTENDED TO IDENTIFY THE GENERAL REMEDIAL EXCAVATION AND DREDGING LIMITS AS INDICATED IN CAP/EDR DOCUMENTS.
2. SEE APPENDIX A FOR AS-BUILT EXCAVATION AND DREDGING LIMITS.

LEGEND:

- EXCAVATION/DREDGING LIMITS
- PROPERTY LINE
- PROJECT LIMIT LINE
- HIGH-VISIBILITY FENCE
- OHW — ORDINARY HIGH WATER
- MHHW — MEAN HIGHER HIGH WATER
- MLLW — MEAN LOWER LOW WATER
- FENCE
- STORM DRAIN LINE
- MONITORING WELL AND BOLLARDS
- INTERTIDAL SHORELINE REMEDIAL AREA
- 2-FT DEPTH REMEDIAL AREA
- 6-FT DEPTH REMEDIAL AREA
- EELGRASS
- PILE/STRUCTURE

PLAN SHEET PRODUCED AT HALF SIZE

N

60' 0 60' 120'

SCALE: 1"=60'

EXCAVATION AND DREDGING PLAN

1"=60'

Custom Plywood Site
Anacortes, Washington

Excavation and Dredging Plan

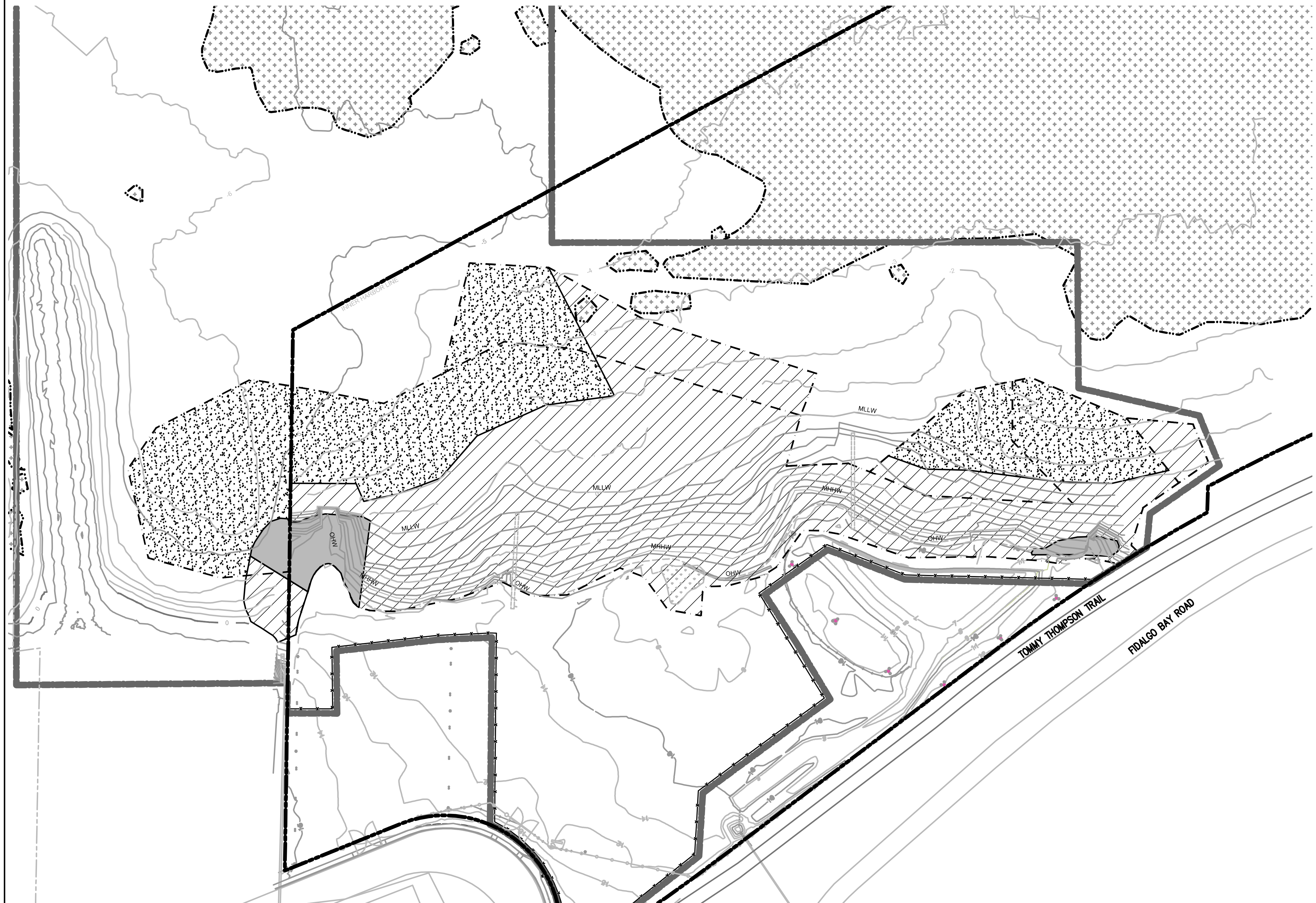
17800-40 (CCR) 5/14

HARTCROWSER

Figure **3**

Source: Drawing No. G1.2 Remedial Design Plan prepared by KPFF Consulting Engineers, dated 3/4/13.

JAB 05/7/14 1780040-003 (Exc-Dredge).dwg



LEGEND:

- SAND BACKFILL
- FISH / HABITAT MIX
- COBBLE/GRAVEL MIX
- EXCAVATION/DREDGING LIMITS
- OHW — ORDINARY HIGH WATER (OHW)
- HIGH-VISIBILITY FENCE
- PROJECT LIMIT LINE
- MHHW — MEAN HIGHER HIGH WATER
- MLLW — MEAN LOWER LOW WATER

NOTES:

1. 0.5 FT OF SAND BACKFILL SHALL BE PLACED ALONG ENTIRE BEACH BETWEEN ELEVATIONS +4 AND +9 FT MLLW.

BACKFILLING PLAN

1"=60'

PLAN SHEET PRODUCED AT HALF SIZE

N

60' 0 60' 120'

SCALE: 1"=60'

Custom Plywood Site
Anacortes, Washington

Backfilling Plan

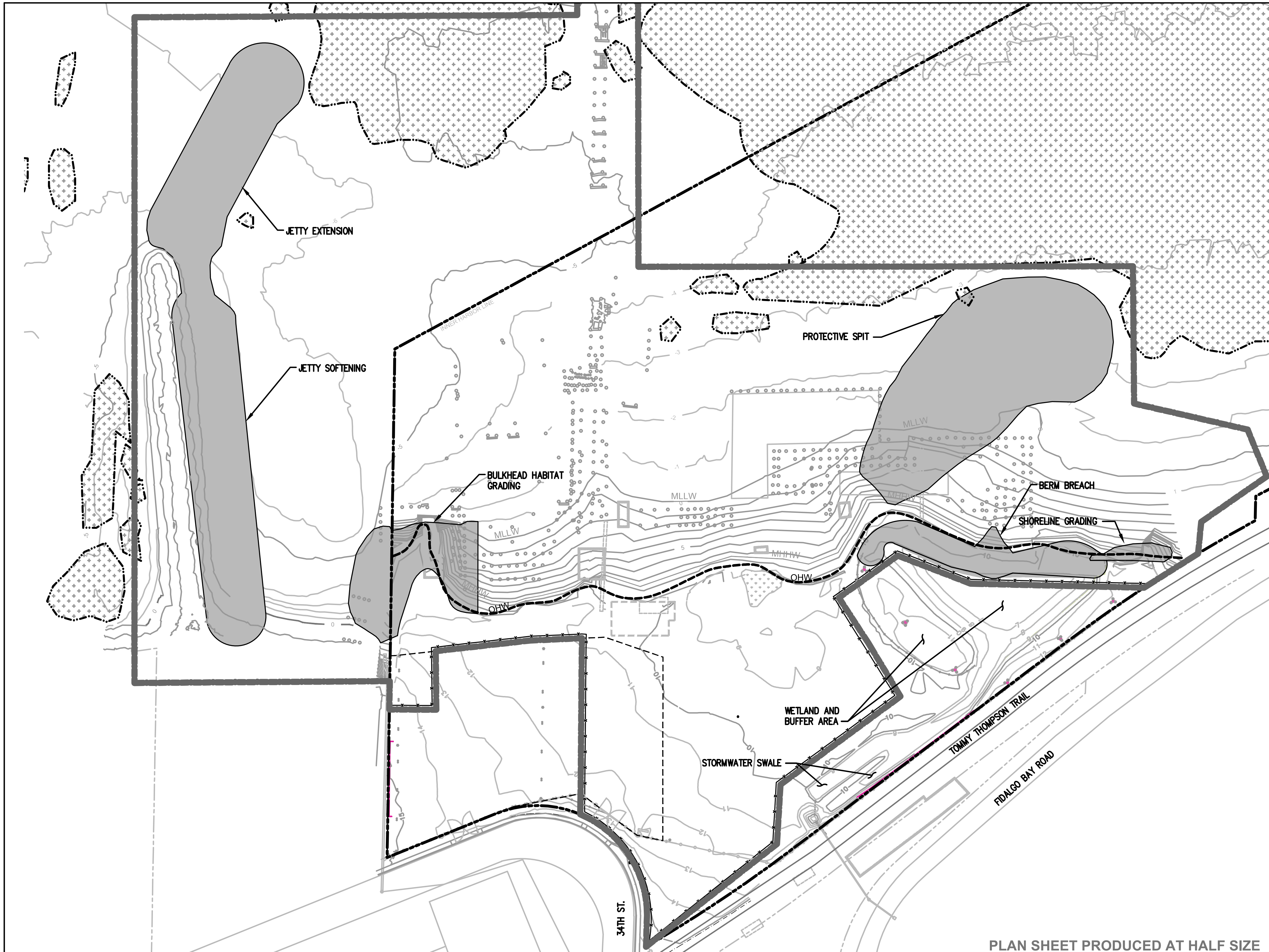
17800-40 (CCR) 5/14

HARTCROWSER

Figure **4**

JAB 05/7/14 1780040-004 (Backfill).dwg

Source: Drawing No. C4.0 Backfill Plan prepared by KPFF Consulting Engineers, dated 3/4/13.



NOTES:

1. THIS PLAN IS INTENDED TO IDENTIFY THE MAJOR FEATURES TO BE CONSTRUCTED AFTER THE COMPLETION OF ALL DEMOLITION, REMEDIAL EXCAVATION/ DREDGING AND BACKFILL ACTIVITIES HAVE OCCURED IN EACH AREA. FEATURES INCLUDE A JETTY EXTENSION, BULKHEAD HABITAT GRADING, A PROTECTIVE SPIT, AND A BREACH IN THE EXISTING BERM.

LEGEND:

- PROPERTY LINE
- PROJECT LIMIT LINE
- HIGH-VISIBILITY FENCE
- OHW — ORDINARY HIGH WATER
- MHHW — MEAN HIGHER HIGH WATER
- MLLW — MEAN LOWER LOW WATER
- FENCE
- STORM DRAIN LINE
- MONITORING WELL AND BOLLARDS
- EELGRASS
- PILE/STRUCTURE

SHORELINE PROTECTION AND ENHANCEMENT FEATURES

1"=60'

PLAN SHEET PRODUCED AT HALF SIZE

N

60' 0 60' 120'

SCALE: 1"=60'

Custom Plywood Site
Anacortes, Washington

Shoreline Protection and Enhancement Features

17800-40 (CCR) 5/14

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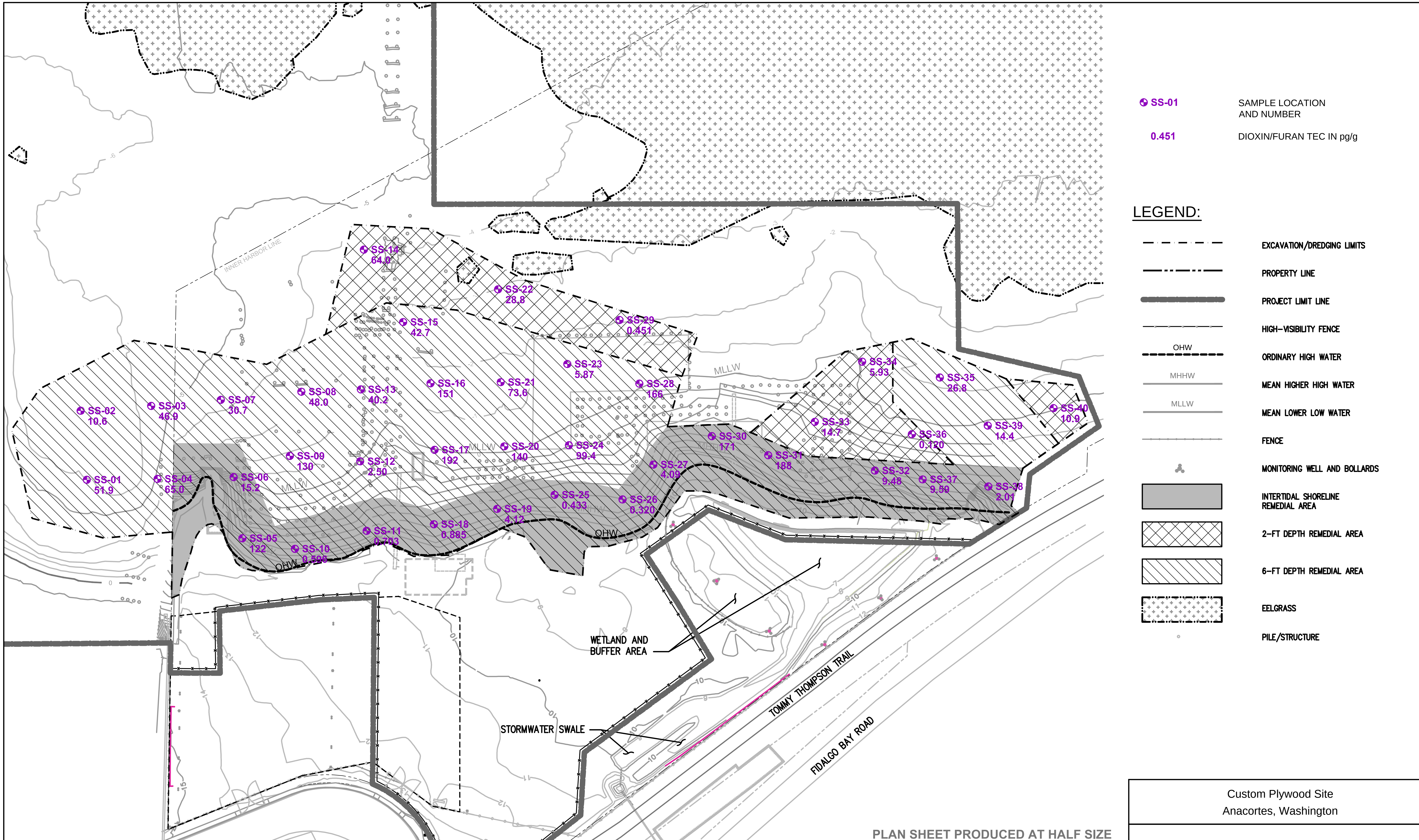
Figure 5

Source: Drawing No. G1.1 Site Plan prepared by KPFF Consulting Engineers, dated 3/4/13.

JAB 05/7/14 1780040-005 (Shore Protect).dwg



PLAN SHEET PRODUCED AT HALF SIZE

N

50' 0 50' 100'

SCALE: 1"=50'

SEDIMENT DOCUMENTATION SAMPLE DIOXIN/FURAN TECs

1"=50'

Source: Drawing No. G1.2 Remedial Design Plan prepared by KPFF Consulting Engineers, dated 3/4/13.

Custom Plywood Site
Anacortes, Washington

Sediment Documentation Sample Dioxin/Furan TECs

17800-40 (CCR) 5/14

HARTCROWSER

Figure
6

JAB 05/7/14 1780040-006 (Samples).dwg

Table 1 - Imported and Exported Material Quantities Summary

Imported Materials		
Material	**Quantity**	**Unit**
Fish/Habitat Mix	63,522	tons
Sand Backfill	33,175	tons
Bedding Stone	4,131	tons
Armor Stone	9,875	tons
Cobble/Gravel Mix	14,012	tons
Beach Sand	1,257	tons
Gravel Borrow	8,702	tons

Exported Materials		
Material	**Quantity**	**Unit**
Excavated Sediment	15,394	CY
Dredged Sediment	29,600	CY
Excavated/Dredged Sediment	51,591	tons
Removed Timber Piles	1,465	each
Removed Timber Piles	1,213	tons

Table 2 - Sediment Documentation Sample Analytical Results

Sample ID	SS-01-2013-08-05	SS-02-2013-08-06	SS-03-2013-07-24	SS-04-2013-07-26	SS-05-2013-12-07	SS-06-2013-12-06
Sampling Date	8/5/2013	8/6/2013	7/24/2013	7/26/2013	12/7/2013	12/6/2013
Total Solids in %	42.4	46.9	46.2	43.0	35.3	22.6
Dioxins/Furans in pg/g						
2,3,7,8-TCDD	1.5	0.776 U	1.89	2.84	3.73	1.73 U
1,2,3,7,8-PeCDD	9.45	3.4	11.1	13.7	27	5.41
1,2,3,4,7,8-HxCDD	10.7	3.15	11.2	11.6	33.3	2.23
1,2,3,6,7,8-HxCDD	61.1	11.6	56.9	59.7	125	7.13
1,2,3,7,8,9-HxCDD	23.2	6.25	24.7	23.1	59.6	4.66
1,2,3,4,6,7,8-HpCDD	1540	235	1260	2040	4440	114
OCDD	10900 E	1630	8980 E	23600	33300 E	752
2,3,7,8-TCDF	5.18	1.94	4.8	9.45	10.7	12.1
1,2,3,7,8-PeCDF	3.35 JL	1.25 JL	3.8 JL	6.84 JL	10.3 JL	10 JL
2,3,4,7,8-PeCDF	6.19	1.68	5.4	9.46	14.1	9.64
1,2,3,6,7,8-HxCDF	8.44	2.14	7.57	8.99	14.5	7.04
1,2,3,7,8,9-HxCDF	3.94	0.71 T	2.89	5.94	10.1	2.03
1,2,3,4,7,8-HxCDF	16.7	2.96 JL	11.8 JL	18.5	28.8	8.55
2,3,4,6,7,8-HxCDF	16.3	3.15	13.6	14.7	12.4 U	4.2
1,2,3,4,6,7,8-HpCDF	489	60.1	305	244	389	34.1
1,2,3,4,7,8,9-HpCDF	21.6	3.3 U	15.9	14	22.3	2.95
OCDF	2270	204	1030	688	1090	95.4
Total TCDD	80.5 J	55.8 J	138 J	198	185 J	127 J
Total PeCDD	118	62.4 J	185 J	186	339	111
Total HxCDD	462	135	500	635	2180	128
Total HpCDD	3090	492	2470	6300	13800	291
Total TCDF	52.9 J	30.8 J	64 J	122 J	170 J	227 J
Total PeCDF	125 J	34.8 J	117 J	150 J	243 J	139 J
Total HxCDF	411 J	64.3 J	315 J	373 J	854 J	78.5
Total HpCDF	1820 J	183 J	968	840	1480 J	92.4
TEC - 1/2 MRL	**51.9**	**11.0**	**46.9**	**65.0**	**123**	**16.0**
TEC - Detections only	**51.9**	**10.6**	**46.9**	**65.0**	**122**	**15.2**

Table 2 - Sediment Documentation Sample Analytical Results

Sample ID	SS-07-2013-08-09	SS-08-2013-09-17	SS-09-2013-09-16	SS-10-2013-08-30	SS-11-2013-08-29	SS-12-2013-09-25
Sampling Date	8/9/2013	9/17/2013	9/16/2013	8/30/2013	8/29/2013	9/25/2013
Total Solids in %	29.1	39.9	24.0	19.8	16.8	43.3
Dioxins/Furans in pg/g						
2,3,7,8-TCDD	1.52	1.65	3.5	0.153 U	0.291 U	0.341 U
1,2,3,7,8-PeCDD	8.33	10.1	23.7	0.38 T	0.385 T	0.888 T
1,2,3,4,7,8-HxCDD	8.81	10.3	25.9	0.362 U	0.538 U	0.595 U
1,2,3,6,7,8-HxCDD	34.3	55.8	173	0.589 T	0.662 T	2.9
1,2,3,7,8,9-HxCDD	18.9	22.7	56.5	0.706 U	0.967 T	1.26
1,2,3,4,6,7,8-HpCDD	719	1450	4170	13.4	13.2	59.5
OCDD	4900 E	10600 E	28900	77.5	70.7	430
2,3,7,8-TCDF	4.12	4.75	10	0.184 U	0.335 U	0.9 T
1,2,3,7,8-PeCDF	3.1 JL	3.84	8.89	0.166 U	0.255 U	0.515 T
2,3,4,7,8-PeCDF	4.35	6.88	19.4	0.153 U	0.269 U	0.627 U
1,2,3,6,7,8-HxCDF	6.85	7.51	20.3	0.104 U	0.189 U	0.473 T
1,2,3,7,8,9-HxCDF	1.51	2.47	7.73	0.123 U	0.233 U	0.317 T
1,2,3,4,7,8-HxCDF	7.64	13.9	45.9	0.104 U	0.189 U	0.89 T
2,3,4,6,7,8-HxCDF	8.46	7.14	19.5	0.11 U	0.189 U	0.433 U
1,2,3,4,6,7,8-HpCDF	158	331	959	1.01 U	2.32 U	16.4
1,2,3,4,7,8,9-HpCDF	6.82	15.2	39.8	0.153 U	0.276 U	0.952 T
OCDF	394	1450	3230	0.693 U	6.24 T	67.5
Total TCDD	137 J	124 J	132 J	1.58 J	0.697 J	10.5 J
Total PeCDD	160	162 J	246 J	3.33 J	3.08 J	14.8 J
Total HxCDD	369 J	483	1430	10.5 J	11 J	79.2 J
Total HpCDD	1460	3140	9650	34.6	30.7	169
Total TCDF	64.1 J	76.7 J	167 J	0.391 J	0.335 U	16.9 J
Total PeCDF	84.9 J	116 J	331 J	0.207 J	0.269 U	8.69 J
Total HxCDF	173 J	341 J	1280 J	0.639 J	1.29 J	23.1 J
Total HpCDF	385	1150 J	3190 J	1.44 J	6.17 J	65.5 J
TEC - 1/2 MRL	**30.7**	**48.0**	**130**	**0.789**	**0.989**	**2.81**
TEC - Detections only	**30.7**	**48.0**	**130**	**0.596**	**0.703**	**2.50**

Table 2 - Sediment Documentation Sample Analytical Results

Sample ID	SS-13-2013-09-17	SS-14-2013-09-12	SS-15-2013-09-16	SS-16-2013-09-25	SS-17-2013-09-25	SS-18-2013-08-29
Sampling Date	9/17/2013	9/12/2013	9/16/2013	9/25/2013	9/25/2013	8/29/2013
Total Solids in %	56.4	45.6	28.3	32.1	23.0	17.4
Dioxins/Furans in pg/g						
2,3,7,8-TCDD	1.06	1.81 U	1.37	3.75	7.42	0.239 U
1,2,3,7,8-PeCDD	5.76	11	8.31	27.7	40.9	0.542 T
1,2,3,4,7,8-HxCDD	7.01	11.6	8.76	34.4	36.9	0.57 T
1,2,3,6,7,8-HxCDD	48.3	88.5	56.1	198	243	0.641 U
1,2,3,7,8,9-HxCDD	14.5	27	20.2	72.6	85.8	0.93 T
1,2,3,4,6,7,8-HpCDD	1520	1970	1420	4870	5730	10.9
OCDD	10200 E	12800	10400 E	35800	46000 E	59 U
2,3,7,8-TCDF	3.16	4.35	3.34	8.09	14	0.507 T
1,2,3,7,8-PeCDF	3.49	3.56	2.27 JL	7.47	10.5	0.479 T
2,3,4,7,8-PeCDF	5.81	8.03	4.1	13.8	16.6	0.225 U
1,2,3,6,7,8-HxCDF	13.4	10.4	5.97	22.1	24.4	0.169 U
1,2,3,7,8,9-HxCDF	3.36	4.04	1.74	7.35	5.91	0.155 U
1,2,3,4,7,8-HxCDF	6.1	23.1	11.4	39.9	43.7	0.127 U
2,3,4,6,7,8-HxCDF	4.71	21.9	6.87 U	41.4	39	0.19 T
1,2,3,4,6,7,8-HpCDF	277	669	325	1130	1590	0.415 U
1,2,3,4,7,8,9-HpCDF	13.7	29.3	11.8	48.3	53	0.183 U
OCDF	1200	3070	979	3760	4370	0.915 U
Total TCDD	41 J	106 J	59.6	254 J	349	7.17 J
Total PeCDD	78.3	141 J	82.3	359	443 J	7.27 J
Total HxCDD	590	591 J	345	1420	1550	14.1 J
Total HpCDD	5710 J	3790	2650	9440	10900	30.4
Total TCDF	40.7 J	73 J	60.3 J	164 J	279	4.65 J
Total PeCDF	101 J	166 J	95.1 J	302 J	331 J	0.818 J
Total HxCDF	381 J	687 J	305 J	1210 J	1500 J	0.896 J
Total HpCDF	1070 J	2410 J	855 J	3280	4350	0.75 J
TEC - 1/2 MRL	**40.2**	**65.0**	**43.1**	**151**	**192**	**1.10**
TEC - Detections only	**40.2**	**64.0**	**42.7**	**151**	**192**	**0.885**

Table 2 - Sediment Documentation Sample Analytical Results

Sample ID	SS-19-2013-08-22	SS-20-2013-10-09	SS-21-2013-10-09	SS-22-2013-10-08	SS-23-2013-10-09	SS-24-2013-10-16
Sampling Date	8/22/2013	10/9/2013	10/9/2013	10/8/2013	10/9/2013	10/16/2013
Total Solids in %	37.4	31.0	48.0	45.6	39.0	31.9
Dioxins/Furans in pg/g						
2,3,7,8-TCDD	0.899 U	10.9	3.52	1.14 U	0.873 U	3.7
1,2,3,7,8-PeCDD	1.99	52.5	15.3	6.17	1.97	20.8
1,2,3,4,7,8-HxCDD	1 U	40.1	18.1	6.22	1.22	18.2
1,2,3,6,7,8-HxCDD	1.53 U	132	98.4	38.2	5.22	114
1,2,3,7,8,9-HxCDD	1.25 U	72	31.7	13.6	2.13	43.9
1,2,3,4,6,7,8-HpCDD	10.4 U	2250	2070	822	102	2870
OCDD	51.5 U	14400	15200	5760 E	662	21600
2,3,7,8-TCDF	5.91	25	6.82	3.44	3.68	9.34
1,2,3,7,8-PeCDF	3.49 JL	19.6 JL	4.96	2.27	1.62	7.42 JL
2,3,4,7,8-PeCDF	2.28	27.2	9.21	4.05	1.72	12
1,2,3,6,7,8-HxCDF	2.23	24.5	10.3	4.68	1.04	16.1
1,2,3,7,8,9-HxCDF	0.799 T	6.23	4.24	2.04	0.379 U	6.05
1,2,3,4,7,8-HxCDF	2.41	27.6 JL	20.3	9.25	1.81	28.6
2,3,4,6,7,8-HxCDF	1.43 T	30.1	20.9	9.99	1.29	13.1 J
1,2,3,4,6,7,8-HpCDF	4.95	426	476	227	42.4	922 J
1,2,3,4,7,8,9-HpCDF	0.806 T	20.1	25.1	12.1	1.33	40.8
OCDF	8.78	1280	1800	930	148	4480
Total TCDD	52.4 J	1230	149	71 J	52.2 J	235 J
Total PeCDD	35.4	1290	176	88.7	39.2 J	310
Total HxCDD	30.1 J	1770 J	662	314	51.8 J	986
Total HpCDD	21.5	4220	4190	1770	209	6260
Total TCDF	71.3 J	561 J	144 J	54.9 J	73.1 J	165 J
Total PeCDF	31.6 J	398 J	177 J	75.7 J	25.6 J	218 J
Total HxCDF	14.9 J	582	667 J	278	40.5 J	1020 J
Total HpCDF	9.75	1260	1670	818	128	3400 J
TEC - 1/2 MRL	**4.82**	**140**	**73.6**	**29.4**	**6.33**	**99.4**
TEC - Detections only	**4.12**	**140**	**73.6**	**28.8**	**5.87**	**99.4**

Table 2 - Sedment Documentation Sample Analytical Results

Sample ID	SS-25-2013-08-21		SS-26-2013-08-20		SS-27-2013-08-20		SS-28-2013-10-16		SS-29-2013-10-15		SS-30-2013-08-19	
Sampling Date	8/21/2013		8/20/2013		8/20/2013		10/16/2013		10/15/2013		8/19/2013	
Total Solids in %	23.6		15.9		22.8		48.0		56.9		37.4	
Dioxins/Furans in pg/g												
2,3,7,8-TCDD	0.747	U	0.76	U	0.678	U	2.4		0.227	U	3.84	
1,2,3,7,8-PeCDD	0.708	U	0.736	U	1.34	U	17.5		0.278	T	30	
1,2,3,4,7,8-HxCDD	0.315	U	0.57	U	0.96	U	21.5		0.224	T	36.9	
1,2,3,6,7,8-HxCDD	0.455	U	1.38	U	6.25		240		0.598	U	231	
1,2,3,7,8,9-HxCDD	0.461	U	1.07	U	2.33	U	59.9		0.502	T	86.4	
1,2,3,4,6,7,8-HpCDD	3.59	U	32.7	U	131		5990		10.4	U	5100	
OCDD	14.6	U	262		1030		38900		64.9	U	40600	
2,3,7,8-TCDF	1.84	T	0.694	T	1.8	T	5.07		0.244	T	4.32	
1,2,3,7,8-PeCDF	0.916	U	0.43	U	0.851	U	6.15		0.146	U	6.47	
2,3,4,7,8-PeCDF	0.798	T	0.207	T	0.644	T	21.2		0.0837	T	12	
1,2,3,6,7,8-HxCDF	0.309	U	0.207	U	1.04	T	20.7		0.111	T	31.7	
1,2,3,7,8,9-HxCDF	0.0955	U	0.19	U	0.506	U	11.7		0.0319	U	10.8	
1,2,3,4,7,8-HxCDF	0.315	U	0.165	U	1.33	T	70.4		0.146	U	43.1	
2,3,4,6,7,8-HxCDF	0.197	U	0.165	U	1.98	T	20.2		0.124	U	60	
1,2,3,4,6,7,8-HpCDF	0.927	T	9.55		87.8		1980	J	3.54	J	1720	
1,2,3,4,7,8,9-HpCDF	0.197	U	0.529	U	3.64	U	81.2		0.183	U	90.7	
OCDF	2.22	U	47		517		9010		13.9		6840	
Total TCDD	19.3	J	8.44	J	26.9	J	142	J	3.96	J	69.1	J
Total PeCDD	12.7	J	8.26	J	18.8	J	161	J	3.47	J	153	
Total HxCDD	9.41	J	17.9	J	46.3	J	1280	J	6.9	J	1310	
Total HpCDD	7.19		70.9		261		11700		23.4		12000	
Total TCDF	28.2	J	6.71	J	30.3	J	91.7	J	5.06	J	85.2	J
Total PeCDF	9.34	J	3.4	J	13.2	J	302	J	1.22	J	376	J
Total HxCDF	2.32	J	5.71	J	62	J	1900	J	4.01	J	1610	J
Total HpCDF	2.13	J	30.7	J	352	J	7480		12.3	J	6430	J
TEC - 1/2 MRL	**1.30**		**1.43**		**5.32**		**166**		**0.674**		**171**	
TEC - Detections only	**0.433**		**0.320**		**4.09**		**166**		**0.451**		**171**	

Table 2 - Sediment Documentation Sample Analytical Results

Sample ID	SS-31-2013-08-19	SS-32-2013-08-06	SS-33-2013-08-07	SS-34-2013-09-19	SS-35-2013-09-14	SS-36-2013-08-05
Sampling Date	8/19/2013	8/6/2013	8/7/2013	9/19/2013	9/14/2013	8/5/2013
Total Solids in %	24.5	63.2	16.9	64.1	47.1	57.8
Dioxins/Furans in pg/g						
2,3,7,8-TCDD	2.51 U	0.617 U	0.134 UJ	0.345 U	0.951 T	0.288 U
1,2,3,7,8-PeCDD	11.2	2.43	2.01 JT	1.44	4.77	0.207 U
1,2,3,4,7,8-HxCDD	14	1.84	1.17 UJ	1.39	5.3	0.117 U
1,2,3,6,7,8-HxCDD	261	11	20.9 J	7.66	37.5	0.139 U
1,2,3,7,8,9-HxCDD	40.9	3.85	5.03 J	3.13	12	0.175 U
1,2,3,4,6,7,8-HpCDD	6750	251	476 J	173	821	1.2
OCDD	48800	1920	2500 J	1170	5600 E	7.23
2,3,7,8-TCDF	4.92	1.01	0.299 UJ	0.721 T	1.97	0.67 T
1,2,3,7,8-PeCDF	4.58 JL	0.837 JTL	1.72 UJ	0.474 JTL	1.48 JL	0.25 JTL
2,3,4,7,8-PeCDF	8.93	1.54	1.43 JT	0.829 T	2.96	0.235 U
1,2,3,6,7,8-HxCDF	19.4	1.76	2.2 JT	1.04 U	4.13	0.0775 U
1,2,3,7,8,9-HxCDF	12.9	0.87 T	1.44 JT	0.45 T	1.67	0.0477 U
1,2,3,4,7,8-HxCDF	45.4	3.75	3.02 JT	2.01	9.06	0.0934 T
2,3,4,6,7,8-HxCDF	54.5	2.91	2.17 UJ	1.1 U	4.44	0.0755 U
1,2,3,4,6,7,8-HpCDF	3850	65.6	301 J	51.9	229	0.171 U
1,2,3,4,7,8,9-HpCDF	122	4.19	9.16 J	2.61	12.2	0.0338 U
OCDF	22900	257	1390 J	224	911	0.223 T
Total TCDD	86.7 J	37.2 J	7.55 J	13.5 J	73.2 J	8.14 J
Total PeCDD	128	36.6	22.5 J	18.3 J	75.6 J	4.37 J
Total HxCDD	1620 J	94.3 J	454 J	60.2 J	258 J	3.1 J
Total HpCDD	13300	467	813 J	348	1470	2.58
Total TCDF	71.9 J	16.7 J	7.89 J	11.3 J	34.5 J	10.3 J
Total PeCDF	209 J	26.2 J	9.82 J	17.8 J	67 J	2.77 J
Total HxCDF	2540	72.6 J	186 J	53.9 J	249 J	0.416 J
Total HpCDF	15300	235	1160 J	175	802 J	0.413 J
TEC - 1/2 MRL	**189**	**9.79**	**15.0 J**	**6.21**	**26.8**	**0.413**
TEC - Detections only	**188**	**9.48**	**14.7 J**	**5.93**	**26.8**	**0.098**

Table 2 - Sediment Documentation Sample Analytical Results

Sample ID	SS-37-2013-08-14		SS-38-2013-08-02		SS-39-2013-09-14		SS-40-2013-09-14	
Sampling Date	8/14/2013		8/2/2013		9/14/2013		9/14/2013	
Total Solids in %	52.2		71.5		58.0		77.2	
Dioxins/Furans in pg/g								
2,3,7,8-TCDD	0.639	T	0.24	U	0.622	U	0.412	U
1,2,3,7,8-PeCDD	2.01		0.509	T	3.11		2.29	
1,2,3,4,7,8-HxCDD	1.88	U	0.453	T	3.09		2.22	
1,2,3,6,7,8-HxCDD	10.9		2.37		17.1		13.9	
1,2,3,7,8,9-HxCDD	4.87		0.998		7.04		5.53	
1,2,3,4,6,7,8-HpCDD	286		49.5		381		311	
OCDD	2320		320		2560		2050	
2,3,7,8-TCDF	1.18		0.156	U	1.66		0.716	T
1,2,3,7,8-PeCDF	0.714	U	0.222	U	1.81		0.795	U
2,3,4,7,8-PeCDF	0.817	U	0.321	T	2.94		1.61	
1,2,3,6,7,8-HxCDF	1.55		0.547	T	3.64		2.32	
1,2,3,7,8,9-HxCDF	0.67	T	0.156	U	1.41		0.992	T
1,2,3,4,7,8-HxCDF	2.41		0.976	T	5.73		4.24	
2,3,4,6,7,8-HxCDF	3.36		0.872	T	3.43		2.12	
1,2,3,4,6,7,8-HpCDF	73		16.4		123		98.8	
1,2,3,4,7,8,9-HpCDF	5.57		1.21		7.63		5.72	
OCDF	337		64.4		630		467	
Total TCDD	23.9	J	3.58	J	25.3	J	12.6	J
Total PeCDD	25.7	J	6.71	J	54.3		28.7	J
Total HxCDD	88.3	J	30.7	J	182		132	
Total HpCDD	491		95.5		717		583	
Total TCDF	19.5	J	2.25	J	29.9	J	13	J
Total PeCDF	19.9	J	6.4	J	53.7	J	31.5	J
Total HxCDF	80.6	J	19.5	J	141		103	J
Total HpCDF	269	J	57.5		457		346	
TEC - 1/2 MRL	**9.81**		**2.15**		**14.7**		**11.1**	
TEC - Detections only	**9.59**		**2.01**		**14.4**		**10.9**	

U = Not detected at the reporting limit indicated.
J = Estimated value.
T = Value is between the EDL and RL.
JL = The analyte was positively identified and the value may be less than the reported estimate.
JTL = The value may be less than the reported result, which is below the reporting limit.
E = Estimated concentration calculated for an analyte response above the valid instrument calibration range.

Table 3 - Sediment Documentation Sample Location Coordinates and Depths

Sample Point	Coordinates		Depth (ft)
	Northing	Easting	
SS-01	550524.1358	1211943.569	5.6
SS-02	550530.9938	1212020.845	6.3
SS-03	550452.0278	1212026.268	6.0
SS-04	550444.9785	1211944.543	6.1
SS-05	550349.8862	1211878.106	4.0
SS-06	550359.7321	1211946.516	4.0
SS-07	550374.0076	1212033.072	6.1
SS-08	550283.8227	1212042.137	6.1
SS-09	550296.7698	1211970.294	6.1
SS-10	550291.0356	1211866.299	6.0
SS-11	550210.776	1211886.35	6.0
SS-12	550217.9638	1211964.238	5.7
SS-13	550217.2658	1212044.716	3.7
SS-14	550213.8556	1212201.207	2.0
SS-15	550169.8567	1212120.142	6.1
SS-16	550139.2062	1212051.613	6.0
SS-17	550134.6992	1211977.073	6.0
SS-18	550135.4781	1211893.794	6.0
SS-19	550064.6176	1211910.993	6.0
SS-20	550056.5994	1211980.99	6.3
SS-21	550060.6312	1212052.831	6.0
SS-22	550063.537	1212156.836	4.0
SS-23	549986.0104	1212073.171	5.2
SS-24	549984.2984	1211982.187	6.2
SS-25	550000.2855	1211926.754	6.0
SS-26	549924.1896	1211921.514	6.0
SS-27	549889.6332	1211960.53	6.0
SS-28	549905.3675	1212051.183	0.6
SS-29	549927.569	1212122.411	2.2
SS-30	549824.1584	1211992.375	6.0
SS-31	549761.0814	1211971.051	6.0
SS-32	549641.625	1211953.844	8.0
SS-33	549708.9071	1212008.446	2.0
SS-34	549655.8374	1212075.795	4.0
SS-35	549568.8235	1212058.025	0.8
SS-36	549600.2206	1211994.554	2.2
SS-37	549588.1005	1211943.997	4.5
SS-38	549514.5006	1211936.074	4.2
SS-39	549515.1475	1212004.246	2.0
SS-40	549441.5699	1212023.781	0.5

Notes:
Coordinate datum: Washington State Plane North, NAD83/91, US feet.
Sample depths are relative to pre-construction grade and are approximate. Sample depths were estimated using dredged area floor elevations provided by the contractor at the time of dredging/sampling and surveyed pre-construction grade elevations.

APPENDIX A
Survey and As-Built Drawings

APPENDIX B
Piling Removal Summary

APPENDIX C
Selected Site Photographs

APPENDIX D
Hart Crowser Daily Field Reports

APPENDIX E
Off-Site Disposal and Import Scale Ticket Summary

Sediment Export Scale Ticket Summary

Timber Piling Export Scale Ticket Summary

Import Scale Ticket Summary

APPENDIX F
Chemical Data Quality Review and Laboratory Reports
Analytical Resources, Inc.

APPENDIX F
CHEMICAL DATA QUALITY REVIEW AND LABORATORY REPORTS

F.1 Chemical Data Quality Review for Sediment Documentation Samples

Forty sediment documentation samples were collected during implementation of the Phase II interim remedial action and submitted for batch analysis at Analytical Resources, Inc. (ARI), in Tukwila, Washington. Six batches were submitted and analyzed under ARI job numbers XA61, XC36, XG26, XJ93, XO78, and XQ93, with a laboratory report received for each batch. The chemical data quality review is organized in chronological order by ARI job number for the six lab reports that were received.

Analytical Methods and Validation Procedure

Samples were prepared and analyzed for dioxins/furans by EPA Method 1613B.

Quality assurance/quality control (QA/QC) reviews of laboratory procedures were performed on an ongoing basis by the laboratory. Hart Crowser performed an EPA Stage 4 validation. Data review followed the format outlined in the National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review modified to include specific criteria of the analytical method. The following criteria were evaluated in the validation process:

- Sample Preservation and Holding Times;
- Sample Reporting Limits;
- Mass Calibration and Resolution;
- Window Defining Mixture Analysis;
- Instrument Stability;
- Ongoing Precision and Recovery (OPR) Analysis;
- Analyte Identification Criteria;
- Method Blanks;
- Labeled Isotope (Surrogate) Recoveries;
- Internal Standard (IS) and Cleanup Standard Recoveries; and
- Standard Reference Material (SRM) recoveries.

Data were determined to be acceptable for use as qualified.

F.2 ARI Laboratory Job Number XA61

Nine surface sediment samples were collected from the dredged/excavated area at the Custom Plywood site between July 24 and August 9, 2013. The samples were transported to ARI Laboratory, in Tukwila, Washington, for analysis.

Sample Preservation and Holding Time

Sediment samples were preserved by refrigeration and were received by the laboratory in good condition. Samples were extracted and analyzed within holding time limits.

Sample Reporting Limits

Laboratory reporting and detection limits were acceptable. Sample extraction volumes were increased to adjust for low total solids values. Reported detection limits and analytical results were adjusted for any required dilution factors.

Detections that fell between the estimated detection limit (EDL) and the reporting limit (RL) were qualified as estimated (J) by ARI. The J qualifier was changed to T to be consistent with Washington State's EIM database.

Mass Calibration and Resolution

Mass spectrometer resolution was greater than 10,000 resolving power.

The laboratory uses an RTX-Dioxin 2 column rather than DB5 and DB225 columns to confirm 2,3,7,8-TCDF detections. A resolution test mixture was designed specifically for this column, consisting of 2,3,4,8-TCDF; 2,3,7,8-TCDF; and 3,4,6,7-TCDF to evaluate the minimum valley between isomers of 25 percent or less. The column met the valley resolution criteria.

Window Defining Mixture

The homolog window defining mixture was run and retention time windows were appropriately established.

Instrument Stability

The absolute RT of the first internal standard was greater than 25 minutes on the RTX-Dioxin 2 column.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Initial Calibration

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

Continuing Calibration Verification Checks (CCVs)

CCVs were performed at the proper frequency.

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits. Absolute RTs of the internal standards were within ±15 seconds of the RTs obtained during the initial calibration.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Ongoing Precision and Recovery Sample Results

An ongoing precision and recovery (OPR) sample was used to evaluate accuracy. Sample percent recoveries were within specified control limits.

Compound Identification

The laboratory reported EMPC or estimated maximum possible concentration values for one or more of the target analytes. An EMPC value is reported when a peak is detected but cannot meet identification criteria as required by the method; therefore, the result cannot be considered as positive identification for the analyte. To indicate that the reported result for an individual analyte is, in effect, an elevated detection limit, the EMPC values were qualified as not detected (U) at the reported values. EMPC values on total homolog groups were qualified as estimated (J).

Blank Contamination

MB-081513: The method blank had detections for the following analytes at concentrations between the EDL and the RL:

- 1,2,3,7,8-PeCDD
- 1,2,3,7,8,9-HxCDF
- 1,2,3,7,8,9-HxCDD

- 1,2,3,4,6,7,8-HpCDF
- OCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. The results for the analytes were evaluated and qualifiers updated as follows:

- Results that were less than five times the amount in the MB had the B qualifier changed to U:
  - SS-38-2013-08-02 [1,2,3,7,8,9-HxCDF]
  - SS-36-2013-08-05 [1,2,3,7,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
- Results that were greater than five times the amount in the MB had the B qualifier removed, if present:
  - SS-03-2013-07-24 [1,2,3,7,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
  - SS-04-2013-07-26 [1,2,3,7,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
  - SS-38-2013-08-02 [1,2,3,7,8-PeCDD; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
  - SS-01-2013-08-05 [1,2,3,7,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
  - SS-32-2013-08-06 [1,2,3,4,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
  - SS-02-2013-08-06 [1,2,3,4,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]
  - SS-07-2013-08-09 [1,2,3,4,8-PeCDD; 1,2,3,7,8,9-HxCDF; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDF]

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 2,3,7,8-TCDF
- 2,3,7,8-TCDD
- 1,2,3,7,8-PeCDF
- 2,3,4,7,8-PeCDF
- 1,2,3,4,7,8-HxCDF
- 1,2,3,6,7,8-HxCDF
- 1,2,3,4,7,8-HxCDD
- 1,2,3,4,6,7,8-HpCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. The B qualifier was removed from the following samples:

- SS-38-2013-08-02 [2,3,7,8-TCDF; 2,3,7,8-TCDD; 1,2,3,7,8-PeCDF; and 2,3,4,7,8-PeCDF]

- SS-36-2013-08-05 [2,3,7,8-TCDD; 1,2,3,7,8-PeCDF; 2,3,4,7,8-PeCDF; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF; 1,2,3,4,7,8-HxCDD; and 1,2,3,4,6,7,8-HpCDD]
- SS-32-2013-08-06 [2,3,7,8-TCDD]
- SS-02-2013-08-06 [2,3,7,8-TCDD]

MB-082213: The MB had detections for the following analytes that fell between the EDL and the RL:

- 1,2,3,4,7,8-HxCDD
- OCDD

The laboratory qualified detected results in the associated sample, SS-33-2013-08-07, with B. The results for OCDD and 1,2,3,4,7,8-HxCDD were greater than ten times the amount in the MB and the B qualifier was removed.

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 2,3,7,8-TCDD
- 1,2,3,7,8-PeCDF
- 1,2,3,4,6,7,8-HpCDF
- 1,2,3,4,6,7,8-HpCDD

The laboratory qualified detected results in the associated sample that were less than ten times the amount in the method blank with B. EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. The B qualifier was removed from the following sample:

- SS-33-2013-08-07 [1,2,3,7,8-PeCDF]

Stable Isotope Labeled Compound Recoveries

The labeled compound recoveries and ion abundance ratios were within control limits with the following exceptions:

- SS-33-2013-08-07: The recoveries failed low for ^{13}C-2,3,7,8-TCDD and ^{13}C-2,3,7,8-TCDF. The sample was re-extracted on August 22, 2013, with similar results, indicating a matrix effect. The sample results were reported from the original extraction on August 22, 2013, and the results for 2,3,7,8-TCDF and 2,3,7,8-TCDD were qualified as estimated (J).

Internal Standard and Cleanup Standard Recoveries

Internal standard and cleanup standard recoveries were acceptable with the following exception:

- SS-33-2013-08-07: The recovery failed low for ^{37}Cl-2,3,7,8-TCDD. The sample was re-extracted on August 22, 2013, with similar results, indicating a matrix effect. The sample results were reported from the original extraction on August 22, 2013, and all analytes were qualified as estimated (J).

Standard Reference Material Recovery

The Puget Sound SRM (SRS1137) was analyzed. Advisory acceptance limits are 50 to 150 percent recovery. The concentration for the following analyte was outside of the advisory acceptance range.

Analyte	Result	Percent Recovery	Advisory Recovery Range
1,2,3,7,8,9-HxCDF	0.931 T	182%	50 – 150%

Results were not qualified since ranges are currently advisory only.

Sample Qualifiers

Results for the following samples/analytes were qualified by the laboratory with an X due to interferences from chlorodiphenyl ethers. The X qualifiers were changed to JL (estimated).

Sample	Analyte
SS-03-2013-07-24	1,2,3,7,8-PeCDF 1,2,3,4,7,8-HxCDF
SS-04-2013-07-26	1,2,3,7,8-PeCDF
SS-36-2013-08-05	1,2,3,7,8-PeCDF
SS-01-2013-08-05	1,2,3,7,8-PeCDF
SS-32-2013-08-06	1,2,3,7,8-PeCDF
SS-02-2013-08-06	1,2,3,7,8-PeCDF 1,2,3,4,7,8-HxCDF
SS-07-2013-08-09	1,2,3,7,8-PeCDF
SRM-081513	1,2,3,7,8-PeCDF

Results for OCDD in the following samples were qualified by the laboratory with an E as the value reported was an estimated concentration above the instrument calibration range. The E qualifier was not changed.

- SS-03-2013-07-24
- SS-01-2013-08-05
- SS-07-2013-08-09

F.3 ARI Laboratory Job Number XC36

Seven surface sediment samples were collected from the dredged/excavated area at the Custom Plywood site between August 14 and 22, 2013. The samples were transported to ARI Laboratory, in Tukwila, Washington, for analysis.

Sample Preservation and Holding Time

The laboratory noted that sample receipt temperature was 7.3^{o}C, slightly above the 2 to 6^{o}C temperature specified in the SAP. Data were not qualified since samples were refrigerated prior to delivery to the lab and the slight short-duration temperature exceedance is not expected to alter dioxin concentrations. Samples were extracted and analyzed within holding time limits.

Sample Reporting Limits

Laboratory reporting and detection limits were acceptable. Reported detection limits and analytical results were adjusted for moisture content and any required dilution factors. The following samples contained less than 50 percent solids, resulting in elevated reporting limits.

- SS-37-2013-08-14
- SS-31-2013-08-19
- SS-30-2013-08-19
- SS-27-2013-08-20
- SS-26-2013-08-20
- SS-25-2013-08-21
- SS-19-2013-08-22

Detections that fell between the estimated detection limit (EDL) and the reporting limit (RL) were qualified as estimated (J) by ARI. The J qualifier was changed to T to be consistent with Washington State's EIM database.

Mass Calibration and Resolution

Mass spectrometer resolution was greater than 10,000 resolving power.

The laboratory uses an RTX-Dioxin 2 column rather than DB5 and DB225 columns to confirm 2,3,7,8-TCDF detections. A resolution test mixture was designed specifically for this column, consisting of 2,3,4,8-TCDF; 2,3,7,8-TCDF; and 3,4,6,7-TCDF to evaluate the minimum valley between isomers of 25 percent or less. The column met the valley resolution criteria.

Window Defining Mixture

The homolog window defining mixture was run and retention time windows were appropriately established.

Instrument Stability

The absolute RT of the first internal standard was greater than 25 minutes on the RTX-Dioxin 2 column.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Initial Calibration

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

Continuing Calibration Verification Checks (CCVs)

CCVs were performed at the proper frequency.

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits. Absolute RTs of the internal standards were within ±15 seconds of the RTs obtained during the initial calibration.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Ongoing Precision and Recovery Sample Results

An ongoing precision and recovery (OPR) sample was used to evaluate accuracy. Sample percent recoveries were within specified control limits.

Compound Identification

The laboratory reported EMPC or estimated maximum possible concentration values for one or more of the target analytes. An EMPC value is reported when a peak was detected but did not meet identification criteria as required by the method; therefore, the result cannot be considered as positive identification for the analyte. To indicate that the reported result for an individual analyte is, in effect, an elevated detection limit, the EMPC values were qualified as not detected (U) at the reported values. EMPC values on total homolog groups were qualified as estimated (J).

Blank Contamination

MB-082913: The method blank had detections for the following analytes at concentrations above the RL:

- 1,2,3,4,6,7,8-HpCDD
- OCDD

The method blank had detections for the following analytes at concentrations between the EDL and the RL:

- 2,3,7,8-TCDF
- 1,2,3,7,8-PeCDD
- 1,2,3,4,7,8-HxCDD
- 1,2,3,6,7,8-HxCDD
- 1,2,3,7,8,9-HxCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. The results for the analytes were evaluated and qualifiers updated as follows:

- Results that were less than five times the amount in the MB (ten times for OCDD), had the B qualifier changed to U:
  - SS-37-2013-08-14 [1,2,3,4,7,8-HxCDD]
  - SS-27-2013-08-20 [1,2,3,7,8-PeCDD; 1,2,3,4,7,8-HxCDD; and 1,2,3,7,8,9-HxCDD]
  - SS-26-2013-08-20 [1,2,3,7,8-PeCDD; 1,2,3,4,7,8-HxCDD; 1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; and 1,2,3,4,6,7,8-HpCDD]
  - SS-25-2013-08-21 [1,2,3,7,8-PeCDD; 1,2,3,4,7,8-HxCDD; 1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,6,7,8-HpCDD; and OCDD]
  - SS-19-2013-08-22 [1,2,3,4,7,8-HxCDD; 1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,6,7,8-HpCDD; and OCDD]

Results that were greater than five times the amount in the MB (ten times for OCDD) had the B qualifier removed, if present:

- SS-37-2013-08-14 [1,2,3,7,8-PeCDD and 1,2,3,7,8,9-HxCDD]
- SS-27-2013-08-20 [1,2,3,6,7,8-HxCDD and 1,2,3,4,6,,7,8-HpCDD]
- SS-26-2013-08-20 [2,3,7,8-TCDF and OCDD]
- SS-19-2013-08-22 [1,2,3,7,8-PeCDD]

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 1,2,3,4,6,7,8-HpCDF

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. The B qualifier was removed from the following samples:

- SS-25-2013-08-21 [1,2,3,4,6,7,8-HpCDF]

Stable Isotope Labeled Compound Recoveries

The labeled compound recoveries and ion abundance ratios were within control limits.

Internal Standard and Cleanup Standard Recoveries

Internal standard and cleanup standard recoveries were acceptable.

Standard Reference Material Recovery

The Puget Sound SRM (SRS1137) was analyzed. Advisory acceptance limits are 50 to 150 percent recovery. The concentration for the following analyte was outside the advisory acceptance range.

Analyte	Result	Percent Recovery	Advisory Recovery Range
OCDF	100	171%	50 – 150%

Results were not qualified since ranges are currently advisory only.

Sample Qualifiers

Results for the following samples/analytes were qualified by the laboratory with an X due to interferences from chlorodiphenyl ethers. The X qualifiers were changed to JL (estimated).

Sample	Analyte
SS-31-2013-08-19	1,2,3,7,8-PeCDF
SS-19-2013-08-22	1,2,3,7,8-PeCDF

F.4 ARI Laboratory Job Number XG26

Twelve surface sediment samples were collected from the dredged/excavated area at the Custom Plywood site between August 29 and September 19, 2013. The samples were transported to ARI Laboratory, in Tukwila, Washington, for analysis.

Sample Receiving Discrepancies

Samples SS-35-2013-09-14 and SS-40-2013-09-14: Sample identification on the jar lids did not match the sample name on the sample label. The laboratory was contacted and the correct sample identification was determined. The laboratory issued a revised report.

Sample SS-13-2013-09-17: The incorrect sampling time was written on the sample label and chain of custody. The correct sampling time was 14:32, and changes were made on associated documents.

Sample Preservation and Holding Time

Sediment samples were preserved by refrigeration and were received by the laboratory in good condition. Samples were extracted and analyzed within holding time limits.

Sample Reporting Limits

Laboratory reporting and detection limits were acceptable. Reported detection limits and analytical results were adjusted for moisture content and any required dilution factors. Sample extraction volumes were increased to adjust for low total solids values for several samples. Dry weight corrected sample extraction mass for the following samples was significantly lower than 10 grams due to the presence of sawdust and wood chips resulting in elevated reporting limits.

- SS-18-2013-08-29
- SS-11-2013-08-29
- SS-10-2013-08-30

Detections that fell between the estimated detection limit (EDL) and the reporting limit (RL) were qualified as estimated (J) by ARI. The J qualifier was changed to T to be consistent with Washington State's EIM database.

Mass Calibration and Resolution

Mass spectrometer resolution was greater than 10,000 resolving power.

The laboratory uses an RTX-Dioxin 2 column rather than DB5 and DB225 columns to confirm 2,3,7,8-TCDF detections. A resolution test mixture designed specifically for this column, consisting of 2,3,4,8-TCDF; 2,3,7,8-TCDF; and 3,4,6,7-TCDF to evaluate the minimum valley between isomers of 25 percent or less. The column met the valley resolution criteria.

Window Defining Mixture

The homolog window defining mixture was run and retention time windows were appropriately established.

Instrument Stability

The absolute RT of the first internal standard was greater than 25 minutes on the RTX-Dioxin 2 column.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Initial Calibration

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

Continuing Calibration Verification Checks (CCVs)

CCVs were performed at the proper frequency.

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits. Absolute RTs of the internal standards were within ±15 seconds of the RTs obtained during the initial calibration.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Ongoing Precision and Recovery Sample Results

An ongoing precision and recovery (OPR) sample was used to evaluate accuracy. Sample percent recoveries were within specified control limits.

Compound Identification

The laboratory reported EMPC or estimated maximum possible concentration values for one or more of the target analytes. An EMPC value is reported when a peak was detected but did not meet identification criteria as required by the method; therefore, the result cannot be considered as positive identification for the analyte. To indicate that the reported result for an individual analyte is, in effect, an elevated detection limit, the EMPC values were qualified as not detected (U) at the reported values. EMPC values on total homolog groups were qualified as estimated (J).

Blank Contamination

MB-092713: The method blank had detections for the following analytes at concentrations above the RL:

- OCDD

The method blank had detections for the following analytes at concentrations between the EDL and the RL:

- 1,2,3,6,7,8-HxCDD
- 1,2,3,7,8,9-HxCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. The results for the analytes were evaluated and qualifiers updated as follows:

- Results that were less than five times the amount in the MB (ten times for OCDD) had the B qualifier changed to U:
  - SS-18-2013-08-29 [OCDD]
  - SS-10-2013-08-30 [1,2,3,7,8,9-HxCDD]
- Results that were greater than five times the amount in the MB (ten times for OCDD) had the B qualifier removed, if present.:
  - SS-18-2013-08-29 [1,2,3,6,7,8-HxCDD and 1,2,3,7,8,9-HxCDD]
  - SS-11-2013-08-29 [OCDD, 1,2,3,6,7,8-HxCDD, and 1,2,3,7,8,9-HxCDD]
  - SS-10-2013-08-30 [OCDD and 1,2,3,6,,7,8-HxCDD]

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 1,2,3,4,6,7,8-HpCDF
- 1,2,3,4,6,7,8-HpCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. The B qualifier was removed from the following samples:

- SS-18-2013-08-29 [1,2,3,4,6,7,8-HpCDF and 1,2,3,4,6,7,8-HpCDD]
- SS-10-2013-08-30 [1,2,3,4,6,7,8-HpCDF and 1,2,3,4,6,7,8-HpCDD]
- SS-11-2013-08-29 [1,2,3,4,6,7,8-HpCDD]

Stable Isotope Labeled Compound Recoveries

The labeled compound recoveries and ion abundance ratios were within control limits.

Internal Standard and Cleanup Standard Recoveries

Internal standard and cleanup standard recoveries were acceptable.

Standard Reference Material Recovery

The Puget Sound SRM (SRS1137) was analyzed. All analyte recoveries met advisory limits.

Results for 2,3,7,8-TCDD were qualified as non-detected due to ion ratios outside method limits. Numerical values were within advisory recovery limits of 50 to 150 percent.

Sample Qualifiers

Results for 1,2,3,7,8-PeCDF in the following samples were qualified by the laboratory with an X due to interferences from chlorodiphenyl ethers. The X qualifiers were changed to JL (estimated).

- SS-35-2013-09-14
- SS-40-2013-09-14
- SS-15-2013-09-16
- SS-34-2013-09-19

Results for OCDD in the following samples were qualified by the laboratory with an E as the value reported was an estimated concentration above the instrument calibration range. The E qualifier was not changed.

- SS-08-2013-09-17
- SS-15-2013-09-16
- SS-13-2013-09-17

F.5 ARI Laboratory Job Number XJ93

Seven surface sediment samples were collected from the dredged/excavated area at the Custom Plywood site on September 25 and October 9, 2013. The samples were transported to ARI Laboratory, in Tukwila, Washington, for analysis.

Sample Preservation and Holding Time

Sediment samples were preserved by refrigeration and were received by the laboratory in good condition. Samples were extracted and analyzed within holding time limits.

Sample Extraction Notes

Sample SS-23-2013-10-09: Approximately 2 to 3 percent of the sample was lost during the extraction procedure. As the labeled compound recoveries were within control limits, sample results were not qualified.

Samples SS-17-2013-09-25; SS-16-2013-09-25; and SS-20-2013-10-09: Due to the color of the sample extracts, double acid volume was used on the columns during sample extraction. As the labeled compound recoveries and the cleanup standard recoveries were within control limits, sample results were not qualified.

Sample Reporting Limits

Laboratory reporting and detection limits were acceptable. Sample extraction volumes were increased to adjust for low total solids values. Reported detection limits and analytical results were adjusted for moisture content and any required dilution factors.

Detections that fell between the estimated detection limit (EDL) and the reporting limit (RL) were qualified as estimated (J) by ARI. The J qualifier was changed to T to be consistent with Washington State's EIM database.

Mass Calibration and Resolution

Mass spectrometer resolution was greater than 10,000 resolving power.

The laboratory uses an RTX-Dioxin 2 column rather than DB5 and DB225 columns to confirm 2,3,7,8-TCDF detects. A resolution test mixture was designed specifically for this column, consisting of 2,3,4,8-TCDF; 2,3,7,8-TCDF; and 3,4,6,7-TCDF to evaluate the minimum valley between isomers of 25 percent or less. The column met the valley resolution criteria.

Window Defining Mixture

The homolog window defining mixture was run and retention time windows were appropriately established.

Instrument Stability

The absolute RT of the first internal standard was greater than 25 minutes on the RTX-Dioxin 2 column.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Initial Calibration

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

Continuing Calibration Verification Checks (CCVs)

CCVs were performed at the proper frequency.

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits. Absolute RTs of the internal standards were within ±15 seconds of the RTs obtained during the initial calibration.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Ongoing Precision and Recovery Sample Results

An ongoing precision and recovery (OPR) sample was used to evaluate accuracy. Sample percent recoveries were within specified control limits.

Compound Identification

The laboratory reported EMPC or estimated maximum possible concentration values for one or more of the target analytes. An EMPC value is reported when a peak was detected but did not meet identification criteria as required by the method; therefore, the result cannot be considered as positive identification for the analyte. To indicate that the reported result for an individual analyte is, in effect, an elevated detection limit, the EMPC values were qualified as not detected (U) at the reported values. EMPC values on Total Homolog groups were qualified as estimated (J).

Blank Contamination

MB-102213: The method blank had detections for the following analytes at concentrations above the RL:

- 1,2,3,4,6,7,8-HpCDD
- OCDD

The method blank had detections for the following analytes at concentrations between the EDL and the RL:

- 1,2,3,7,8-PeCDD
- 1,2,3,4,7,8-HxCDF
- 1,2,3,4,7,8-HxCDD
- 1,2,3,7,8,9-HxCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. The results for the analytes were evaluated and qualifiers updated as follows:

- Results that were less than five times the amount in the MB (ten times for OCDD) had the B qualifier changed to U:
  - SS-12-2013-09-25 [1,2,3,4,7,8-HxCDD]
- Results that were greater than five times the amount in the MB (ten times for OCDD) had the B qualifier removed, if present:
  - SS-12-2013-09-25 [1,2,3,7,8-PeCDD and 1,2,3,7,8,9-HxCDD]
  - SS-23-2013-10-09 [1,2,3,4,7,8-HxCDD]

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 2,3,7,8-TCDF
- 2,3,7,8-TCDD
- 1,2,3,7,8-PeCDF
- 2,3,4,7,8-PeCDF
- 1,2,3,6,7,8-HxCDF
- 2,3,4,6,7,8-HxCDF
- 1,2,3,6,7,8-HxCDD
- 1,2,3,4,6,7,8-HpCDF
- 1,2,3,4,7,8,9-HpCDF
- OCDF

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. The B qualifier was removed from the following samples:

- SS-12-2013-09-25 [2,3,7,8-TCDD; 1,2,3,7,8-PeCDF; and 2,3,4,6,7,8-HxCDF]
- SS-22-2013-10-08 [2,3,7,8-TCDD]
- SS-23-2013-10-09 [2,3,7,8-TCDD]

Stable Isotope Labeled Compound Recoveries

The labeled compound recoveries and ion abundance ratios were within control limits.

Internal Standard and Cleanup Standard Recoveries

Internal standard and cleanup standard recoveries were acceptable.

Sample Qualifiers

Results for the following samples/analytes were qualified by the laboratory with an X due to interferences from chlorodiphenyl ethers. The X qualifiers were changed to JL (estimated).

Sample	Analyte
SS-20-2013-10-09	1,2,3,7,8-PeCDF 1,2,3,4,7,8-HxCDF

Results for OCDD in the following samples were qualified by the laboratory with an E as the value reported was an estimated concentration above the instrument calibration range. The E qualifier was not changed.

- SS-17-2013-09-25
- SS-22-2013-10-08

F.6 ARI Laboratory Job Number XO78

Three surface sediment samples were collected from the dredged/excavated area the Custom Plywood site on October 15 and 16, 2013. The samples were transported to ARI Laboratory, in Tukwila, Washington, for analysis.

Sample Preservation and Holding Time

Sediment samples were preserved by refrigeration and were received by the laboratory in good condition. The samples were extracted within one year for frozen samples.

Sample Reporting Limits

Laboratory reporting and detection limits were acceptable. Sample extraction volumes were increased to adjust for low total solids values. Reported detection limits and analytical results were adjusted for moisture content and any required dilution factors.

Detections that fell between the estimated detection limit (EDL) and the reporting limit (RL) were qualified as estimated (J) by ARI. The J qualifier was changed to T to be consistent with Washington State's EIM database.

Mass Calibration and Resolution

Mass spectrometer resolution was greater than 10,000 resolving power.

The laboratory uses an RTX-Dioxin 2 column rather than DB5 and DB225 columns to confirm 2,3,7,8-TCDF detections. A resolution test mixture was designed specifically for this column, consisting of

2,3,4,8-TCDF; 2,3,7,8-TCDF; and 3,4,6,7-TCDF to evaluate the minimum valley between isomers of 25 percent or less. The column met the valley resolution criteria.

Window Defining Mixture

The homolog window defining mixture was run and retention time windows were appropriately established.

Instrument Stability

The absolute RT of the first internal standard was greater than 25 minutes on the RTX-Dioxin 2 column.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Initial Calibration

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

Continuing Calibration Verification Checks (CCVs)

CCVs were performed at the proper frequency.

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits. Absolute RTs of the internal standards were within ±15 seconds of the RTs obtained during the initial calibration.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Ongoing Precision and Recovery Sample Results

An ongoing precision and recovery (OPR) sample was used to evaluate accuracy. Sample percent recoveries were within specified control limits with the following exception:

- OPR-112613: The recovery for 1,2,3,4,6,7,8-HpCDF exceeded the control limits. The results for that analyte in the associated samples (SS-29-2013-10-15; SS-24-2013-10-16; and SS-28-2013-10-16) were qualified as estimated (J).

Compound Identification

The laboratory reported EMPC or estimated maximum possible concentration values for one or more of the target analytes. An EMPC value is reported when a peak was detected but did not meet identification criteria as required by the method; therefore, the result cannot be considered as positive identification for the analyte. To indicate that the reported result for an individual analyte is, in effect, an elevated detection limit, the EMPC values were qualified as not detected (U) at the reported values. EMPC values on total homolog groups were qualified as estimated (J).

Blank Contamination

MB-112613: The method blank had detections for the following analytes at concentrations above the RL:

- 1,2,3,4,6,7,8-HpCDD
- OCDD

The method blank had detections for the following analytes at concentrations between the EDL and the RL:

- 1,2,3,4,6,7,8-HpCDF
- OCDF

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. The results for the analytes were evaluated and qualifiers updated as follows:

- Results that were less than five times the amount in the MB (ten times for OCDF), had the B qualifier changed to U:
  - SS-29-2013-10-15 [1,2,3,4,6,7,8-HpCDD and OCDD]

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 1,2,3,7,8-PeCDD

The laboratory qualified detected results in the associated samples that were less than ten times the amount in the method blank with B. EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. The B qualifier was removed from the following samples:

- SS-29-2013-10-15 [1,2,3,7,8-PeCDD]

Stable Isotope Labeled Compound Recoveries

The labeled compound recoveries and ion abundance ratios were within control limits.

Internal Standard and Cleanup Standard Recoveries

Internal standard and cleanup standard recoveries were acceptable.

Sample Qualifiers

Results for the following samples/analytes were qualified by the laboratory with an X due to interferences from chlorodiphenyl ethers. The X qualifiers were changed to JL (estimated).

Sample	Analyte
SS-24-2013-10-16	1,2,3,7,8-PeCDF

F.7 ARI Laboratory Job Number XQ93

Two surface sediment samples were collected from the dredged/excavated area at the Custom Plywood site on December 6 and 7, 2013. The samples were transported to ARI Laboratory, in Tukwila, Washington, for analysis.

Sample Receiving Discrepancies

Sample SS-05-2013-12-07: The lid of the jar was incorrectly labeled SS-05-2013-12-06. The sample label was correct.

Sample Preservation and Holding Time

Sediment samples were preserved by refrigeration and were received by the laboratory in good condition. Samples were extracted and analyzed within holding time limits.

Sample Reporting Limits

Laboratory reporting and detection limits were acceptable. Sample extraction volumes were increased to adjust for low total solids values. Reported detection limits and analytical results were adjusted for moisture content and any required dilution factors.

Detections that fell between the estimated detection limit (EDL) and the reporting limit (RL) were qualified as estimated (J) by ARI. The J qualifier was changed to T to be consistent with Washington State's EIM database.

Mass Calibration and Resolution

Mass spectrometer resolution was greater than 10,000 resolving power.

The laboratory uses an RTX-Dioxin 2 column rather than DB5 and DB225 columns to confirm 2,3,7,8-TCDF detections. A resolution test mixture was designed specifically for this column, consisting of 2,3,4,8-TCDF, 2,3,7,8-TCDF, and 3,4,6,7-TCDF to evaluate the minimum valley between isomers of 25 percent or less. The column met the valley resolution criteria.

Window Defining Mixture

The homolog window defining mixture was run and retention time windows were appropriately established.

Instrument Stability

The absolute RT of the first internal standard was greater than 25 minutes on the RTX-Dioxin 2 column.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Initial Calibration

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits.

All native and labeled CDDs/CDFs were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

Continuing Calibration Verification Checks (CCVs)

CCVs were performed at the proper frequency.

The absolute RT of the first internal standard was greater than 25 minutes.

The RRTs of the native and labeled CDDs/CDFs were within the method specified limits. Absolute RTs of the internal standards were within ±15 seconds of the RTs obtained during the initial calibration.

All native and labeled CDDs/CDFs in the CS3 standard were within their respective ion abundance ratios.

All peaks representing both native and labeled analytes in the CS3 standard had signal-to-noise ratios greater than 10:1.

The percent difference (%D) of the relative response (RR) was within ±25 percent of the mean RR of the initial calibration. The %D of the mean relative response factor (RRF) was within ±35 percent of the initial calibration.

Ongoing Precision and Recovery Sample Results

An ongoing precision and recovery (OPR) sample was used to evaluate accuracy. Sample percent recoveries were within specified control limits.

Compound Identification

The laboratory reported EMPC or estimated maximum possible concentration values for one or more of the target analytes. An EMPC value is reported when a peak was detected but did not meet identification criteria as required by the method; therefore, the result cannot be considered as positive identification for the analyte. To indicate that the reported result for an individual analyte is, in effect, an elevated detection limit, the EMPC values were qualified as not detected (U) at the reported values. EMPC values on Total Homolog groups were qualified as estimated (J).

Blank Contamination

MB-121213: The method blank had detections for the following analytes at concentrations above the RL:

- 1,2,3,4,6,7,8-HpCDD
- OCDD

Results for those analytes in the associated samples were greater than ten times the amount in the method blank and not qualified.

The method blank had detections for the following analytes that did not meet ion ratio criteria and were EMPC qualified:

- 1,2,3,6,7,8-HxCDD
- 1,2,3,7,8,9-HxCDD

EMPC qualified results in the method blank are considered as false positives, and no action levels were established for these analytes. Results for those analytes in the associated samples were greater than ten times the amount in the method blank and not qualified.

Stable Isotope Labeled Compound Recoveries

The labeled compound recoveries and ion abundance ratios were within control limits.

Internal Standard and Cleanup Standard Recoveries

Internal standard and cleanup standard recoveries were acceptable.

Sample Qualifiers

Results for the following samples/analytes were qualified by the laboratory with an X due to interferences from chlorodiphenyl ethers. The X qualifiers were changed to JL (estimated).

Sample	Analyte
SS-06-2013-12-06	1,2,3,7,8-PeCDF
SS-05-2013-12-07	1,2,3,7,8-PeCDF

Results for OCDD in the following sample was qualified by the laboratory with an E as the value reported was an estimated concentration above the instrument calibration range. The E qualifier was not changed.

- SS-05-2013-12-07

LABORATORY REPORTS
Analytical Resources, Inc.

APPENDIX G
Forage Fish Monitoring Reports

APPENDIX H
Water Quality Monitoring Plan