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 for
Washington State Department of Ecology
under Agreement with GBH Investments, LLC

February 2013
17800-27

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ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BMP	best management practice
CAP	Cleanup Action Plan
cm	centimeter
COA	City of Anacortes
COC	constituent of concern
COPC	constituent of potential concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CSM	conceptual site model
CY	cubic yard
DAHP	Department of Archaeology and Historic Preservation
DCA	disproportionate cost analysis
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
ENR	enhanced natural recovery
EPA	US Environmental Protection Agency
FS	Feasibility Study
GAC	granular activated carbon
GBH	GBH Investments, LLC
IAWP	Interim Action Work Plan
JARPA	Joint Aquatic Resource Permit Application
MHHW	mean higher high water
MTCA	Model Toxics Control Act
OHW	ordinary high water
OMMP	Operations, Monitoring, and Maintenance Plan
pg/g	picograms per gram
PLP	Potentially Liable Party
POC	point of compliance
POTW	publically owned treatment works
ppt	parts per trillion
PSI	Puget Sound Initiative
RCW	Revised Code of Washington
RI	Remedial Investigation
SEA	Shorelands and Environmental Assistance
SEPA	State Environmental Policy Act
SF	square feet
SMA	sediment management area
SMP	Shoreline Master Program
SMS	sediment management standards
SQS	sediment quality standards
SVOCs	semivolatile organic compounds

ACRONYMS AND ABBREVIATIONS (Continued)

TCP	(Ecology) Toxics Cleanup Program
TEC	toxic equivalent concentration
TLC	thin-layer capping
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TVS	total volatile solids
USACE	US Army Corps of Engineers

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EXECUTIVE SUMMARY

This combined Cleanup Action Plan and Engineering Design Report (CAP-EDR) has been prepared for cleanup of the intertidal and selected subtidal portions of the Custom Plywood Site, located in Anacortes, Washington. The cleanup is being completed under the direction of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP). GBH Investments, LLC (GBH), is the current property owner and the Potentially Liable Party (PLP) under provisions of the Washington State Model Toxics Control Act (MTCA – Chapter 173-340 WAC).

The 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 approximately 13.6 acres of upland and 19.2 acres of intertidal and subtidal areas, which includes a portion of the property currently owned by GBH (6.6 acres of upland and 3.4 acres of intertidal and subtidal land).

This CAP-EDR is part of the MTCA Interim Action Work Plan (IAWP) for the Site and specifically covers planned remedial actions that include the intertidal portion of the Site (defined as the region that extends approximately 50 feet seaward from the ordinary high water [OHW] line), and nearshore subtidal areas, herein referred to as Phase II. A separate CAP-EDR will be prepared for the remaining subtidal remediation component (Phase III), and construction for Phase III will be completed as a separate, follow-on effort.

The CAP and EDR for Phase II are presented as a single combined document to reduce redundancy and to increase efficiency of document preparation and use. Although CAP and EDR documents are typically prepared sequentially and not simultaneously, this combined CAP-EDR satisfies the regulatory requirements that apply to individual CAP and EDR documents.

Summary of Planned Phase II Cleanup Activities, Related Elements, and Preliminary Schedule

The Phase II intertidal area is defined as a strip along the Site shoreline extending approximately 50 feet seaward of the OHW line. Additional remedial work is planned in Phase II for the nearshore subtidal areas adjacent to the intertidal area. The nearshore subtidal areas are defined as the areas located seaward of the intertidal area where eelgrass is absent and where wood waste is greater than 1 foot thick or where the dioxin toxic equivalent concentration (TEC) exceeds 25 parts per trillion (ppt, equivalent to picograms per gram [pg/g]). The planned cleanup activities for the intertidal portions of the Custom Plywood Site are summarized as follows.

- Abandoned in-water concrete structures in the intertidal and subtidal areas will be demolished and disposed of off site. Demolition of structures in the subtidal area is included in Phase II because of the cost benefit of completing the work in one contractor mobilization. Near-surface debris generally consisting of concrete, brick, wood, and other materials will be removed from the planned intertidal excavation area where needed to access contaminated sediment. Available information indicates that it would not be practical or cost-effective to screen the near-surface debris for recyclable material, and the cleanup plans call for shipping debris off site for landfill disposal along with contaminated sediment.

- Wooden piles that remain in the intertidal and subtidal areas will be completely extracted or sawed off at the excavation bottom, depending on projected pile lengths and target sediment excavation depths. Along with concrete structure demolition, wood piles will be removed from the subtidal area as part of the Phase II cleanup effort. The piles will be disposed of off site at a permitted landfill.

- The intertidal area (see Figure 5-1) will be excavated[1] to native material or to a depth of approximately 6 feet, whichever is reached first. This intertidal area is characterized as exceeding the TEC of 25 ppt for dioxin through much of its extent, and wood waste in this area is often greater than 6 feet thick.

- Nearshore subtidal areas where the dioxin TEC exceeds 25 ppt will be dredged to native material. Nearshore subtidal areas where wood waste is greater than 1 foot thick will be dredged up to 2 feet below surface grade. In addition to contamination from wood waste, this area also typically contains dioxin TECs between 10 and 25 ppt.

- Excavated material from the intertidal area will be dewatered on site in a temporary holding cell before it is shipped off-site for disposal at a Subtitle D

[1] For contaminated sediment removal, excavation technologies apply after water is diverted or drained, whereas dredging technologies apply while sediment is submerged, per EPA definition. Refer to Chapter 6, Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, EPA-540-R-05-012, December 2005 (EPA 2005).

landfill facility. Water from the dewatering process will be captured for treatment and/or off-site disposal as necessary.

- Sediment dredged from the subtidal areas will be loaded directly to barges and allowed to dewater. Solids will be disposed off site at an approved upland disposal facility. Water pumped from the barges will be containerized for treatment at the publicly owned treatment works (POTW) and/or off-site disposal.

- 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 will be constructed as part of Phase II. In addition, the berm constructed in Phase I to protect the wetland area will be partially breached to connect the wetland area to the bay.

- The interim remedial action will provide shoreline enhancements, which will improve habitat for juvenile salmonids, forage fish spawning, shorebirds and waterfowl, and other aquatic species on and adjacent to the Site.

Confirmational monitoring consisting of groundwater and sediment sampling and analysis will be conducted to assess the long-term effectiveness of the interim cleanup action.

The Draft Final CAP-EDR for Phase II was issued in August 2012 for combined MTCA/SEPA public review. Prior to public review, a planned briefing meeting with the resource agencies and Tribes took place in June through July 2012. These briefing meetings were meant to provide further information during the combined MTCA/SEPA public review period for the IAWP including this CAP-EDR for Phase II. Final issuance of the Phase II IAWP documents is expected in late February 2013.

To support the contract bid and permitting process, the detailed design phase to develop project plans and specifications began after the public comment period. The design phase is scheduled to be completed by the end of February 2013. Related construction management planning documents are also being completed during this period.

Bid solicitation and contracting for Phase II are currently planned to occur in early 2013, with construction anticipated to begin in mid-June 2013. Phase II in-water construction is currently scheduled to last for the duration of the fish window, from July 16, 2013, through January 31, 2014.

Post-construction sampling and analysis will then begin and continue in accordance with the Operations, Monitoring, and Maintenance Plan (OMMP) schedule, which will be developed during the final design of the remedy.

Overview and Preliminary Schedule for Phase III (Tentative)

The Phase III remedial action will consist of dredging and/or capping contaminated sediment within the subtidal areas of the property that will not be addressed during Phase II. Dredging to native material will be completed in the southern offshore portion of the Site where sediment dioxin TEC exceeds 25 ppt. The dredging areas will be backfilled with sandy material. It is anticipated that areas containing dioxin TEC between 10 and 25 ppt will be remediated using thin-layer capping (TLC) methods to achieve enhanced natural recovery (ENR).

The Draft CAP-EDR for Phase III is planned to be issued in late 2015 for combined MTCA/SEPA public review. The public review will be followed by a planned briefing meeting with the resource agencies, Tribes, and public. These briefing meetings are meant to provide further information during the combined MTCA/SEPA public review period for the Phase III IAWP. Final issuance of the IAWP documents for Phase III is expected in late 2015.

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

1.0 INTRODUCTION

This combined Cleanup Action Plan and Engineering Design Report (CAP-EDR) has been prepared for cleanup of intertidal and selected subtidal portions of the Custom Plywood Site, located in Anacortes, Washington (Figure 1-1), herein referred to as Phase II. The cleanup is being completed under the direction of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP). GBH is the current property owner and Potentially Liable Party (PLP) under provisions of the Washington State Model Toxics Control Act (MTCA – Chapter 173-340 WAC).

The 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 approximately 13.6 acres of upland and 19.2 acres of intertidal and subtidal areas (Figure 1-2), which includes a portion of the property currently owned by GBH (6.6 acres of upland and 3.4 acres of intertidal and subtidal land).

The Site was the location of lumber and plywood milling operations beginning in about 1900. Milling activities produced wood waste and chemical contaminants affecting site soil, groundwater, and sediment, as described in more detail in later sections.

This CAP-EDR describes the planned Phase II remedial actions at the Site, defined as the region that extends approximately 50 feet seaward from the ordinary high water (OHW) line (Figure 1-2), and the nearshore portion of the subtidal area that is adjacent to the intertidal area. Overall, three interim remedial actions are planned at the Site, to be conducted in phases. Phase I consists of the upland remediation that was completed in the summer of 2011. Phases II is to be completed in 2013. A separate CAP-EDR is to be prepared for Phase III, with construction completed as a separate, follow-on effort.

1.1 Interim Action Contact Information

Questions regarding Site remediation and mitigation activities should be directed to the Washington State Department of Ecology's site manager, Hun Seak Park, at (360) 407-7189, hpar461@ecy.wa.gov.

1.2 Regulatory Framework

The Phase II CAP and EDR are presented as a single combined document to reduce redundancy and for more efficient document preparation and use. Although CAP and EDR documents are typically prepared sequentially and not simultaneously, this combined CAP-EDR satisfies the regulatory requirements that are applicable to individual CAP and EDR documents. This combined CAP-EDR is intended to achieve the following:

- Further identify and evaluate potential areas of intertidal and selected subtidal contamination;
- Inform cleanup and habitat restoration decisions;
- Confirm the priority areas for cleanup as part of a MTCA Interim Action Work Plan (IAWP);
- Document the engineering concepts and criteria used for design of the planned interim remedial action in the intertidal portion and selected subtidal portion of the Site; and
- Provide information necessary for the development and review of construction plans and specifications.

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 2011b);
- Phase I CAP prepared by Hart Crowser for Ecology, September 2011 (Hart Crowser 2011c);
- Phase I EDR prepared by Hart Crowser for Ecology, September 2011 (Hart Crowser 2011d); and
- 2012 Phase II CAP-EDR prepared by Hart Crowser for Ecology, August 2012.

(Note: These reports are referred to herein as the RI, FS, Phase I CAP, Phase I EDR, and Phase II CAP-EDR, respectively.)

GBH completed the RI in response to Ecology Agreed Order DE 5235, dated March 17, 2008. The RI identified the nature and extent of contaminated soil and groundwater in the upland and sediment in the intertidal and subtidal portions of the Site. The RI further identified cleanup screening levels for affected soil, groundwater, and sediment relative to applicable requirements of MTCA, SMS, and other regulatory criteria.

The FS further developed a conceptual site model (CSM) describing contaminant sources, pathways, and receptors for the upland and in-water portions of the Site. Remedial action objectives, including applicable cleanup levels, were identified for upland and aquatic areas planned for remediation as part of the IAWP. In accordance with WAC 173-340-350(8), the FS screened potential remedial technologies and alternatives in accordance with applicable MTCA and SMS cleanup action requirements. Remedial action alternatives were evaluated by assessing their compliance with the requirements for cleanup actions specified in WAC 173-340-360. The FS then identified preferred remedial alternatives for the upland and in-water areas of the Site.

1.3 Summary of Phase II Cleanup Activities and Related Elements

The Phase II intertidal area is defined as a strip along the Site shoreline extending approximately 50 feet seaward of the OHW line. Additional remedial work is planned in Phase II for the nearshore subtidal areas adjacent to the intertidal area. The nearshore subtidal areas are defined as the areas located seaward of the intertidal area where eelgrass is absent and where wood waste is greater than 1 foot thick or where the dioxin toxic equivalent concentration (TEC) exceeds 25 parts per trillion (ppt, equivalent to picograms per gram [pg/g]). The planned cleanup activities for these portions of the Custom Plywood Site are summarized as follows.

- Abandoned in-water concrete structures in the intertidal and subtidal areas will be demolished and disposed of off site. Demolition of structures in the subtidal area is included in the Phase II cleanup work because of the cost benefit of completing the work in one contractor mobilization. Near-surface debris generally consisting of concrete, brick, wood, and other materials will be removed from the planned intertidal excavation area where needed to access contaminated sediment. Available site information indicates that it would not be practical or cost-effective to screen the near-surface debris for on-site or off-site recycling. Plans call for shipping debris off site for landfill disposal with contaminated sediment.

- Wooden piles that remain in the intertidal and subtidal areas will be completely extracted or sawed off at the excavation bottom, depending on projected pile lengths and target sediment excavation depths. Along with concrete structure demolition, wood piles will be removed from the subtidal area as part of the Phase II cleanup effort. The piles will be disposed of off site at a permitted landfill.

- The intertidal area (see Figure 5-1) will be excavated to native material or to a depth of approximately 6 feet, whichever is reached first. This intertidal area is characterized as exceeding the TEC of 25 ppt for dioxin through much of its extent, and wood waste in this area is often greater than 6 feet thick.

- Nearshore subtidal areas where the dioxin TEC exceeds 25 ppt will be dredged to native material. Nearshore subtidal areas where wood waste is greater than 1 foot thick will be dredged up to 2 feet below surface grade. In addition to contamination from wood waste, this area also typically contains dioxin TECs between 10 and 25 ppt.

- Excavated material from the intertidal area will be dewatered on site in a temporary holding cell before off-site disposal at a Subtitle D landfill facility. Water from the dewatering process will be containerized for treatment at the publicly owned treatment works (POTW) and/or off-site disposal.

- Sediment dredged from the subtidal areas will be loaded directly to barges and allowed to dewater. Solids will be disposed off site at an approved upland disposal facility. Water pumped from the barges will be containerized for treatment at the POTW and/or off-site disposal.

- Shoreline protection features will be constructed as part of Phase II. These features include 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. In addition, the berm constructed in Phase I to protect the wetland area will be partially breached to connect the wetland area to the bay.

- The interim remedial action will provide shoreline enhancements, which will improve habitat for juvenile salmonids, forage fish spawning, shorebirds and waterfowl, and other aquatic species on and adjacent to the Site.

- Confirmational monitoring consisting of groundwater sampling and analysis will be conducted to assess the long-term effectiveness of the interim cleanup action.

1.4 Phase II CAP-EDR Approach and Organization

Elements of this combined CAP-EDR address requirements of WAC 173-340-380 and WAC 173-340-400, including:

- A description of the planned interim remedial action;
- Rationale for selecting the preferred alternative;
- A summary of other remedial action alternatives evaluated;
- Cleanup standards for hazardous substances and media of concern;
- Institutional controls;
- Applicable state and federal laws;
- Preliminary determination of compliance with MTCA remedy selection criteria;
- Types, levels, and amounts of hazardous substances remaining on site, and measures to prevent migration and contact;
- Definition of the goals of the planned interim remedial action;
- Design criteria and assumptions for the planned interim remedial action;
- Schedule for the implementation of Phase II; and
- Description of compliance monitoring that will be performed during and after the planned remedial action.

Specific discussion points pertinent to these MTCA criteria are presented in the following section:

Section 2.0 Summary of Site Conditions

This section summarizes the historical uses of the Site and its current land use. An overview of the results of the RI and other recent investigation work is tabulated in the FS and this CAP-EDR, and prior cleanup actions at the Site are summarized. This information is used to develop a CSM for the Site.

Section 3.0 Cleanup Requirements

Remedial action objectives and cleanup standards for Phase II are identified in Section 3.0.

Section 4.0 Remedial Action Alternatives Considered and Basis for Aquatic Remedy Selection

The technology screening process used in the FS to identify candidate remedial technologies for the intertidal and subtidal areas of the Site, and the assembly of these technologies into remedial alternatives is summarized in Section 4.0. The process used to assess the relative compliance of each alternative with MTCA criteria is also summarized in Section 4.0.

Section 5.0 Selected Phase II Remedial Action

The cleanup actions planned for the intertidal and nearshore subtidal areas are detailed in Section 5.0. These actions include sediment removal and off-site disposal activities, demolition of in/overwater structures, wood piling removal, shoreline protection, and habitat restoration. Section 5.0 also contains information on:

- Planned monitoring during and after implementation of the interim remedial action;
- Contingency actions that will be implemented if the remedial action objectives for the Site are not achieved;
- Potential future land uses of the Site; and
- Anticipated restrictive covenants to protect human health and the environment once the remedial action has been implemented.

A preliminary implementation schedule is presented in Section 5.0.

Section 6.0 Basis of Design

Section 6.0 presents the basis of design for the Phase II cleanup action including key assumptions, construction sequencing approach, and other design considerations. This section also includes a description of how excavated material will be handled, characterized, and disposed of.

Section 7.0 Compliance Monitoring Plan

Section 7.0 presents planned compliance monitoring activities to be performed during the intertidal interim cleanup action to confirm that human health and the environment are adequately protected, and following the interim action to confirm that cleanup requirements were satisfied.

Section 8.0 General Approach for the Operation, Maintenance, and Monitoring Plan

Section 8.0 introduces the Operation, Maintenance, and Monitoring Plan (OMMP) elements that will be performed following completion of Phase II.

Section 9.0 Ecology Periodic Reviews

The interim cleanup action described in this CAP-EDR may leave hazardous or deleterious substances behind at concentrations above cleanup levels and may require restrictive covenants as part of the remedy. Therefore, a 5-year review of the interim action will be required. The components of this review are outlined in Section 9.0.

This also serves as a decision document for the selected intertidal remediation alternative identified as part of the IAWP. Design and construction considerations for this alternative are further developed and evaluated in the forthcoming project design plans and specifications.

Section 10.0 References

Section 10.0 includes references cited in this CAP-EDR.

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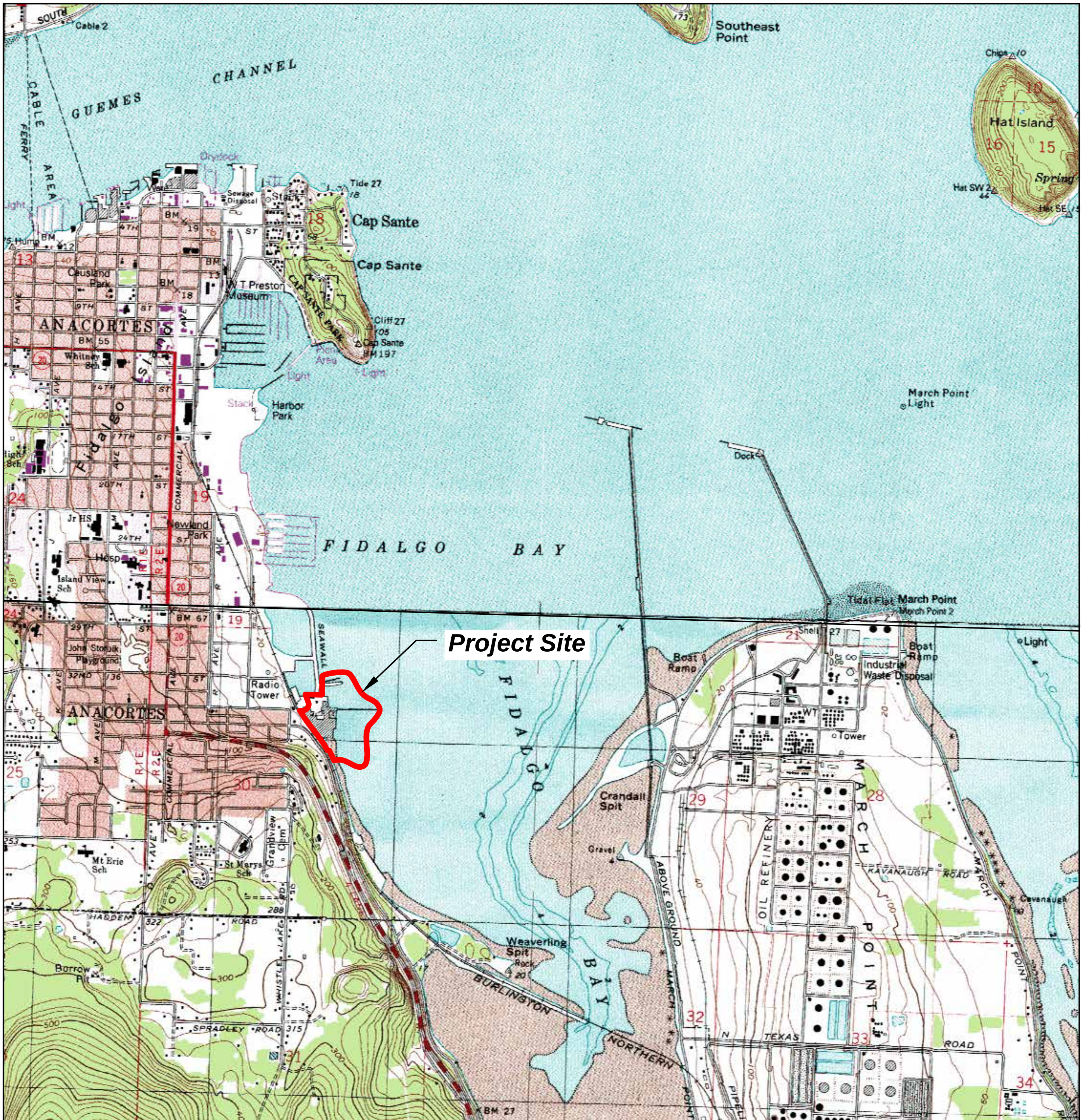

Source: Base map prepared from USGS 7.5-Minute Series Topographic Map, Anacortes North and Anacortes South Quadrangles.

0 0.5 1

Scale in Miles

N

Custom Plywood Site
Anacortes, Washington

Vicinity Map

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Figure
1-1

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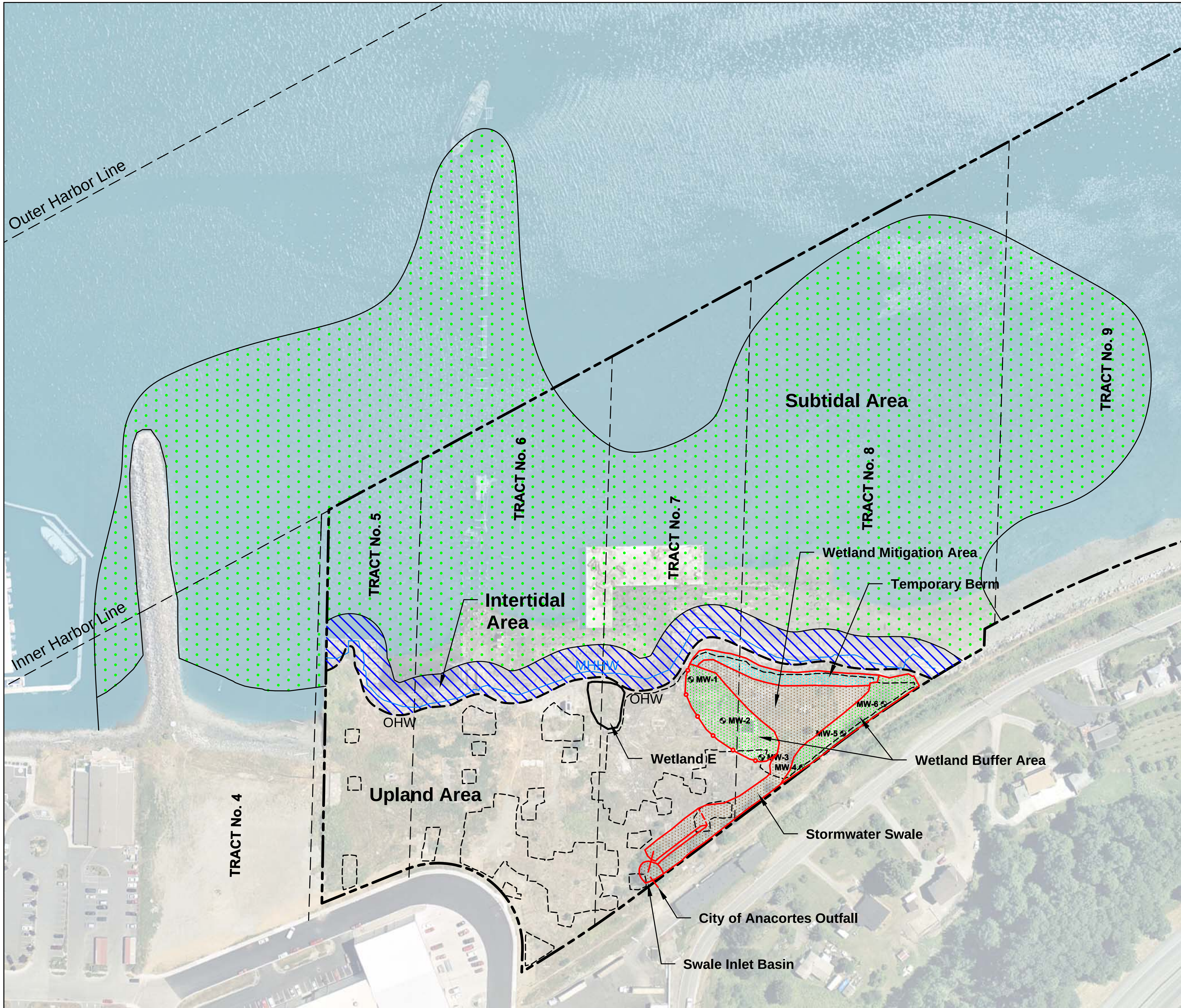

Phase I Upland Interim Action Constructed Feature

OHW Ordinary High Water

MHHW Mean Higher High Water

Property Boundary

Temporary Fence

Phase I Excavation Limits

Tract Boundary

MW-3 Monitoring Well Location and Number

Source: Aerial photo courtesy of City of Anacortes, 2003.

Note: Constructed feature locations based on as-built drawings provided by Pacific Survey & Engineering Inc. See Draft Construction Completion Report Attachments A through C.

N

0 150 300

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Site Layout Plan and Existing Conditions

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Figure

1-2

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2.0 SUMMARY OF SITE CONDITIONS

For purposes of this CAP-EDR, the Site is defined by the extent of contamination on or near the Custom Plywood Mill facility. The Site includes the footprint of the former plywood mill at its maximum extent during operation, including property currently owned by GBH, and property owned by other parties. The Site encompasses offshore areas extending to the Inner Harbor Line including GBH-owned aquatic parcels and state aquatic lands located farther offshore and affected by dioxin contamination above the Fidalgo Bay background concentration. Ecology determined that the aquatic portion of the Site boundary extends well into Fidalgo Bay following the 2010 sediment quality sampling and testing by SAIC (2010).

The property is defined as the tracts of land (Tract Nos. 5 through 10) currently owned by GBH, including upland and tideland seaward to the inner harbor line (Figure 1-2). According to Skagit County Assessor's records, the property is an irregularly shaped parcel that covers approximately 6.6 acres of upland and 34 acres of intertidal and subtidal areas (Figure 1-2).

The remaining portions of the Site property consist of roughly 7 upland acres and 1.3 tideland acres that are owned and redeveloped by other parties. These remaining property areas are not part of the current interim action or current CAP.

Sections 2.1 and 2.2 summarize the historical and current uses of the Site, respectively. Section 2.2 describes the nearshore, intertidal, and subtidal areas for completeness and to provide context. The investigatory work presented in the RI, in addition to more recent investigations, is summarized in Section 2.3. Limited interim cleanup actions have been conducted at the Site since 1998. These prior cleanup actions are summarized in Section 2.4 for background context. This prior investigatory and cleanup work is used to create a CSM of the Site in Section 2.5.

2.1 Site History

As summarized in the RI, the property was originally developed as a saw and planing mill around 1900 until it burned down sometime between 1925 and 1937. Through the years, the property changed hands several times, and was rebuilt and added onto 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, many of which were built in the 1940s, were consumed again by fire on

November 28, 1992. Historical site features are shown on Figure 2-1, and current features are shown on Figure 1-2.

Except for the parcels on the periphery that have been sold and redeveloped, the main part of the former mill property has been used sporadically since 1992. In December 2007, the main part of the former mill property was sold to GBH. For further discussion of the history of Site operation and ownership and the history and characteristics of surrounding properties, refer to the RI.

2.2 Current Land Use and Description

The Site has been divided into upland, wetland, intertidal, and subtidal areas, as described in detail in the following sections.

2.2.1 Upland Area

The upland portion of the Site consists of approximately 13.6 total upland acres, with approximately 6.6 acres owned by GBH. The Phase I interim remedial action was completed in the upland area of the Site in the summer of 2011 (see Section 2.4). 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 (Figure 2-1).

As part of the upland interim action, approximately 25,000 cubic yards (CY) of contaminated material was excavated from the Site and disposed of off site. A wetland mitigation area and vegetated buffer zone were constructed in the southern portion of the Site, and a stormwater conveyance and treatment swale was constructed along the western boundary of the Site (see Figure 1-2). The swale receives stormwater from a City of Anacortes outfall that discharges onto the Site, and conveys the water into the wetland mitigation area. The remainder of the Site has been graded and hydroseeded.

2.2.2 Wetlands

An approximately 12,000-square-foot (SF) wetland mitigation area was constructed as part of the Phase I upland interim action, which was designed to replace the wetland areas on the Site that were removed during cleanup. These wetlands were identified as Wetlands A through D in the Phase I CAP (see Figure 2-1) and were removed to allow for excavation of impacted soil and wood waste. Wetland E was preserved during the cleanup action and remains on site.

Wetland E was delineated and its boundaries accepted by the US Army Corps of Engineers (USACE) and Ecology's Shorelands and Environmental Assistance (SEA) Program. Wetland E (1,389 SF) is an estuarine wetland and is rated as a Category II system (refer to Phase I CAP Appendix B).

2.2.3 Nearshore and Intertidal Area

The shoreline of the Site property contains industrial debris and significant quantities of naturally occurring woody debris. Woody debris ranges in size from sawdust to large mill end remnants and logs. Active erosion is occurring along the northeast and central portion of the property where storms and long-period waves have locally destabilized the shoreline (refer to Appendix B-2 of the FS). Within the central portion of the shoreline and concrete/debris, ecology blocks covered in a geotextile fabric were placed near the mean higher high water (MHHW) line during an emergency erosion control action following a high wave and storm event in January 2010. The southernmost tip of the property is armored with riprap, which extends to the south.

The intertidal zone contains piles, considerable quantities of wood waste embedded in the substrate, and structural debris from previous buildings on the property (Figure 2-1). An estimated 770 and 350 piles remain in the intertidal and subtidal areas, respectively. A derelict L-shaped pier supported by piles is in the subtidal area immediately adjacent to the intertidal zone. Rockweed (*Fucus* sp.) is present on a variety of structures and debris along the central and northern portions of the shoreline.

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

Site conditions show an actively eroding shoreline. Ecology blocks and rubble have 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 provide some protection from wind and wave energy. Coastal wave modeling for the property shows 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 this report). This strongly suggests that the beach face is subject to acute, episodic erosion events similar to the event during the winter of 2010, 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.

2.2.4 Subtidal Area

The immediate subtidal portion of the property is a low-slope mudflat that contains large amounts of wood debris and sawdust, and is partially covered by overwater structures (Figure 2-1). This heavily impacted zone contains macroalgae (*Ulva* sp.) and an abundance of cyanobacteria and reducing bacteria (likely *Beggiatoa* sp.) that indicate sulfide-rich sediment. This apparent reducing layer is present at the surface at several locations on the mudflat.

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 was limited by the occurrence of wood waste, debris, and high-organic-content sediments within the project footprint.

2.3 Summary of Environmental Conditions and Previous Investigations

A brief summary of environmental characterization and sampling and analysis investigations at the Site is presented in Table 2-1. Further discussion of the individual investigations and findings between 1993 and 2010 are presented in the RI. Investigations conducted in 2010 are summarized in the FS, and more recent investigations are discussed below.

Sampling locations for historical sediment investigations from 1995 to 2012 are shown on Figure 2-2. A representation of the Site setting in uplands, nearshore, and tideland areas, based on previous and current investigations, is depicted on Cross Sections A-A′, B-B′, and C-C′ on Figures 2-3 through 2-5 for reference.

Site Sediment

Former plywood milling operations produced large amounts of wood waste that was placed on upland and aquatic portions of the Site over many years. Fill soil consists 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 are more than 15 feet thick in some areas and include the general “upper” and “lower” fill units 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.

Sediment containing wood waste is an ongoing source of contamination in the aquatic environment at the Site. Wood waste accumulation in nearshore areas and near former overwater structures exceeds 6 feet in places. In sufficient quantities, wood waste can represent an environmental pollutant and deleterious substance per SMS criteria (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 and was further addressed in the May 2011 supplemental sediment field investigation report (see FS Section 2.4 and FS Appendix E). More recently, in January 2012, an investigation was conducted to fill additional data gaps in the aquatic area at the Site (Hart Crowser 2013 – See Appendix A of this report).

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

2.4 Summary of Prior Cleanup Actions

Since 1993, previous property owners, the City of Anacortes (COA), Ecology, and the US Environmental Protection Agency (EPA) have conducted a series of environmental characterization and sampling and analysis investigations near the Site. These investigations were conducted to define the extent of contamination and evaluate the condition of the soil, groundwater, and offshore sediment. Each successive investigation targeted data gaps identified in the previous investigations.

Interim remedial actions were conducted under WAC 173-340-515 (Independent Remedial Actions) on the upland portion of the Site beginning in 1998, as summarized in Table 2-2. In 1998, Woodward-Clyde removed soil impacted by hydraulic oil within the COA right-of-way located immediately northwest of the GBH property. Ecology issued a No Further Action determination for this location following three years of groundwater monitoring. The area in question is not located within the project area covered by this upland CAP.

Investigations between 1995 and 2003 culminated in the development of an Interim Remedial Action Plan for soil removal within the upland excavation areas 2 though 5, as noted on Figure 2-1 (Geomatrix 2007). The Interim Remedial Action Plan was implemented by Concord, LLC, without Ecology's oversight and included excavation and off-site disposal of soil in the northern tracts (Tracts 5 and 6) first, followed by planned excavation and disposal of the soil in the southern tracts (Tracts 7 and 8) a year later. The first phase of the interim action work on the northern tracts was conducted in July 2007 to remove a limited amount of impacted soil from four areas where petroleum hydrocarbons and other constituents exceeded MTCA Method A cleanup levels. A more complete description of the northern interim cleanup action is provided in the RI. After the interim action in 2007, Ecology required the subsequent work to be conducted within the Puget Sound Initiative (PSI) program under an Agreed Order to be consistent with the approach at other PSI-led sites in Fidalgo Bay.

Phase I cleanup activities were completed in the summer of 2011. 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 (see Figure 1-2).

2.5 Conceptual Site Model

The conceptual site model (CSM) for the Site describes the physical and chemical conditions of the upland portion of the GBH property area and adjacent aquatic area addressed in the FS. The CSM identifies the potential or suspected sources of hazardous substances, the types and concentration of hazardous substances, potentially contaminated media, and actual and potential exposure pathways and receptors (WAC 173-340-200) at the Site.

The CSM is a set of hypotheses derived from existing site data and knowledge gained from environmental evaluations conducted at other similar sites. This model summarizes our understanding of the environmental processes underway at the Site based on data available as of April 2012.

The following sections summarize:

- The suspected contaminant sources and media present in aquatic portions of the Site (Section 2.5.1);

- The contaminant release mechanisms, transport, and exposure pathways that can allow contaminants to migrate from aquatic source areas to potential receptors (Section 2.5.2);

- The potential receptors that could be impacted by contaminants from aquatic sources (Section 2.5.3); and

- The completed exposure pathways (Section 2.5.4).

The CSM builds on information presented in the RI, and additional site data presented in the FS. A generalized CSM for the Site is depicted on Figure 2-6.

2.5.1 Contaminant Sources and Affected Media

Lumber milling and plywood operations took place at the Site for over 100 years. Although operational details are lacking, former plant operations produced large amounts of wood waste fill placed in upland and aquatic portions of the Site over many years. Site operations ceased following the 1992 fire, with no continuing primary sources of contamination.

The primary and secondary sources of contaminants for the aquatic portion of the Site are identified below. Affected environmental media are also described.

Sources and Contaminants

Historical sources and processes that released wood waste and hazardous chemical materials to the environment during mill operation are not well documented. The RI identified petroleum hydrocarbons (diesel and heavy oil), cPAHs, and metals as COPCs in soil and groundwater, and dioxin/furans as COPCs for sediment. Wood waste was also identified as a potential deleterious substance in aquatic areas of the Site. The process used to further evaluate and identify COPCs is described in Section 4.0 of the FS.

In the aquatic environment, thick sections of sawdust, mill ends, and other wood waste fill were deposited near former overwater structures associated with former site operations. The seaward extent of wood waste as a source of contamination in the aquatic environment was not established by the RI and related site investigations to date, although additional field sampling was conducted in December 2010 (see FS Section 2.0) and January 2012 to address this data gap. In sufficient quantities, wood waste can represent an environmental pollutant and deleterious substance per SMS criteria (WAC 173-240-200(17)). Potentially deleterious effects of wood waste have been evaluated in biological response studies such as those conducted during the FS for the former Scott Paper site north of Custom Plywood (GeoEngineers, AMEC Geomatrix, and Anchor 2008). Results of these studies with regard to wood waste and associated total volatile solids (TVS) content are summarized further in Section 4.0 of the FS.

Dioxin is the other notable contaminant in the aquatic environment. Dioxin sources associated with site activities were not documented in the RI. However, surface sediment dioxin concentrations uniformly ranging from about 10 to 20 ppt total TEC occur over much of the aquatic area of the Site based on January 2012 sampling analytical data, in addition to data reported in the RI and by SAIC (2010) (see Figure 2-7). The FS previously noted that two “outlier” dioxin concentrations of 81 and 41 ppt were detected (see FS Figure 5-2). However, more recent sampling conducted in January 2012 to fill data gaps in the aquatic area of the Site found additional surface sediment locations with comparable dioxin concentrations in the nearshore area (Figure 2-7). The results indicated a broader extent of dioxin concentrations exceeding 25 ppt along the northernmost and southernmost portions of the intertidal area, with concentrations in surface sediment ranging as high as 95 ppt at sample location SC-44.

With the exception of these higher concentration samples in the nearshore area, the relatively uniform occurrence of dioxin farther seaward in the subtidal area suggests that dioxins were redistributed in the aquatic environment following release from some combination of local Custom Plywood sources, and possibly from off-site sources. Dioxin concentrations tend to diminish seaward toward the central part of Fidalgo Bay.

Secondary Sources of Contamination and Affected Media

Sediment containing wood waste is an ongoing source of contamination in the aquatic environment. Wood waste accumulation in nearshore areas and near former overwater structures exceeds 6 feet in places. As part of the sediment profile, wood waste can adversely affect benthic habitat in the biologically active zone by potentially generating sulfide, ammonia, phenols, and related degradation products harmful to marine biota. As noted above, the seaward extent and magnitude of wood waste in quantities sufficient to promote adverse impacts is uncertain and was further addressed in the May 2011 supplemental sediment field investigation report.

Near-surface sediment throughout the aquatic portion of the Site is further impacted by dioxin concentrations exceeding Fidalgo Bay background levels. Deeper portions of the sediment profile were also affected as shown in the May 2011 and January 2012 supplemental field investigations. Elevated dioxin concentrations were encountered in deeper sediment associated with relatively thick, nearshore accumulations of wood waste. Analysis of deeper sediment samples collected in January 2012 detected dioxin concentrations ranging as high as 263 ppt (sample location SC-43, from approximately 7 feet below mudline) in the nearshore area. As wood waste quantities decrease seaward, dioxin is more likely restricted to surface sediment because of secondary redistribution following in-water fill placement or erosion of nearshore deposits.

2.5.2 Release Mechanisms and Transport Processes

The primary release mechanisms and transport processes by which contaminants can migrate from sources to receptors are identified in this section. For the aquatic environment, contaminants can migrate from source areas to receptors by the routes described below for affected media.

The release mechanisms and transport processes identified for the aquatic environment include:

- Erosion or exposure of wood waste through wave and tidal action;
- Migration of sulfide, ammonia, phenols, and related wood waste constituents to aquatic receptors;
- Transfer of groundwater/surface water chemical contaminants to sediment;
- Direct contact of COPCs with human or ecological receptors; and
- Uptake of COPCs by marine organisms.

2.5.3 Receptors

Several classes of human and ecological receptors have been identified. For the aquatic environment, potential human receptors include current and future site users (noting that the GBH-owned portion of the Site is currently restricted to commercial or industrial uses), who may be exposed to surface water or sediment via direct contact or through consumption of marine biota. Ecological receptors include organisms in the biologically active zone such as shellfish and other benthic fauna exposed to sediment via direct contact and secondary food chain consumers such as fish and birds.

2.5.4 Summary of Completed Exposure Pathways

For a constituent of concern (COC) to present a risk to human health and/or the environment, the pathway from the COC to the receptor must be completed. The COC to receptor pathways judged to be present at the Site are listed in this section by contaminated medium.

Sediment

The pathways judged to be present that could potentially allow COCs in groundwater and surface water to reach receptors in sediment and marine waters include:

Human Receptors. Direct contact (dermal contact, or incidental ingestion) pathways and consumption of affected marine species and incidental consumption of marine waters pathways.

Ecological Receptors. Direct contact and/or uptake of contaminants including wood waste and wood waste degradation products pathways and food chain consumption of affected marine species pathways.

Table 2-1 - Summary of Previous Environmental Characterization and Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type and Nomenclature	
1993 Preliminary Environmental Evaluation (John A. Pinner and Associates, 1993)	Collected and analyzed surface water samples and a soil sample as a preliminary environmental evaluation. Samples locations not clearly located in report.	Surface Water:	One from Press Pit #2 and one from a depression north of Press Pit #2.
		Soil:	One northeast of Press Pit #3.
1995 Phase I and Limited Phase II Environmental Site Assessment (Enviros, 1995a)	Collected and analyzed hand-auger (HA) and shallow grab soil samples from areas with the highest likelihood of contamination.	Hand-auger:	HA3, HA4, HA5, HA6, HA7, HA8, HA9, HA11, HA14, HA17, HA18
		Soil:	G15-S
1995 Preliminary Sediment Sampling Report (Enviros, 1995b)	Collected and analyzed sediment samples offshore of the Site as a preliminary characterization study of sediment chemistry.	Sediment:	S1, S2, S3, S4a, S4b, S4c, S4d, S5, S6, S7, S8, S9, S10, S11, S12
1997 Marine Habitat and Resources Survey (URS Greiner, 1997)	Conducted a marine habitat and resources survey offshore of the City of Anacortes and the Site in the area from the shoreline to the outer harbor line.	Survey:	Vegetation and surficial sediment surveys, bathymetric contours, video data noting distribution of eelgrass and macroalgae, sediment grain size, wood content, and fauna present.
1997 Phase I and Limited Phase II Environmental Site Assessment (Woodward-Clyde, 1997a)	Collected and analyzed soil samples from 13 test pits on the upland portion of the V Place property owned by the City of Anacortes.	Test Pit:	AN1, AN2, AN3, AN4, AN5, AN6, AN7, AN8, AN9, AN10, AN11, AN12, AN13
1997 Survey for Petroleum and Other Chemical Contaminants in the Sediments of Fidalgo Bay (Ecology, 1997b)	Collected and analyzed sediment samples to investigate the extent of oil and chemical contamination within Fidalgo Bay.	Sediment:	Outer_26, Outer_17, Inner_8
1997 Soil Sampling, 3205 V Place Property (Woodward-Clyde, 1997b)	Collected and analyzed soil samples from 3 test pits from the area described in Woodward-Clyde (1997a) as having the highest concentrations of TPH.	Test Pit:	ANX1, ANX2, ANX4
1997 Custom Plywood Soil Sampling (Woodward-Clyde, 1997c)	Collected and analyzed soil samples from 4 borings and 15 hand-auger/shovel sample locations to investigate the presence of PCBs in the upland soil on the Site	Boring:	CP-GP1, CP-GP2, CP-GP3, CP-GP22
		Hand-auger /Shovel:	CP-HA20, CP-HA21, CP-HA23, CP-HA24, CP-HA25, CP-HA26, CP-HA27, CP-HA28, CP-HA29, CP-HA30, CP-HA31, CP-HA32, CP-HA33, CP-HA34, CP-HA??
1997 EMAP Program (Ecology, 1997a)	Collected and analyzed sediment samples for conventional parameters (i.e., total organic carbon), metals, SVOCs, and PCBs within Fidalgo Bay.	Station:	WA000007 and WA000008

Table 2-1 - Summary of Previous Environmental Characterization and Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type and Nomenclature	
1997 Limited Phase II Site Assessment (Woodward-Clyde, 1997d)	Collected and analyzed soil samples from 11 test pits on the northern property boundary of the Site to determine the extent of heavy petroleum hydrocarbon contamination.	Test Pit:	ANA-TP1, ANA-TP2, ANA-TP3, ANA-TP4, ANA-TP5, ANA-TP6, ANA-TP7, ANA-TP8, ANA-TP9, ANA-TP10, ANA-TP11
1998 Site Investigation and Remedial Options Evaluation (Woodward-Clyde, 1998b)	Collected and analyzed soil and grab groundwater samples from 7 push probes, 5 hand augers, and 3 shallow soil sample locations to: (1) delineate the extent of petroleum-impacted soil and groundwater in the press pit area; (2) identify potentially impacted soil in the vicinity of the resin/caustic storage shed and the former mixed glue tank; and (3) assess the quality of surface water contained in the press pits for disposal purposes. A preliminary evaluation of remedial options was also developed for the Site.	Push-probe:	CP-GP4 through CP-GP10
		Hand-auger:	CP-HA36 through CP-HA40
		Soil:	CP-HARC-A, CP-HARC-B, CP-HAGT
		Grab Groundwater:	CP-GP5, CP-GP7, CP-GP8
2000 START Preliminary Assessment/Site Inspection (EPA, 2000)	Collected and analyzed 10 sediment samples, 61 soil samples, 6 grab groundwater samples, and one shoreline seep sample to document the nature and extent of contamination that may be present at the Site.	Sediment:	FB01 through FB10
		Boring:	BH01 to BH06, PP01 to PP08, CB01 to CB03, CB03b and CB04, RC01 to RC03, GT01 to GT03, UL01 to UL03, BG01, SL01
2003 Draft Engineering Evaluation/Cost Analysis and Cleanup Action Plan (URS, 2003)	Prepared for the City of Anacortes and the Anacortes Public Development Authority (PDA) to evaluate soil and groundwater cleanup alternatives in the upland portion of the Site. Intended to summarize previous investigations, evaluate remedial technologies, and provide a conceptual plan for preferred remedial action. Note: document was not finalized and the work was not performed.	No additional explorations were completed, summarized previous investigations.	
2003 Chemical Contamination, Acute Toxicity in Laboratory Tests, and Benthic Impacts in Sediments of Puget Sound (Ecology and NOAA, 2003)	Collected and analyzed sediment samples as a survey of background conditions within Puget Sound. Three stations were located within Fidalgo Bay and are close enough to provide potential background conditions in the vicinity of the Site.	Station:	17-1-50, 17-2-51, 17-3-52

Table 2-1 - Summary of Previous Environmental Characterization and Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type and Nomenclature	
2006 Wetlands Delineation Study (Geomatrix, 2006)	Conducted a study of the Site and several small areas were identified as wetlands that met all three jurisdictional wetland criteria used by the US Army Corps of Engineers and Ecology to define a wetland.	Survey:	Wetland Delineation
2007 Underwater Habitat Survey (Geomatrix, 2007b)	Conducted an underwater survey offshore of the Site in the area from the shoreline to the outer harbor line.	Survey:	Underwater survey of the extent of eelgrass, macroalgae, and debris in the marine areas near the Site.
2007 to 2009 Additional Remedial Investigation and Supplemental investigations (AMEC Geomatrix 2007 to 2010)	Collected and analyzed soil, groundwater, and offshore sediment samples, and conducted a bathymetric and benthic habitat survey for the Site. Samples included: (1) soil samples at 58 push probes and 9 monitoring well boreholes; (2) groundwater samples at 9 new monitoring wells and 2 existing monitoring well locations; and (3) sediment samples at 9 test pits and 4 seep locations.	Soil:	GMX-S1 to GMX-S58 Nine monitoring well boreholes
		Groundwater:	GMX-MW-01 to GMX-MW-09, ANCP-MW-01 and ANCP-MW-02
		Sediment:	TP-01 to TP-09 SEEP1 to SEEP4
		Survey:	Bathymetric and benthic habitat survey witin the Site.
2010 Supplementary Custom Plywood Site and Fidalgo Bay Sediment Dioxin/Furan Study (SAIC, June 2010)	Conducted a supplementary investigation of Fidalgo and Padilla Bays and areas adjacent to the former Custom Plywood Site to determine potential sources of dioxin contamination observed in previous investigations (SAIC 2008, AMEC 2008). The purpose of this supplementary sediment investigation was to determine the bay-wide background concentrations of dioxin/furan in Fidalgo and Padilla Bays and to further characterize and delineate the extent of dioxin/furan in sediment and clam tissue in nearshore sediment adjacent to the Custom Plywood Site.	Sediment:	FB-01 through FB-10; PB-01 through PB-10; CPD-01 through CPD-21
		Clam Tissue:	CT-01 through CT-05
2010 Intertidal Investigations, Custom Plywood Site Test Pits (Hart Crowser, August 2010)	Collected sediment and water samples from 9 test pits within the intertidal area during morning low tides along the Site shoreline. The sampling locations were selected to supplement explorations completed by AMEC in 2008 and 2009 (AMEC 2011) and to fill in special data gaps in the intertidal area as determined by Ecology.	Test Pit:	HC-TP-1 through HC-TP-9

Table 2-1 - Summary of Previous Environmental Characterization and Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type and Nomenclature	
2010 Supplemental Field Investigation, Sediment Dioxin and Wood Waste (Hart Crowser, December 2010)	Collected additional sediment samples from intertidal and subtidal areas to fill depth and areal extent data gaps for dioxin hot spots and wood waste. Samples for dioxin analysis were collected from 29 sediment cores and 13 surface grab locations. The wood waste distribution data were collected from 23 additional cores and the surface grab samples.	Sediment:	HC-SS-1 through HC-SS-14; HC-SC-4 through HC-SC-7 and HC-SC-15 through HC-SC-38
2012 Supplemental Field Investigation, Sediment Dioxin and Wood Waste (Hart Crowser, January 2012)	Collected additional sediment samples from intertidal and subtidal areas to fill depth and areal extent data gaps for dioxin hot spots and wood waste. A total of 40 sediment samples were collected for analysis from 9 surface grab locations and 22 core locations.	Sediment:	SS-15 through SS-23 and SC-39 through SC-59.

Notes:
Refer to the RI and FS for further discussion of the individual investigations and findings of previous investigations.
See CAP-EDR Figure 2-2 for historical aquatic exploration locations.

Table 2-2 - Summary of Previous Cleanup Actions at the Custom Plywood Site

Remediation Event	Remediation Description	Remediation Area
1998 Soil Remediation Report for 3205 V Place (Woodward-Clyde 1998a)	Conducted a limited cleanup action on the City of Anacortes V Place property in the areas where soil was heavily impacted by hydraulic oil located near the hardboard plant (Woodward-Clyde 1997a,b,c,d). Three groundwater monitoring wells (MW-1, MW-2, and MW-3) were installed downgradient of the soil excavation areas. After 3 years of groundwater monitoring, the City of Anacortes received a "No Further Action" letter under the VCP through Ecology's NMRO. In 2002, the monitoring wells were decommissioned.	City of Anacortes V Place Properties Areas #1, #2, #3
2007 Interim Remedial Action Areas 2 through 5 (Geomatrix 2007)	Conducted an interim remedial action on the Site in the areas where concentrations of COPCs exceeded unrestricted MTCA Method A soil cleanup levels. Four of the five identified areas (Areas 2 through 5) were excavated. Approximately 1,500 tons of contaminated soil was disposed of off site at Rabanco's Subtitle D landfill in Klickitat County.	Former Custom Plywood Properties
2011 Phase I Interim Upland Remedial Action (Hart Crowser 2011e)	The interim remedial action involved demolition of existing upland structures, excavation and off-site disposal of near-surface debris and contaminated soil and wood waste, backfilling of excavated areas and site grading, construction of a wetland mitigation area and buffer zone, and provision of post-construction stormwater management. Approximately 24,800 cubic yards of contaminated material were excavated and disposed of off site at the Subtitle D Greater Wenatchee Regional Landfill in Wetnatchee, Washington.	Custom Plywood Site Uplands

Notes:

For further discussion of the 1998 and 2007 remediation actions, refer to the Custom Plywood Remedial Investigation (RI) report (AMEC 2011). The Phase I interim remedial action is described in its Draft Construction Completion Report (Hart Crowser 2011e).

Refer to Figure 1-2 for Phase I interim remedial action features and to Figure 2-1 for historical upland remedial action locations.

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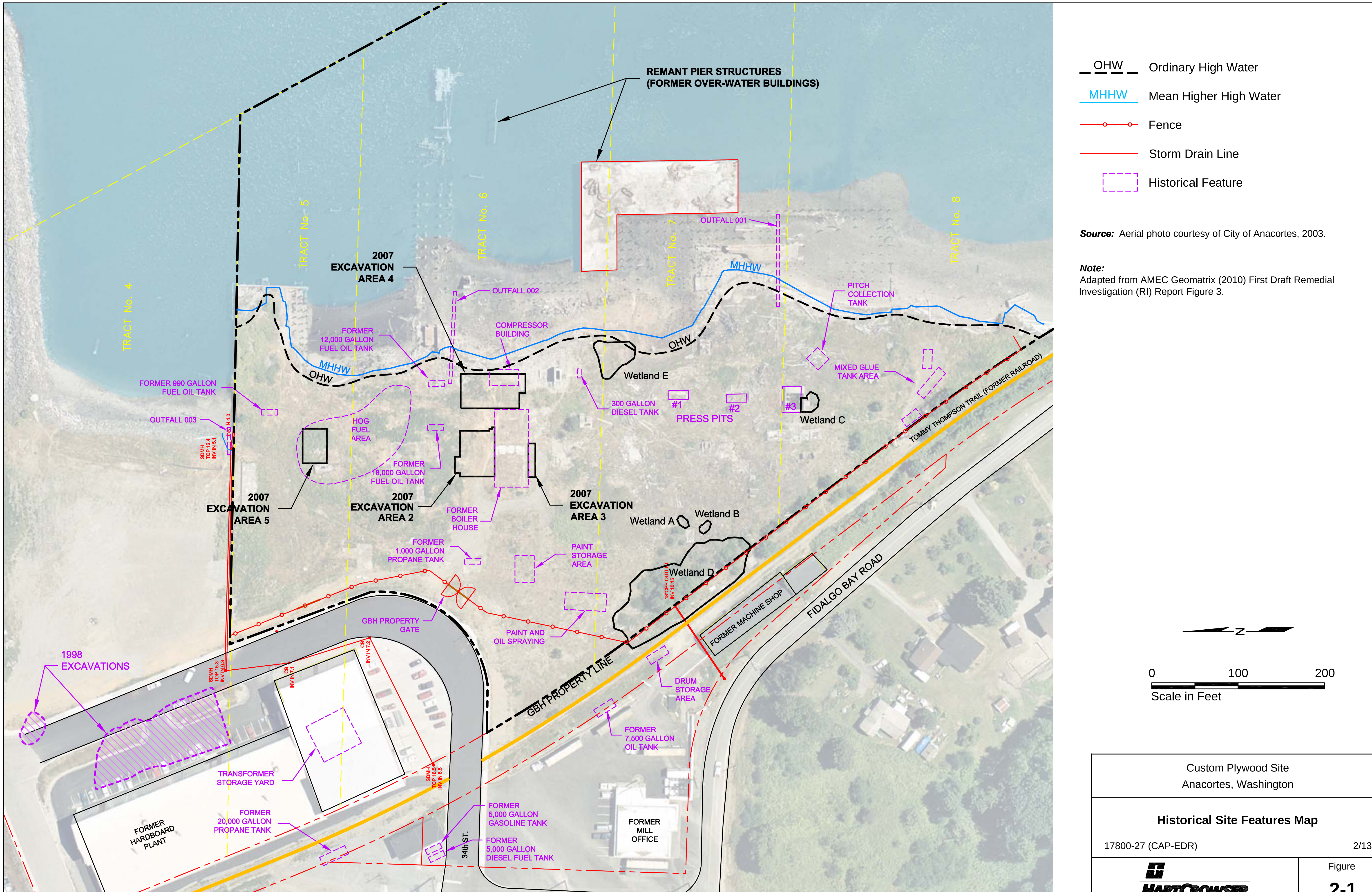

Source: Aerial photo courtesy of City of Anacortes, 2003.

Note: Adapted from AMEC Geomatrix (2010) First Draft Remedial Investigation (RI) Report Figure 3.

Custom Plywood Site
Anacortes, Washington

Historical Site Features Map

17800-27 (CAP-EDR) 2/13

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Figure **2-1**

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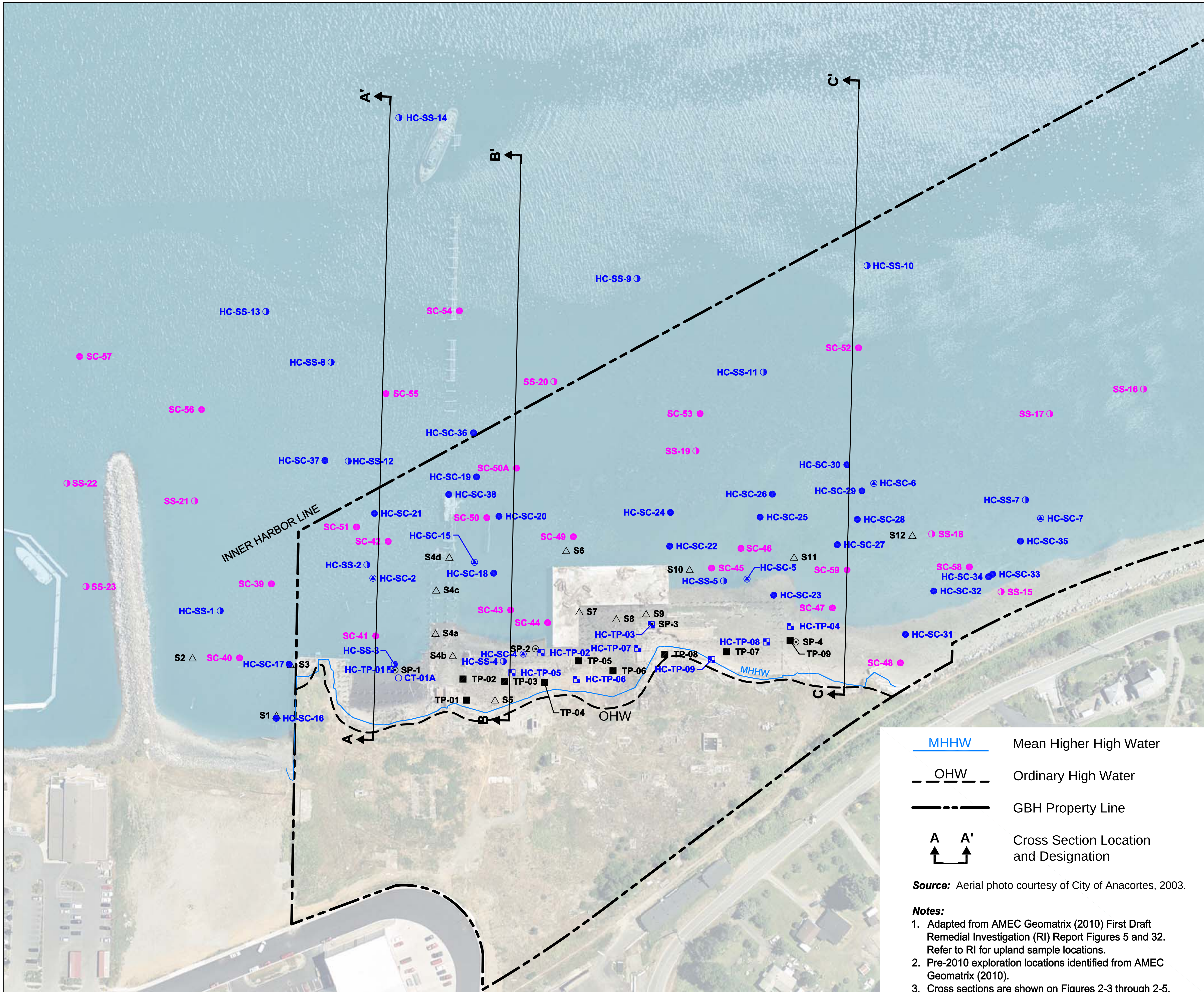

2012 Exploration Location and Number

- SS-16 ◑ Surface Sediment Sample (Hart Crowser 2012)
- SC-40 ● Vibracore Sample (Hart Crowser 2012)

2010 Exploration Location and Number

- CT-01A ○ Sample (SAIC 2010)
- HC-TP-01 Test Pit (Hart Crowser 2010)
- HC-SS-2 ◑ Surface Sediment Sample (Hart Crowser 2010)
- HC-SC-2 Subsurface Sediment Sample (Hart Crowser 2010)
- HC-SC-37 ● Vibracore Sample (Hart Crowser 2010)

Pre-2010 Exploration Location and Number

- S1 △ Sediment Sample (Enviros 1995b)
- TP-01 ■ Test Pit (Geomatrix 2007; AMEC 2009)
- SP-1 ⊙ Seep Sample (AMEC 2009)

N

0 150 300

Scale in Feet

MHHW Mean Higher High Water

OHW Ordinary High Water

GBH Property Line

A A' Cross Section Location and Designation

Source: Aerial photo courtesy of City of Anacortes, 2003.

Notes:

1. Adapted from AMEC Geomatrix (2010) First Draft Remedial Investigation (RI) Report Figures 5 and 32. Refer to RI for upland sample locations.
2. Pre-2010 exploration locations identified from AMEC Geomatrix (2010).
3. Cross sections are shown on Figures 2-3 through 2-5.

Custom Plywood Site
Anacortes, Washington

Aquatic Area Historical Exploration Plan

17800-27 (CAP-EDR) 2/13

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Figure **2-2**

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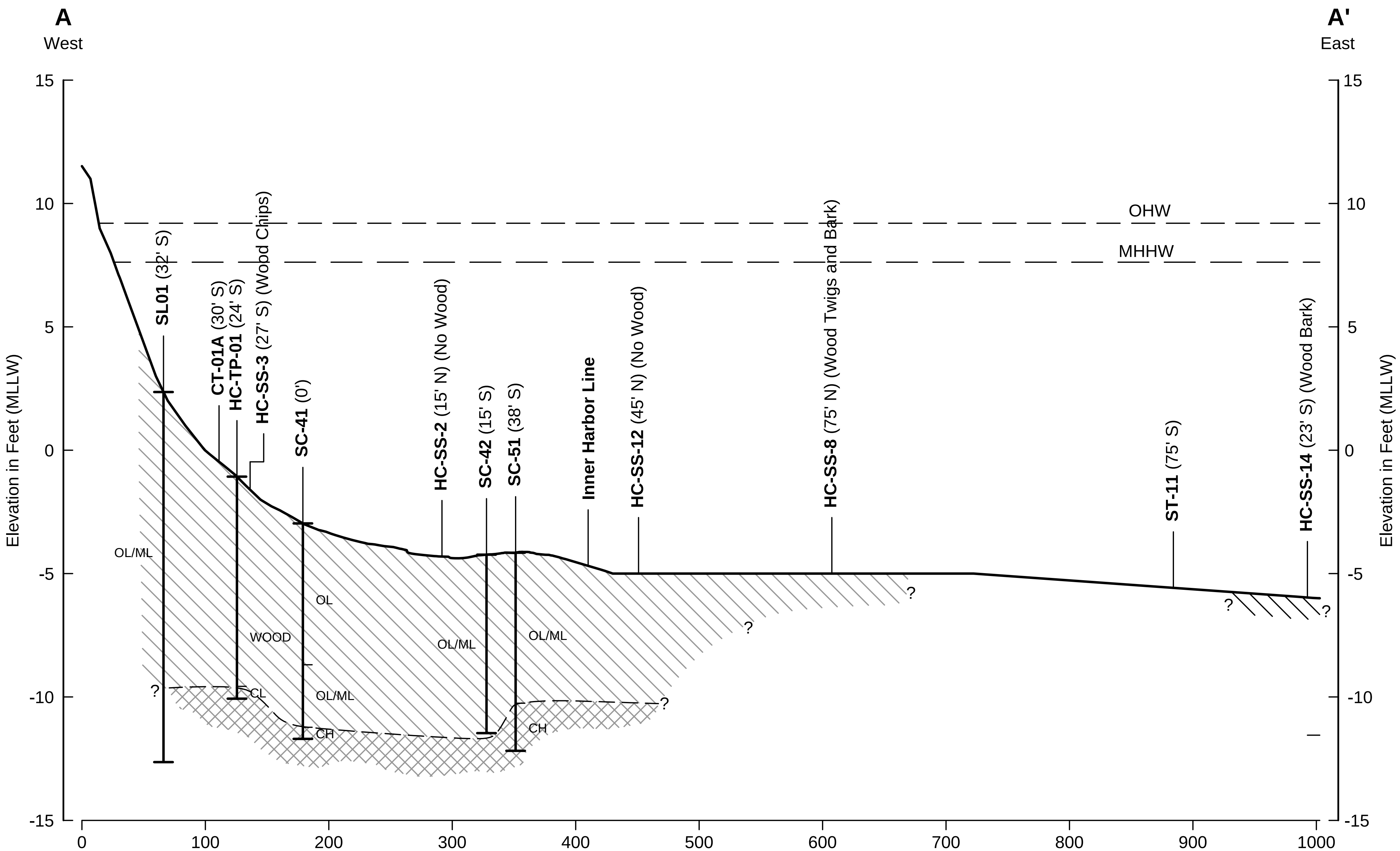

SL01 (32' S) Exploration Number (Offset Distance and Direction)

Exploration Location

Inorganic and Organic Silts with Varying Amounts of Wood Debris

Native (CL/CH), Inorganic Clays

MHHW Mean Higher High Water

OHW Ordinary High Water

Notes:
1. Vibracore logs were corrected for compaction.
2. See Figure 2-2 for cross section location.

Horizontal Scale in Feet
0 100 200

0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 20

Soil Classification Symbols:

OL	Organic silts and organic silty clays of low plasticity
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
WOOD	Primarily wood debris with some silt

Custom Plywood Site
Anacortes Washington

Cross Section A-A'
Aquatic Remediation Alternative A-3
Existing Conditions

17800-27 (CAP-EDR) 2/13

HARTCROWSER

Figure
2-3

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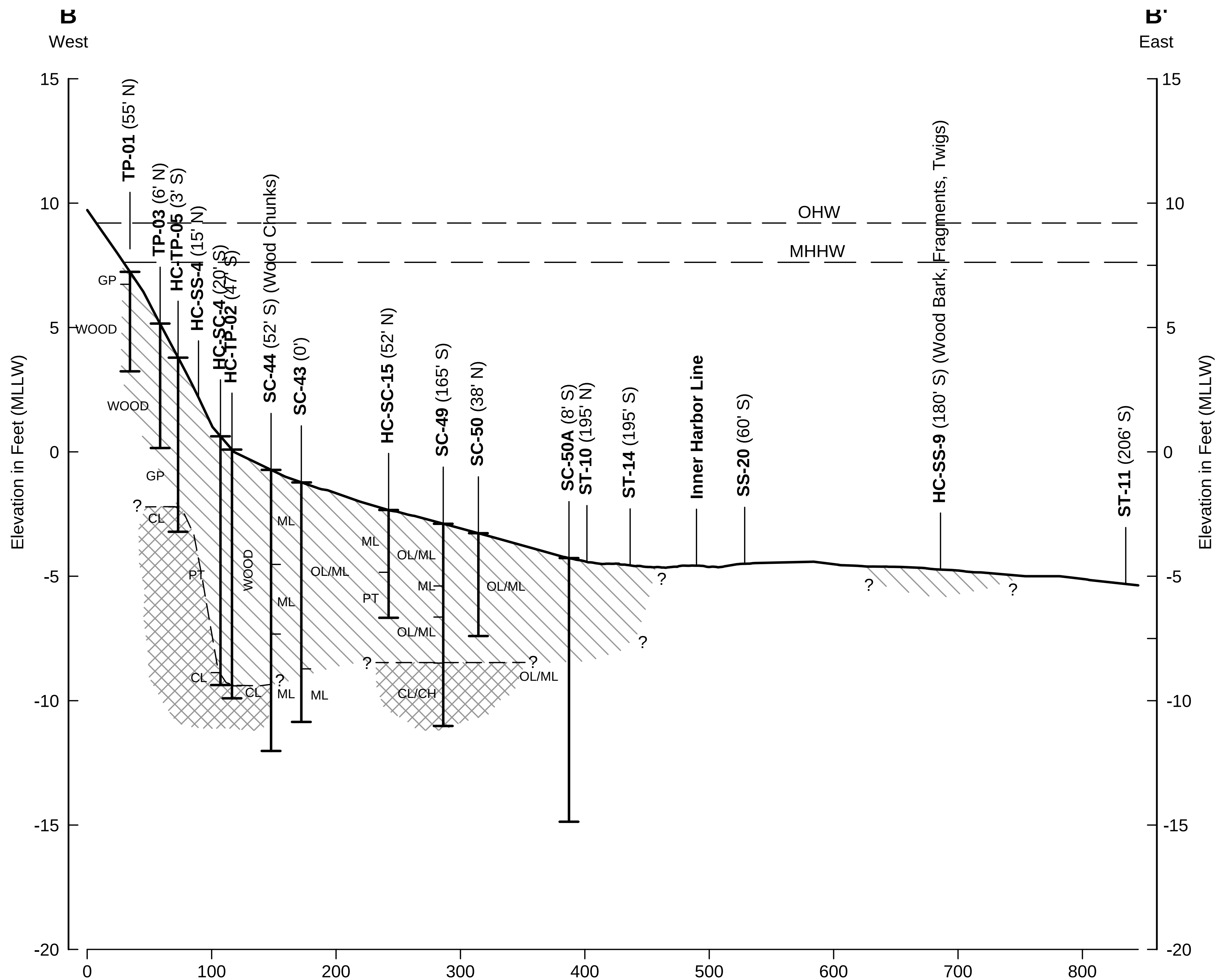

TP-01 (55' N) Exploration Number (Offset Distance and Direction)

Exploration Location

Inorganic and Organic Silts with Varying Amounts of Wood Debris with Some Poorly-Graded Gravels

Native (CL/CH), Inorganic Clays

MHHW Mean Higher High Water

OHW Ordinary High Water

Notes:

1. Vibracore logs were corrected for compaction.
2. See Figure 2-2 for cross section location.

Horizontal Scale in Feet
0 100 200

0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 20

Soil Classification Symbols:

GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
OL	Organic silts and organic silty clays of low plasticity
PT	Peat, humus, swamp soils with high organic content
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
WOOD	Primarily wood debris with some silt

Custom Plywood Site
Anacortes, Washington

Cross Section B-B'
Aquatic Remediation Alternative A-3
Existing Conditions

17800-27 (CAP-EDR) 2/13

HARTCROWSER

Figure
2-4

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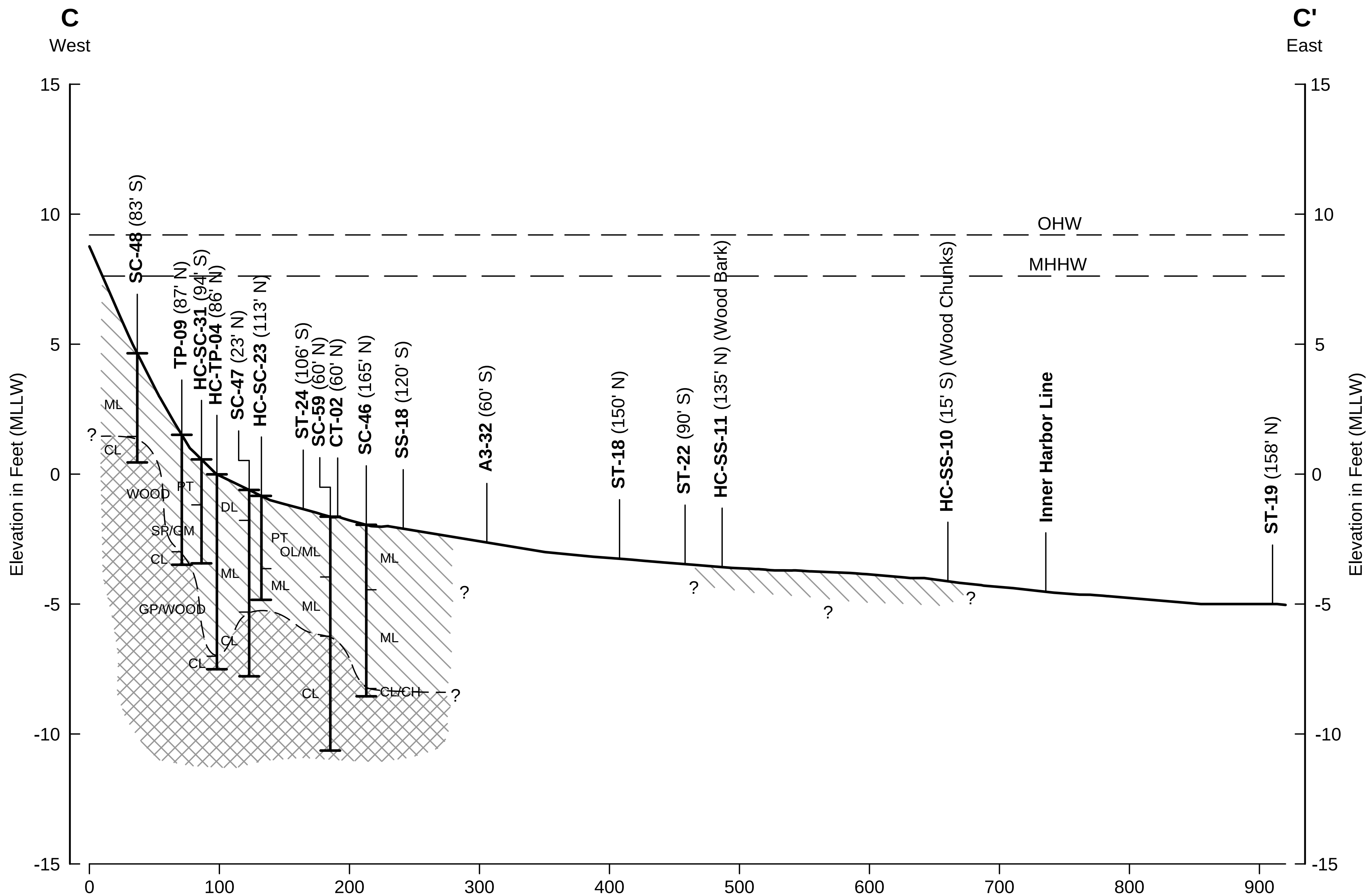

SC-48 (83' S)	Exploration Number (Offset Distance and Direction)
	Exploration Location
	Inorganic and Organic Silts with Varying Amounts of Wood Debris
	Native (CL/CH), Inorganic Clays
MHHW	Mean Higher High Water
OHW	Ordinary High Water

Notes:
1. Vibracore logs were corrected for compaction.
2. See Figure 2-2 for cross section location.

Horizontal Scale in Feet
0 100 200

0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 20

Soil Classification Symbols:

GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
SP	Poorly graded sands, gravelly sand, little or no fines
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
OL	Organic silts and organic silty clays of low plasticity
PT	Peat, humus, swamp soils with high organic content
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
WOOD	Primarily wood debris with some silt

Custom Plywood Site
Anacortes, Washington

Cross Section C-C'
Aquatic Remediation Alternative A-3
Existing Conditions

17800-27 (CAP-EDR) 2/13

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Figure
2-5

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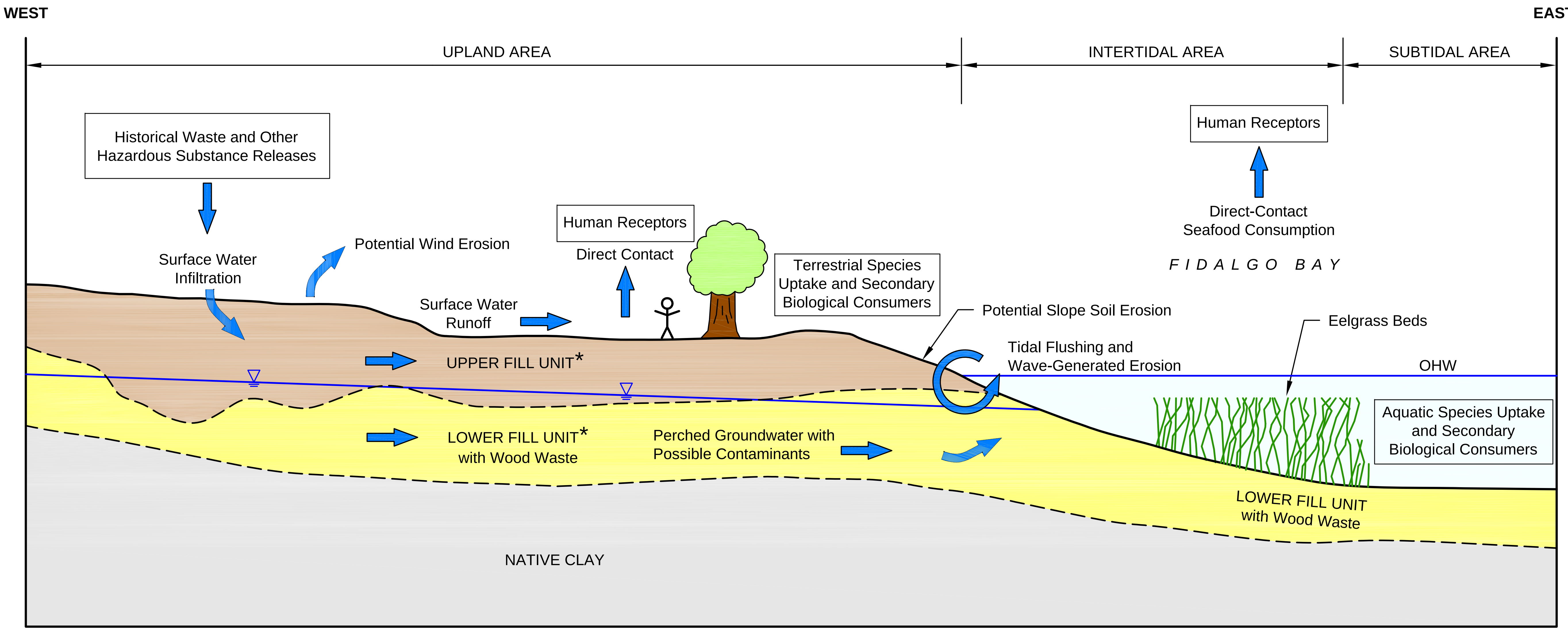

*Secondary Contaminant Sources

Not to Scale

Custom Plywood Site
Anacortes, Washington

Conceptual Site Model
Generalized Cross Section Looking North

17800-27 (CAP-EDR) 2/13

HARTCROWSER

Figure
2-6

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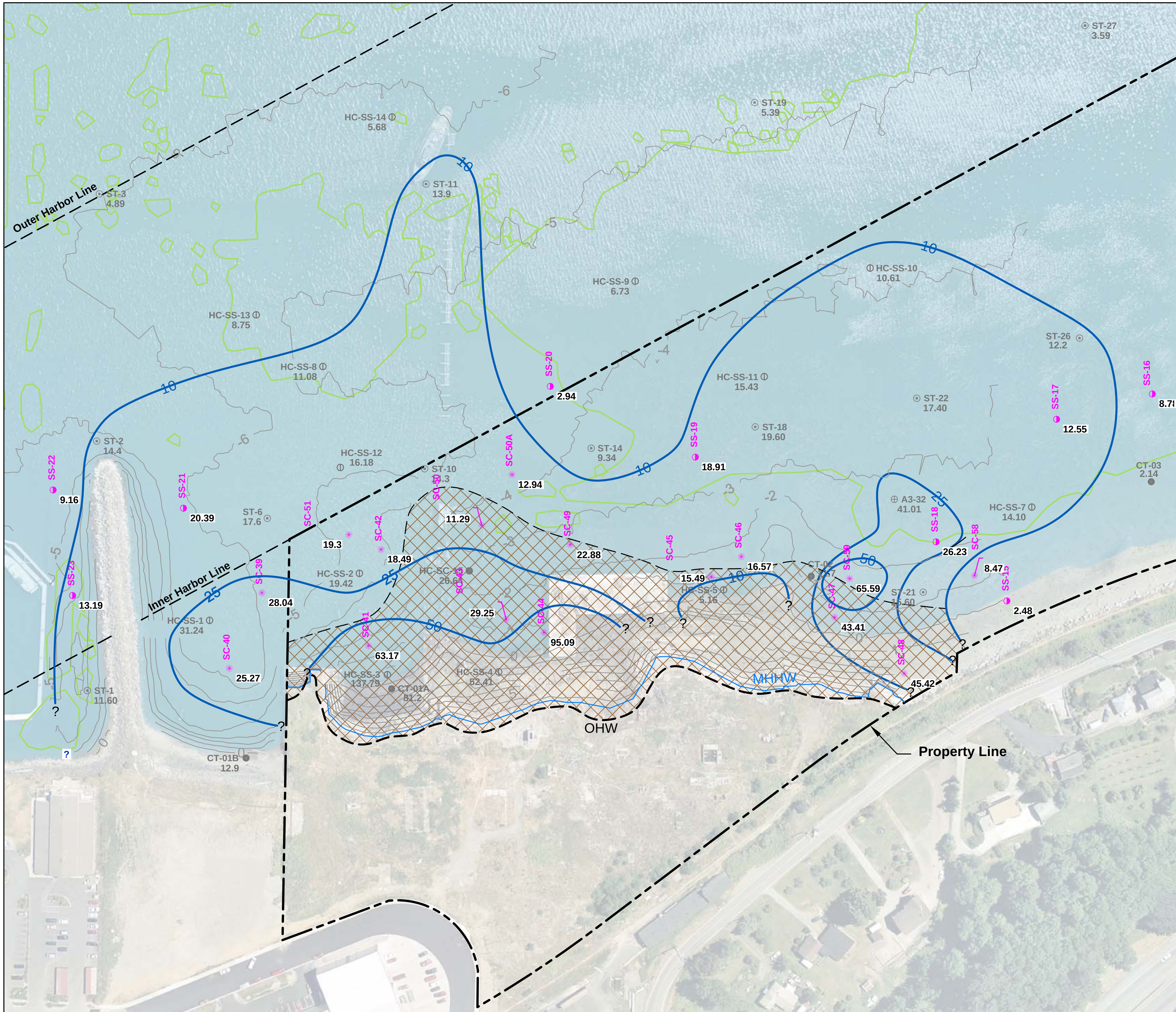

Sediment Exploration Location and Number

- SS-16 — Surface Sediment Sample (Hart Crowser 2012)
- SC-40 — Vibracore Sample (Hart Crowser 2012)
- HC-SS-2 — Surface Sediment Sample (2010 Hart Crowser)
- HC-SC-2 — Vibracore Sample (2010 Hart Crowser)
- CT-01A — Surface Sediment Sample (2010 SAIC)
- A3-23 — Surface Sediment Sample (2008 SAIC)
- ST-1 — Surface Sediment Sample (2008 Geomatrix)
- 8.99 — Discrete Surface Sample Dioxin Concentration in parts per trillion (ppt) TEC (1/2 DL TEC)
- Inferred Extent of Wood Waste 6 Feet Thick or More
- Approximate Extent of Eelgrass Beds
- 10 — Dioxin TEC Contour in ppt
- MHHW — Mean Higher High Water
- OHW — Ordinary High Water

Notes:
1. Seaward of MHHW, elevations in feet (MLLW).
2. Inferred extent of wood waste shown derived from FS Figure 5-2.

Source: Aerial photo courtesy of City of Anacortes, 2003.

N

0 150 300
Scale in Feet

Custom Plywood Mill
Anacortes, Washington

Total Dioxin TEC Contours and Inferred Extent of Wood Waste in Site Aquatic Area

17800-27 (CAP-EDR) 2/13

HARTCROWSER

Figure **2-7**

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3.0 CLEANUP REQUIREMENTS

The following sections identify the remedial action objectives and cleanup standards for the aquatic portions of the Site addressed in this CAP-EDR. 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. Together, project remedial action objectives and cleanup standards provide the framework for selecting a preferred remedial alternative (CAP Section 4.0), as well as evaluating other remedial alternatives (CAP Section 5.0).

3.1 Remedial Action Objectives

The primary objective for the Phase II cleanup action at the Site focuses on substantially eliminating, reducing, and/or controlling unacceptable risks to the environment posed by constituents of potential concern (COPCs) to the extent feasible and 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 will remove 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.

These remedial action objectives are presented as target goals to be achieved to the extent feasible and practicable. A key additional objective is the preservation and protection of cultural resources, should such objects be encountered during the remedial action.

3.1.1 Shoreline Stability Considerations

As discussed in the FS, wave and current action have resulted in significant erosion of the filled shoreline zone and are expected to continue to do so in the future. Results of coastal engineering modeling completed to date are consistent with observed shoreline erosion scarps and high-energy events, such as those that occurred during the winter of 2010. Additional modeling and coastal engineering completed as part of this CAP-EDR are presented in Appendix D. Protective in-water features to prevent further shoreline erosion and migration/dispersion of deleterious sawdust and residual contaminated sediment from the Site intertidal areas are further addressed in this CAP-EDR for the Phase II interim 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 woody debris and dioxins at the Site. However, cleanup criteria established by the MTCA, SMS, or other regulatory criteria may not be achieved by this action. A general discussion of those criteria follows.

3.2.1 Cleanup Levels and Points of Compliance

Cleanup levels for aquatic cleanup consist of applicable MTCA, SMS, and other protective regulatory concentration criteria for sediment. These cleanup levels are identified as the lowest applicable or relevant and appropriate requirement (ARAR) criteria currently established. Cleanup levels for sediment are established through standard SMS criteria for chemical constituents and bioassay testing. Additional interim action cleanup criteria are established for wood waste and dioxins in sediment.

Key indicator hazardous substances and COCs were identified, by medium, after a review of the RI. As noted in Section 7.0 of the RI, indicator hazardous substances were identified based on their frequency of occurrence, mobility and persistence in the environment, and/or their toxicological characteristics (WAC

173-340-703). POCs are identified in accordance with the SMS for affected sediment.

Sediment

The SMS establishes applicable benthic cleanup criteria including sediment quality standards (SQS) and cleanup screening levels (CSLs). The SQS defines the level below which there is no adverse effect on biological resources. The CSL is established as the level above which minor adverse effects are defined for station clusters of potential concern as defined under the SMS. The Sediment Management Standards narrative also establishes the standard that corresponds to no significant health risks to humans.

Sediment quality investigations supporting the RI identified SMS CSL bioassay failures, but no exceedances of SQS chemical criteria. The RI indicated that other contributing factors, such as holding times, may have promoted bioassay failure. The RI also included results of relatively limited dioxin testing in sediment within the former Custom Plywood property area. SAIC conducted additional surface sediment sampling, collection, and testing near the former Custom Plywood facility and elsewhere in Fidalgo and Padilla Bays in 2010. Results from previous investigations verified the presence of near-surface dioxin concentrations exceeding the 1.4 ppt background established by Ecology for Fidalgo Bay following SAIC's 2010 investigation (FS Appendix A). Additional sediment quality sampling for dioxin was conducted in December 2010 (presented in FS Appendix E) and January 2012. Dioxin concentrations ranging up to 95 ppt were detected in the nearshore area during the January 2012 sediment investigation, with multiple locations exceeding 25 ppt (see Figure 2-7).

Dioxin and Wood Waste as Key Indicator Hazardous Substances. No standard dioxin/furan screening criteria for sediment are established in MTCA or in the SMS; however, MTCA requires that cleanup levels be otherwise established based on risk or background concentrations.

Aquatic portions of the Site could extend one-half mile or more seaward (encompassing approximately 440 acres) toward the center of Fidalgo Bay until dioxin concentrations approach background levels. The FS focused on sediment located near the Site. An interim action cleanup criterion of 10 ppt 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. The aquatic area where dioxin TEC exceeds 10 ppt encompasses approximately 19.2 acres, based on sediment monitoring data collected through January 2012 (see Appendix A). A higher action threshold of 25 ppt TEC (encompassing approximately 4.5 acres) was established as a trigger for considering more intensive remedial measures (e.g., dredging or thick capping), given the greater relative risk to receptors at higher dioxin 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 beyond mean higher high water (MHHW). Wood waste also spatially coincides with dioxin concentrations elevated above the 10-ppt lower action cleanup threshold established in this interim action.

Given the current understanding of the nature and extent of wood waste in the aquatic portions of the Site, a practical approach to define interim action cleanup criteria was developed in the FS as follows:

- **Higher Action Threshold.** More intensive remediation (e.g., excavation or dredging[2] versus thin capping) considered for areas with wood waste accumulation of 1 foot or greater below existing mudline; and

- **Lower Action Threshold.** Remaining areas with conspicuous surficial wood waste considered for less intensive remediation (e.g., thin capping versus thick capping).

Quantitative data on wood waste volume percentages, offshore depth extent, related total volatile solids (TVS), and total organic carbon (TOC) are very limited and do not provide a basis to guide the application of these interim action cleanup criteria. Higher and lower action threshold areas were determined from available exploration sample descriptions and related visual observations.

Point of Compliance. 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. As stated previously, this remedy is being completed as an interim

[2] All "excavation" will be done in the dry from the land side using land-based equipment, and therefore not through the water column. Conversely, almost all "dredging" will be done through the water column using barge-based equipment. This distinction is made to reflect that the different types of field activities will be evaluated under differing sets of criteria of the resource/regulating agencies involved.

action. The ultimate goal of any final remedy will include cleanup at the POC. However, COCs that are in excess of final clean up criteria may remain following the interim action.

3.2.2 Potentially Applicable Regulatory Requirements

MTCA and SMS regulatory provisions form the primary basis for evaluating and implementing aquatic cleanup alternatives for remediation at the Site. Following selection of a preferred alternative, MTCA requirements guide the process for preparing this CAP. Additional MTCA and other regulatory requirements will be further addressed in the EDR and in the project design plans and specifications. In-water cleanup components are planned as phased actions, with Phase II beginning in 2013 and Phase III work planned tentatively for the 2015 construction season.

Although exempt from procedural requirements of certain state and local laws and related permitting requirements, pertinent substantive compliance requirements apply. Formal procedural requirements will remain in effect if Ecology determines that an exemption will result in loss of approval by a federal agency. Applicable exempted state laws include:

- Chapter 70.94 RCW – Washington Clean Air Act;
- Chapter 70.95 RCW – Solid Waste Management – Reduction and Recycling;
- Chapter 70.105 RCW – Hazardous Waste Management;
- Chapter 75.20 RCW – Construction Projects in State Waters;
- Chapter 90.48 RCW – Water Pollution Control Act; and
- Chapter 90.58 RCW – Shoreline Management Act.

The exemption also applies to local government permits and approvals associated with the remedial action. Although the in-water remedial actions are expected to be exempt from these procedural requirements, compliance with substantive provisions of these regulatory programs is required. Construction actions associated with cleanup are further subject to requirements of the State Environmental Policy Act (SEPA – Chapter 43.21C RCW).

MTCA does not provide a procedural exemption from federal permitting. Federal permitting for in-water work could likely be conducted under the Nationwide 38 permit program administered by the US Army Corps of Engineers

(USACE), or, alternatively, under a Clean Water Act Section 404 permit. Additional applicable requirements pertain under Clean Water Act Section 401 (Water Quality Certification), and the Endangered Species Act (agency consultation). In addition, the Fidalgo Bay region is known to be archaeologically sensitive, and USACE involvement in Clean Water Act permitting triggers provisions of Section 106 of the National Historic Preservation Act of 1966, and the Archeological and Historical Preservation Act (16 USCA 469). The project will be coordinated with state and local agencies regarding substantive compliance issues, and USACE and other federal agencies for federal permitting issues. In addition, the Samish Indian Nation, Swinomish Tribal Community, and other tribes with usual and accustomed treaty rights within Fidalgo and Padilla Bays, and the Washington State Department of Archaeology and Historic Preservation (DAHP) will be consulted on cultural resource and archaeological matters. An Archaeological Monitoring Plan has been prepared for intertidal construction activities and is presented in Appendix B.

A wide range of state, federal, and local compliance requirements may be applicable to the aquatic work that is planned for the Site. These potential compliance requirements and activities that could trigger the requirements are summarized in Table 3-1. Additional detail is provided in the FS.

City of Anacortes Permits

Applicable City of Anacortes permitting approvals will be obtained for Phase II. Permitting actions will consist of submitting an application for a standard City of Anacortes Grading Permit. Guidance from the City to streamline the permitting process will result in inclusion of applicable elements for demolition and a Shorelines Master Program exemption.

Joint Aquatic Resources Permit Application

In late August 2012, the Joint Aquatic Resources Permit Application (JARPA) along with the Biological Evaluation Report will be submitted for Phase II after pre-consultation with the resource agencies and Tribes. The JARPA addresses impacts and subsequent mitigation efforts that must be undertaken for wetlands and water bodies present on the Site.

3.3 Aquatic Remediation Areas

This section describes aquatic areas of concern at the Site where the concentration of COPCs exceeds 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 Section 2.0 of this CAP. Uncertainty remains regarding the overall depth and extent of contamination in the aquatic area. This uncertainty is due to the limited number of sediment samples that have been collected and analyzed to identify the areal boundaries and depth of contamination in the areas of concern. Detailed historical information that could more thoroughly describe contaminant sources and migration mechanisms is not available.

For these reasons, a number of working assumptions were used to provide a practical means of delineating remediation areas for the purposes of evaluating cleanup alternatives and selecting a preferred alternative.

3.3.1 Marine Sediment Management Areas

Wood waste and dioxin are the identified COCs for defining sediment management areas (SMAs) for marine cleanup at the Custom Plywood Site. Figure 2-7 identifies an overall interim action cleanup area determined by comparing dioxin concentrations in surface sediment to the dioxin screening level established by Ecology (10 ppt TEC) (see FS Section 4.0). Figure 2-7 further identifies two general SMAs defined within this interim action area based on wood waste accumulation thickness, which are 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 to which this CAP-EDR applies lies primarily in the nearshore SMA where wood waste thickness is generally greater than 6 feet. Additional rationale used to establish the aquatic SMAs based on dioxin and wood waste is summarized below.

Criteria for Defining Marine SMAs

Dioxin concentrations measured in sediment near the Custom Plywood Site exceed the 1.4 ppt Fidalgo Bay background concentration for some distance eastward into the bay (refer to Figure 2-7). This background concentration represents the SMS-based cleanup level established for the Custom Plywood Site by Ecology. For the purposes of the FS, an interim action cleanup criterion of 10 ppt dioxin TEC was established as a threshold to delineate marine SMA areas and to provide a practicable means to assess candidate remediation technologies, alternatives, and comparative costs. The overall SMA for the aquatic interim action is, therefore, defined by the 10 ppt dioxin TEC concentration contour shown on Figure 2-7. The overall SMA includes several locations with dioxin concentrations exceeding 25 ppt. The 10 ppt and 25 ppt concentrations represent low and high action levels for the remedial action, respectively.

Wood waste occurrence can be conceptualized as defining a western and an eastern SMA where accumulation of woody material is either greater than 6 feet (nearer the shoreline) or less than 6 feet (away from the shoreline). The hatched area on Figure 2-7 depicts the nearshore SMA where wood waste thickness is generally greater than 6 feet. Although wood waste thickness contours (and associated parameters such as TOC and TVS) are not well established by existing data, Figure 2-7 shows general areas intended to define the east and west SMAs based on wood waste thickness criteria. The intertidal and subtidal zones that are addressed in this CAP for Phase II lie primarily in the nearshore SMA.

3.3.2 Estimated Sediment Volumes for Remediation

Overall wood waste thicknesses and volumes in the marine environment are currently not well defined. However, additional sampling data from the December 2010 and January 2012 field investigations have been used to refine these higher concentration areas and volumes. Assuming a hypothetical average wood waste thickness of about 0.5 foot over the area of the east SMA, and a nominal thickness of up to 6 feet over the area of the west SMA, the total in-water wood waste volume is estimated at about 60,000 CY. This estimate includes wood waste mixed with near-surface debris in the uppermost 2 feet of the sediment profile. In the intertidal zone, the estimated sediment volume to a depth of 6 feet is approximately 13,000 CY.

The volume of dioxin-impacted sediment is difficult to estimate given the limited number of surface and subsurface sediment samples that have been analyzed. Assuming that dioxin in the east SMA is restricted to near-surface sediment and relatively thin wood waste cover, the associated SMA volume exceeding 10 ppt but less than 25 ppt in the east SMA is comparable to that for wood waste (i.e., about 10,300 CY assuming an affected thickness of about 0.5 foot).

Higher concentration areas exceeding 25 ppt are depicted on Figure 2-7. If the higher concentrations are assumed to extend through the entire wood waste profile (say averaging 5 feet in thickness) of the high concentration area, the total affected volume of dioxin-impacted sediment and wood waste could be up to about 36,100 CY.

Table 3-1 - Potentially Applicable Federal and State Regulatory Requirements

Federal Regulations	Regulatory Citation	Triggering Activity
Clean Water Act	Sections 303, 311, 312, 401, and 404 US Code (USC) 1252 et seq.	Dredging and placement of sediment capping materials within navigable waters of the United States, protection of surface water quality, and filling or removal of wetlands.
Coastal Zone Management Act	16 USC 1455	Construction activities requiring federal approval must be consistent with the State's Coastal Zone Management Program.
Rivers and Harbors Act	33 USC 403 and CFR Parts 320 and 32	Alteration of waters of Fidalgo Bay as a navigable waterway.
Endangered Species Act	16 USC 1531 et seq.	Presence or suspected presence of threatened or endangered species or critical habitat at or near the site at the time of anticipated work.
National Historic Preservation Act of 1966	Section 106 – 16 USC 470 and 36 CFR Part 800	SEPA regulatory compliance, and federal permitting, assistance, and related involvement.
Archeological and Historical Preservation Act	16 USCA 469	Discovery of archaeological or historical objects during remediation activities.
State Regulations		
Solid and Hazardous Waste Management and Related Federal Resource Conservation and Recovery Act	Chapter 70.105 and 70.105D (MTCA) and Chapter 173-303; and 42 USC 6921-6949a and 40 CFR Part 268, Subtitle D	Potential for generating, handling, and disposing of dredged material containing designated hazardous wastes.
Sediment Management Standards	Chapter 173-204 WAC	Actions which expose or resuspend surface sediments which exceed, or otherwise cause or potentially cause surface sediments to exceed applicable standards of the WAC 173-204-320 through 340.
Water Quality Standards for Surface Waters of the State of Washington	Chapter 90.48 RCW and Chapter 173-201A WAC	Potential for construction activities for the upland and in-water remedial action to adversely affect surface waters of the State.
State Environmental Policy Act	Chapter 43.21C RCW, Chapter 197-11 WAC, and Chapter WAC 173-802	Permit application or proposed regulatory cleanup action under MTCA or SMS, and impacts to critical areas.
Shoreline Management Act	Chapter 90-58 RCW and Chapter 173-27 WAC	Construction work within the shoreline zone.
Wetlands – Water Pollution Control Act	90-48 RCW, WAC 365-190-090, and Chapter 173-201A WAC	Construction work affecting wetlands.
Fish and Wildlife Habitat Conservation	Chapter 77-85 RCW and WAC 365-190-130	Construction work within fish and wildlife habitat conservation areas and within the shoreline zone.
Saltwater Habitats of Special Concern	WAC 220-110-250	Construction work within the shoreline and intertidal zones.
Washington Hydraulics Code	Chapter 70-95 RCW and Chapter 173-304 WAC	Use, diversion, obstruction, or change in the natural flow or bed of Fidalgo Bay from the in-water component of the remedial action.
Indian Graves and Records and Archaeological Sites and Resources	RCW Chapter 27.44 and RCW Chapter 27.53	Construction project involving state funding.

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4.0 REMEDIAL ACTION ALTERNATIVES CONSIDERED AND BASIS FOR AQUATIC REMEDY SELECTION

Five aquatic remedial alternatives with different excavation, dredging, and sediment capping options were evaluated in the FS. A range of shoreline protection measures and mitigation alternatives were considered, as described in the supporting FS appendices. This section summarizes the process used to identify candidate remedial technologies (Section 4.1), describes the remedial alternatives developed at a generalized level (Section 4.2), and identifies the MTCA criteria used to evaluate each potential remedial alternative (Section 4.3).

4.1 Remedial Technology Screening Process

Candidate remedial technologies were identified and screened in Sections 6.1 and 6.4 of the FS to develop potential cleanup alternatives for further evaluation. The remedial technologies considered include methodologies capable of achieving the remedial action objectives, including MTCA cleanup levels and SMS and other regulatory requirements.

Candidate technologies applicable to impacted sediment were identified in many sources, including compilations such as those discussed in the web-based Federal Remediation Technology Roundtable. Applicable technologies were screened based on their expected implementability, reliability, and relative cost. Screening was consistent with MTCA evaluation criteria described further in Section 4.3. The FS provides additional background on these evaluation factors along with the rationale for retaining or discarding particular technologies.

4.2 FS Alternatives Evaluated

Remediation alternatives applicable to impacted sediment at the Site were developed from the technologies retained through the screening process summarized in Section 4.1. Five aquatic remediation alternatives (A-1 through A-5) were developed from the retained technologies. These remedial technologies include methodologies capable of achieving remedial action objectives, including ARARs pertinent to the intertidal portions of the Site addressed in this CAP.

Only the intertidal portion and part of the subtidal portion of the selected aquatic alternative will be implemented in Phase II of the interim cleanup addressed in this CAP. However, because the development and evaluation of aquatic alternatives in the FS considered the intertidal zone and entire subtidal zone together, the following evaluation summary includes discussion of both. See the FS for the complete aquatic alternatives analysis.

4.2.1 Aquatic Remedial Alternatives Summary

Five aquatic remedial alternatives (A-1 through A-5) were developed from the technologies retained in the technology screening. These alternatives included various combinations of intertidal zone excavation and backfilling and subtidal dredging and thin-layer capping to facilitate enhanced natural recovery (ENR). Demolition of remaining concrete structures, surface debris and wooden piling removal, long-term monitoring, and institutional controls were included in each of the aquatic remediation alternatives, in addition to shoreline protection measures.

Alternatives A-1 through A-3 incorporated variations of excavation and dredging depths in the intertidal and subtidal aquatic areas. Alternative A-1 was the most comprehensive with deep excavation and dredging to 6 feet below the existing surface in both the intertidal and subtidal areas. Alternative A-2 was the least conservative with shallow excavation and dredging to 2 feet below the existing surface in both the intertidal and subtidal areas. Alternative A-3 was a hybrid approach, using deep excavation in the intertidal area and shallow excavation in the subtidal area.

Alternatives A-4 and A-5 are variations of Alternatives A-1 and A-2, respectively, in which implementation of ENR is confined to affected eelgrass bed locations only, and dredging is expanded to include all areas where total dioxin TEC exceeds 10 ppt, excluding eelgrass bed areas. The other remedial elements remain the same as in Alternatives A-1 and A-2. Table 4-1 summarizes and compares specific components for each aquatic remedial alternative.

4.2.2 Additional Technologies Considered

The FS considered a number of additional candidate technologies for aquatic remediation. Biological, physical, and chemical treatment technologies exist for *ex situ* treatment of removed sediment. These technologies include bioremediation, thermal treatment, sediment washing, chemical treatment, and solidification and stabilization options. Although some may provide effective treatment, these technologies may potentially be difficult to implement at the Custom Plywood Site for reasons that include space limitations for the required treatment systems, physical and chemical characteristics of the sediment that reduce effectiveness, and potentially relatively high capital and operation and maintenance (O&M) costs. For these reasons, *ex situ* treatment technologies for removed sediment were not retained for further evaluation.

4.3 Evaluation Process for Aquatic Remedial Alternatives

This section summarizes the process that was used to evaluate aquatic remedial Alternatives A-1 through A-5 and to select Alternative A-3 as providing the most appropriate combination of remedial components for implementation. Key guiding requirements for evaluating FS alternatives and cleanup action selection for the Custom Plywood Site are listed in the MTCA (WAC 173-340-360) and SMS (WAC 173-204-560) regulations. This section summarizes these requirements as applied to the aquatic alternatives evaluation.

The MTCA criteria used to evaluate each alternative are summarized in Section 4.3.1, and SMS criteria are summarized in Section 4.3.2. Aquatic remedial alternatives are then compared by MTCA criteria in Section 4.3.3, with the conclusion of this evaluation process summarized in Section 4.3.4.

4.3.1 MTCA Evaluation Criteria

Key guiding requirements for evaluating remedial alternatives and remedial action selection for the Site are listed in the MTCA regulations and detailed in the FS. MTCA criteria consist of threshold requirements and other criteria listed in WAC 173-340-360(2) Minimum Requirements for Cleanup Actions, as listed in Table 4-2 and detailed in the FS.

MTCA Disproportionate Cost Analysis – WAC 173-340-360(3)(e) and (f)

MTCA places preference on permanent solutions to the maximum extent practicable based on a disproportionate cost analysis (DCA). The benefits of the alternatives considered are balanced against relative costs for implementing each alternative. Preference is also placed on remedies that can be implemented in a shorter time, based on potential environmental risks and effects on current site use and associated site and surrounding area resources. The third criterion, public concerns, is addressed during comment periods for RI/FS documents, remedy selection decision, and subsequent CAP for remedy implementation.

The DCA represents a test to determine whether incremental costs of a given alternative over a lower-cost option exceed the incremental degree of benefit achieved by the higher cost alternative. The most practicable permanent solution is identified as the baseline cleanup action alternative for FS evaluation. The referenced section of MTCA further specifies that where alternatives are equal in benefits, the least costly alternative will be selected, provided that the MTCA threshold and other requirements are met. Relative costs and benefits of the remedial alternatives are evaluated in the DCA based on specific criteria listed in WAC 173-340-360(3)(f) and summarized in Table 4-3.

4.3.2 SMS Evaluation Criteria

Sediment management standard (SMS) requirements are applicable to in-water portions of the Custom Plywood Site cleanup effort. The standards list evaluation requirements for cleanup alternatives comparable to MTCA requirements under SMS section WAC 173-204-560(4). These requirements closely mirror MTCA in requiring evaluation of cleanup actions that protect human health and the environment by eliminating, reducing, or otherwise controlling risks posed through each exposure pathway and migration route. Additional SMS requirements listed in WAC 173-204-560(4)(f) through (k) for consideration include:

- The time for sediment recovery;
- Confirmational monitoring;
- Current and potential future uses of affected areas or areas that may be affected by contaminant releases;
- Institutional controls;
- Phased approach for alternatives evaluation;
- Attainment of cleanup standards;
- Short-term and long-term effectiveness;
- Ability to be implemented;
- Cost;
- Community concerns;
- Degree to which recycling, reuse, and waste minimization are employed; and
- Environmental impacts pursuant to State Environmental Policy Act (SEPA) requirements (not a MTCA requirement).

Requirements for SMS cleanup action decisions are further described in SMS section WAC 173-204-580(2) through (4). Like MTCA, SMS cleanup actions require achieving protection of human health and the environment, compliance with cleanup standards and ARARs, source control, consideration of public concerns, and monitoring. SMS cleanup action decisions must also address cleanup time frames, current and future site and vicinity use and impacts, effectiveness and reliability, contamination control, and natural recovery processes. In addition, SMS allows authorization of cleanup time frames that exceed 10 years where cleanup actions are not practicable in less time. Further net environmental effects of the alternatives, cost effectiveness, public participation, and land access are also to be considered.

4.3.3 Alternatives Comparison by MTCA Criteria

Remedial alternatives for the aquatic area were evaluated based on MTCA regulatory criteria and DCA considerations. The FS alternatives were evaluated to assess compliance with minimum regulatory requirements, including consistency with provisions of MTCA, SMS, and other ARARs. DCA criteria were evaluated based on a relative numeric ranking system from 1 to 5, with 1 as the lowest (least favorable) ranking, and 5 as the highest (most favorable) ranking. The DCA criteria were further weighted on a proportional basis to emphasize protectiveness (30 percent), permanence (20 percent), long-term effectiveness (20 percent), management of short-term risks (10 percent), technical and administrative implementability (10 percent), and consideration of public concerns (10 percent) as the drivers for the ranking.

This DCA ranking approach is consistent with the relative numeric ranking system used for other Puget Sound aquatic cleanup sites. The DCA scores were then totaled and compared to determine the overall ranking and cost benefit. Results of the alternatives evaluation and DCA are presented in Table 4-2, with estimated project costs for the aquatic remedial alternatives presented in Table 4-3. Appendix C of the FS presents a detailed breakdown of the estimated costs for the aquatic (intertidal and subtidal) remedial alternatives.

4.3.4 Aquatic Remedial Action Alternatives Comparison

The ability of each aquatic remedial alternative to meet applicable MTCA criteria is assessed in this section.

MTCA Threshold Criteria – Protectiveness, Compliance with Standards and ARARs, and Provisions for Compliance Monitoring

Alternatives A-1, A-3, and A-4 provide a high degree of protectiveness by removing wood waste up to 6 feet below mudline and backfilling with sandy material and near-surface soft rock armor for wave protection. This depth provides a significant safety factor by removing wood debris that could potentially generate ammonia, sulfide, and other degradation products. Such degradation products represent potential contaminant sources for the near-surface marine environment, depending on potential migration pathways and other risk/exposure considerations. The other alternatives provide some degree of protectiveness by excavating or dredging wood waste to 2 feet below grade and capping.

Other MTCA Criteria – Permanence, Restoration Time Frame, and Public Concerns

Alternatives A-1, A-3, and A-4 provide permanent and effective measures to maximize removal of wood waste (and dioxin) from the marine environment through deeper excavation and dredging. Shallower excavation and dredging associated with Alternatives A-2 and A-5 may also result in permanent, manageable cleanup actions over the long term, but more uncertainty exists given larger volumes of wood waste left in place compared with deeper excavation in Alternatives A-1, A-3, and A-4. Off-site disposal of dredged materials containing abundant wood waste contributes to permanent and effective long-term risk reduction for all alternatives.

Removal of impacted sediment and wood waste via excavation and dredging and subsequent backfilling and capping provide rapid reduction of wood waste exposure. Although excavation and dredging impact existing marine habitat, much of the affected habitat is not optimal substrate because of the wood waste and surficial debris. Backfilling and capping materials with soft armor surface protection provide a permanent habitat enhancement measure that can be readily implemented as part of the site remediation.

Permanence, restoration time frame, and public concerns are further addressed as part of the DCA ranking below.

DCA Evaluation and Alternatives Ranking

As summarized in Table 4-2, aquatic Alternative A-1 ranked highest based on higher scores for protectiveness, permanence, and long-term effectiveness associated with deeper wood waste removal. Alternative A-5 is a variant of

Alternative A-2 and ranked as the lowest based on lower scores in these same categories and management of short-term risks. The lower scores for Alternative A-5 (and the Alternative A-4 variant of Alternative A-1) reflect concerns over resuspension of dioxin-contaminated material and control of dredging residuals. Alternatives A-2 and A-3 were given rankings of 3 and 2, respectively, because of the differences in the depth of wood waste removal accomplished by each alternative. In comparison to the lowest-ranked Alternative A-5 base case, the other alternatives provided incremental benefits ranging from 5 to 25 percent higher because of the DCA scoring. Alternative A-1 provided the maximum amount of wood waste removal of the aquatic alternatives and the corresponding greatest benefit (25 percent).

Total estimated costs for the aquatic remedial alternatives ranged from a low of about $10.5 million for Alternative A-2, which involves shallow wood waste removal, to a high of $23.9 million for Alternative A-4 involving more aggressive offshore dredging. Alternative A-4 costs are disproportionate relative to the incremental benefit (5 percent) achieved over the other aggressive dredging Alternative A-5 base case. Alternative A-4 also provided less benefit than the other alternatives and was considerably more expensive.

None of the remaining alternatives were disproportionate to the lowest-ranked Alternative A-5 base case. Of these alternatives, Alternative A-3 represents the best cost benefit. This can be quantified as a relative difference of 54 percent between the increased benefit (123 percent) and decreased cost (-31 percent) of Alternative A-3 over the A-5 base case. Comparative cost-benefit percentages for Alternatives A-1 and A-2 calculated in this manner are 39 and 48 percent, respectively. Although Alternative A-1 may provide greater protection than Alternative A-3, the cost is more than $4 million higher. The cost for Alternative A-2 is nearly $2 million less than A-3, but the incremental benefit is less because of shallower wood waste excavation in the nearshore environment.

Overall costs for Alternative A-3 are estimated at about $12.3 million for remediation of both the intertidal and subtidal areas. This includes projected construction costs of $9.3 million (incorporating 30 percent contingency) and estimated non-construction, mitigation, shoreline protection feature construction, and long-term monitoring and maintenance costs of about $3.0 million. Excluding contingencies and long-term monitoring, estimated capital costs for construction, related engineering support, and eelgrass mitigation are approximately $7.3 million for Alternative A-3. The shoreline protection feature component (separate from construction) is estimated at $1.3 million to construct the jetty extension and protective spit. Should some fraction of the dredge material be acceptable for in-water disposal, construction costs could be substantially decreased.

4.4 Interim Aquatic Remedial Alternative Selection and Implementation

Following the above MTCA analysis and DCA, Alternative A-3 was identified as the selected alternative for the interim aquatic remedial action, pending public review of the Interim Action Work Plan, including this CAP-EDR. Consistent with Chapter 70.105D RCW, as implemented following the regulatory requirements of Chapter 173-340 WAC, Ecology has 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.

Alternative A-3 is planned to be implemented along with the shoreline protection measures and habitat mitigation components described previously in this CAP-EDR. Additionally, it includes appropriate institutional controls and post-construction monitoring to evaluate long-term remedy performance. Remedy implementation and estimated costs are further evaluated and presented in the following sections of this CAP-EDR.

4.5 Habitat Restoration/Improvement Opportunities

Under the Puget Sound Initiative, MTCA cleanup actions are designed to coincidentally enhance and/or restore marine habitat. The selected Phase II and III in-water cleanup action will significantly restore habitat and will improve almost 19.2 acres of currently degraded and damaged intertidal and subtidal habitat (see Section 2.0).

Habitat enhancements will be constructed as part of the Phase II interim remedial action. These enhancements include creating a jetty extension and softening the jetty; creating a protective spit; removing a bulkhead and enhancing shoreline; and restoring additional wetland. 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 include:

- **Jetty Extension and Softening.** A shoreline protective feature in the northern portion of the Site, the jetty extension allows for placement of a smaller, stable particle size (2 to 3 inches) by attenuating the predominant wave energy from the north. The smaller particle size will support foraging habitat for migrating juvenile salmonids. A breach between the existing jetty and jetty extension will maintain the existing salmonid migratory pathway. The shoreward side of the existing jetty and eastern beach will be enhanced (softened) with a sandy substrate suitable for forage fish spawning habitat, and will support epibenthic crustaceans and other fauna beneficial to foraging juvenile salmonids.

- **Protective Spit.** A shoreline protective feature in the southern portion of the Site, the spit is located in an area of dioxin TEC ranging from 10 to 25 ppt. The spit will serve as a cap over contaminated intertidal substrate, protect the beach face on the southern portion of the Site from erosive wave action, and improve aquatic habitat. The shoreward face of the spit includes a sandy substrate suitable for forage fish spawning habitat at appropriate elevations and will support juvenile salmonid food sources.

- **Existing Bulkhead Replacement Protective Feature.** This protective feature at the northern property boundary will replace the existing degraded bulkhead. The bulkhead replacement will reduce erosion of the northern shoreline while occupying a smaller footprint than the existing bulkhead, and will transition into the soft armoring to the north and south. A layer of sand will cover the bulkhead replacement and will be planted with dunegrass to support backshore habitat and reduce erosion of the upper beach.

- **Bank Stabilization/Soft Shore Armoring.** A surface layer of graded sand and rounded gravel habitat material, 2 to 3 inches in size and smaller, will be placed in intertidal and shallow subtidal areas to support forage fish spawning habitat along the property shoreline. A minimum thickness of 6 inches of material will be placed between +5 and +8 feet MHHW to provide suitable substrate to support forage fish spawning habitat. Dunegrass will be planted along the OHW line of the property shoreline to provide erosion control and backshore habitat.

- **Wetland Mitigation Area.** The wetland mitigation area constructed as part of the Phase I interim upland remedial action will be planted with salvaged and newly acquired native salt marsh vegetation during the Phase II remedial work. This area mitigates adverse effects of remediation activities and construction on freshwater and estuarine wetlands. The mitigation area restores and consolidates smaller individual wetlands, providing higher quality habitat. The wetland buffer was planted with native trees, shrubs, and backshore vegetation during Phase I of the project.

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Table 4-1 - Aquatic Remedial Alternatives Summary

Aquatic Remediation Components	Aquatic Remediation Alternative				
	A-1	A-2	A-3	A-4	A-5
	Deep Nearshore and Offshore Excavation/Dredging ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	**Shallow Nearshore and Offshore Excavation/Dredging[b] ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls**	**Deep Nearshore and Shallow Offshore Excavation/Dredging[b] ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls**	**Alternative A-1 Except: Dredge All Dioxin-Affected Areas > 10 ppt ENR in Eelgrass Beds**	**Alternative A-2 Except: Dredge All Dioxin-Affected Areas > 10 ppt ENR in Eelgrass Beds**
Nearshore Surface Debris and Marine Structure Removal[a]	Yes	Yes	Yes	Yes	Yes
Shoreline Protective Features (To Be Confirmed)	Yes	Yes	Yes	Yes	Yes
Wood Waste and Sediment Removal					
Nearshore: MHHW to 50 Feet Seaward Land-Based Equipment					
Excavate All Areas > 25 ppt Dioxin TEC	Yes	Yes	Yes	Yes	Yes
Excavate Remaining Wood Waste and Dioxin TEC > 10 ppt up to 6 Feet Below Surface Grade	Yes	No	Yes	Yes	Yes
Excavate Remaining Wood Waste and Dioxin TEC > 10 ppt up to 2 Feet Below Surface Grade	Included	Yes	Included	Included	Included
Offshore: Seaward of 50 Feet Beyond MHHW Barge-Based Equipment					
Dredge All Areas Where Dioxin TEC > 25 ppt	Yes	Yes	Yes	Yes	Yes
Dredge up to 6 Feet Below Grade Where Wood Waste > 1 Foot Thick	Yes Excludes Eelgrass Beds	No	No	Yes Excludes Eelgrass Beds	No
Dredge up to 2 Feet Below Grade Where Wood Waste > 1 Foot Thick	Included Excludes Eelgrass Beds	Yes Excludes Eelgrass Beds	Yes Excludes Eelgrass Beds	Included Excludes Eelgrass Beds	Yes Excludes Eelgrass Beds
Dredge All Areas Where Dioxin TEC > 10 ppt and < 25 ppt	Included Where Wood Waste > 1 Foot Thick Except Eelgrass Beds	Included Where Wood Waste > 1 Foot Thick Except Eelgrass Beds	Included Where Wood Waste > 1 Foot Thick Except Eelgrass Beds	All Affected Areas Except Eelgrass Beds	All Affected Areas Except Eelgrass Beds
Backfilling and Capping[c]					
Wave Erosion Zone Excavation and Dredging Areas					
Place Habitat Mix to Within 1 Foot of Existing Grade	Yes	Yes	Yes	Yes	Yes
Place Beach Armor Mix from Top of Habitat Mix to Existing Grade	Yes	Yes	Yes	Yes	Yes
Seaward of Wave Erosion Zone					
Place Habitat Mix to Existing Grade in Dredging Areas	Yes	Yes	Yes	Yes	Yes
Place ENR Thin-Layer Cap In Non-Dredging Areas					
Includes Wood Waste Areas Generally < 1 Foot Thick and Dioxin TEC < 25 ppt Includes Affected Eelgrass Beds	Yes	Yes	Yes	In Affected Eelgrass Bed Areas Only	In Affected Eelgrass Bed Areas Only
Points of Compliance	Upper 10 cm of Sediment Surface	Upper 10 cm of Sediment Surface	Upper 10 cm of Sediment Surface	Upper 10 cm of Sediment Surface	Upper 10 cm of Sediment Surface
Monitoring					
Post-Construction Sediment Confirmation Monitoring: Excavation/Dredge Cut Bottoms and Sidewalls	Yes	Yes	Yes	Yes	Yes
Long-Term Cap Performance/Protection Monitoring (Physical Integrity)	ENR Areas Only	Capped Excavation/Dredge and ENR Areas	Capped Excavation/Dredge and ENR Areas	Not Expected to Be Needed if Dioxin Removed to < Background Concentration	Capped Excavation/Dredge Areas
Institutional Controls					
MTCA Administrative Order Conditions	Yes	Yes	Yes	Yes	Yes
MTCA Site Listing	Yes	Yes	Yes	Yes	Yes
Potential City Administrative Restrictions?	ENR Areas Only?	Yes	Yes	No?	Yes
Long-Term Monitoring Requirements	Yes	Yes	Yes	Yes	Yes
Access and Deed Restrictions	ENR Areas Only?	Yes	Yes	Possibly Not Needed if Dioxin Removed to < Background Concentration	Possibly Not Needed if Dioxin Removed to < Background Concentration

Notes:
(a) Includes nearshore debris removal to approximately 2 feet below grade, and piling and other marine structures removal.
(b) Includes potential deeper excavation/dredging to remove sediments with dioxin/furan concentrations > 25 ppt.
(c) Backfilling applies to areas with residual wood waste < 1 foot thick and dioxin/furan concentrations less than background. Capping applies to areas with residual wood waste > 1 foot thick and dioxin/furan concentrations greater than background.

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Table 4-2 - Summary of MTCA Evaluation Criteria and DCA for Aquatic Remedial Alternatives

Criteria	Alternative				
	A-1	A-2	A-3	A-4	A-5
Criteria	Deep Nearshore and Offshore Excavation/Dredging ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	Shallow Nearshore and Offshore Excavation/Dredging[b] ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	Deep Nearshore and Shallow Offshore Excavation/Dredging[b] ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	Alternative A-1 Except: Dredge All Dioxin-Affected Areas > 10 ppt ENR in Eelgrass Beds	Alternative A-2 Except: Dredge All Dioxin-Affected Areas > 10 ppt ENR in Eelgrass Beds
MTCA Threshold Criteria WAC 173-340-360(2)(a)					
Protection of Human Health and the Environment	Yes	Yes	Yes	Yes	Yes
Compliance with Cleanup Standards	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	Yes	Yes	Yes	Yes	Yes
Provision for Compliance Monitoring	Yes	Yes	Yes	Yes	Yes
Other MTCA Evaluation Criteria WAC 173-340-360(2)(b)					
Permanence	Yes	Yes	Yes	Yes	Yes
Restoration Time Frame	<1 Year[a]	<1 Year[a]	<1 Year[a]	<1 Year[a]	<1 Year[a]
Consideration of Public Concerns	Yes	Yes	Yes	Yes	Yes
MTCA Disproportionate Cost Analysis DCA - WAC 173-340-360(3)(f)[b]					
Protectiveness (30%)	1.4	0.9	1.2	1.1	0.9
Permanence (20%)	0.9	0.6	0.8	0.6	0.6
Long-Term Effectiveness (20%)	0.8	0.6	0.7	0.6	0.6
Management of Short-Term Risks (10%)	0.3	0.4	0.4	0.3	0.3
Technical and Administrative Implementability (10%)	0.4	0.4	0.4	0.3	0.3
Consideration of Public Concerns (10%)	0.3	0.3	0.3	0.3	0.3
Total Scores	4.0	3.2	3.7	3.2	3.0
Estimated Cost (+50% -30%)	**$16,580,000**	**$10,518,000**	**$12,276,000**	**$23,880,000**	**$17,706,000**
Overall Alternative Ranking	1	3	2	3	4
% Benefit Compared with Lowest Ranking Alternative A-5	133%	107%	123%	105%	100%
% Cost Difference Compared with Lowest Ranking Alternative	-6%	-41%	-31%	135%	100%
Overall Cost Benefit (% Benefit - % Cost Difference from Base Case)	39%	48%	54%	-30%	0%
Cost Disproportionate?	No	Not Applicable	No	**Yes**	**Yes**

(a) Assumes no exceedances of surface sediment interim action levels during post-construction monitoring.
(b) Ranked on a 1 to 5 scale with 5 being highest.

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Table 4-3 - Aquatic Remedial Alternatives Estimated Cost Summary

Description	Aquatic Remediation Alternative				
	A-1 Deep Nearshore and Offshore Excavation/Dredging ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	**A-2** Shallow Nearshore and Offshore Excavation/Dredging ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	**A-3** Deep Nearshore and Shallow Offshore Excavation/Dredging ENR in Non-Excavated/Dredged Areas Monitoring and Institutional Controls	**A-4** Alternative A-1 Except: Dredge All Dioxin-Affected Areas > 10 ppt ENR in Eelgrass Beds	**A-5** Alternative A-2 Except: Dredge All Dioxin-Affected Areas > 10 ppt ENR in Eelgrass Beds
FS Appendix C Cost Table Reference	C-A1	C-A2	C-A3	C-A4	C-A5
Construction Subtotal (Including Shoreline Protection and 30% Contingency)	$13,236,600	$7,898,800	$9,375,600	$19,454,500	$14,176,500
Non-Construction Costs	$2,648,000	$1,924,000	$2,205,000	$3,730,000	$2,834,000
Long-Term Monitoring and Maintenance (Annual and Periodic Costs)	$695,000	$695,000	$695,000	$695,000	$695,000
Estimated Total	$16,579,600	$10,517,800	$12,275,600	$23,879,500	$17,705,500
Estimated Total (rounded)	**16,580,000**	**10,518,000**	**12,276,000**	**23,880,000**	**17,706,000**

Notes:
Estimated cost assumes an accuracy range of -30 to +50 percent.
See Feasibility Study for additional cost discussion and breakdown.

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5.0 SELECTED PHASE II REMEDIAL ACTION

The Phase II component of the selected aquatic remedial alternative for the Site is described in this section. Additionally, a brief conceptual introduction to the subsequent Phase III subtidal component is provided in the final subsection. This section is organized as follows:

- Section 5.1 describes Phase II. Cleanup activities include sediment excavation and disposal; intertidal structure and piling demolition and removal; and implementing JARPA permit measures and site conditions after the cleanup. See Figure 5-1 for a plan view of the planned remedial action.

- Section 5.2 describes post-cleanup shoreline protection and improvement measures designed to prevent erosion, and restore multiple habitats. These benefits will be achieved by extending the jetty at the Site, constructing a protective spit, providing for continued wetland mitigation, and creating public access to shoreline areas. See Figures 5-1 and 5-2 and Appendix D for plan and cross-section views of the planned shoreline protection and improvement plans.

- Section 5.3 describes the monitoring that will be conducted at the Site, which includes construction performance monitoring; post-construction confirmational monitoring; and contingency actions, should they be found necessary through compliance monitoring.

- Section 5.4 describes potential future land use and institutional controls. This section discusses how the remedy conforms to future land use plans, which includes environmental covenants to protect human health and the environment by controlling the use of the Site and managing any contamination that remains.

- Section 5.5 provides a preliminary schedule for implementing Phase II.

- Section 5.6 provides a conceptual overview and preliminary schedule for implementing Phase III.

5.1 Description of the Phase II Interim Intertidal and Subtidal Remedial Action

Remnants of the Site's former lumber mill and plywood manufacturing plant are present throughout the intertidal zone and adjacent subtidal area. The interim remedial action will remove structures, piles, and debris, and will reduce wood waste and contaminant concentrations to levels protective of human health and the environment within the intertidal zone. Additionally, subtidal structures that can be removed using land-based equipment will be demolished in Phase II, minimizing the future need for land equipment mobilizations.

Throughout this document, excavation, whether upland or within the intertidal zone, is defined as removing soil with conventional land-based equipment such as loaders and excavators (track hoes). Dredging is defined as sediment removal using water-based equipment such as a barge and clamshell bucket. The sections that follow, in addition to Sections 6.4 and 6.5, discuss Phase II excavation and dredging in more detail.

5.1.1 Intertidal Sediment Excavation and Disposal

The remedy selected in the FS (Alternative A-3) will remove near-surface debris and relatively thick accumulations of wood waste in the intertidal zone, which is defined as a strip extending along the Site shoreline approximately 50 feet seaward of the OHW line, as shown on Figure 5-1. Excavation will extend to a depth of 6 feet or to native material, whichever is reached first. Assuming a uniform excavation depth of 6 feet, approximately 13,000 CY of debris and wood waste will be excavated from the intertidal zone. The excavation area will be backfilled to provide a barrier/cap over impacted materials that may be left in place following the interim action and to provide a base for habitat enhancements.

Along the southern portion of the shoreline, excavation will extend a short distance landward of the OHW line in certain locations to remove soil up to the Phase I excavation boundary nearby. In addition, contaminated soil in and around Wetland E, which is a 1,389-SF low- to moderate-quality estuarine and freshwater wetland, will be excavated and backfilled during the interim remedial action. Before excavation, native vegetation from Wetland E and along the property shoreline will be salvaged and planted in the wetland mitigation area constructed during Phase I. Wetland E will be removed using land-based construction equipment that will excavate to approximately 6 feet below existing grade, removing approximately 350 CY of material. Excavation, backfilling, and soil disposal for Wetland E will follow the same procedures outlined for the contaminated sediment excavated during the remedial action.

To access the nearshore excavation locations and to limit the amount of wet sediment work, excavation will be conducted during periods of low tide. The work will progress in successive plots that are sized so that they can be excavated and backfilled during the low-tide window, thus minimizing inundation of the open excavation and release of turbidity to the bay. Similar nearshore and tideflat excavations have been successfully completed elsewhere in Puget Sound to control turbidity and without resulting in cross contamination. Steel plates may need to be placed on the beach to prevent heavy equipment from becoming mired in the soft sediment and wood waste.

The FS considered using sheet pile shoring, if needed, to reduce water inflow and turbidity impacts during nearshore excavation. This shoring contingency was not carried forward for the aquatic alternatives analysis, under the assumption that direct excavation of smaller intertidal areas in the dry at low tide may be feasible. Within the FS, it was assumed that no temporary shoring will be needed to complete the excavations. However, as discussed later in this document, the use of a shoring system will be used to eliminate the sloping of the excavation into the upland portion of the Site that is constructed with newly placed clean fill material.

Debris and Sediment Disposal

Excavated intertidal surface debris and sediment will be sent off site for disposal at a permitted Subtitle D landfill facility. Excavated material containing free water will be dewatered in a temporary holding cell before loading and transporting off site; material not requiring dewatering will be directly loaded into trucks for transport. Water from the dewatering process will be captured for treatment and/or off-site disposal as necessary. Should additional treatment or alternative disposal of excess water become necessary, cost impacts would be proportional to the volume of water requiring treatment/disposal.

Backfilling and Capping

Excavated areas will be backfilled to provide a barrier/cap over impacted materials that may be left in place following the interim action and to provide a base for habitat enhancements. The type and grain size of backfill material depends on proximity to the wave erosion zone. Within the wave erosion zone, graded 1-inch minus sandy gravel material will be placed to within about 1 foot of the existing grade, overlain by protective armor mix consisting of 3-inch minus sandy gravel. In areas outside of the wave erosion zone, the finer grained, fish habitat mix consisting of 1-inch minus material will be used to backfill the excavations to existing grades.

The capping remedy will be coupled with institutional controls to protect the cap structure. Institutional controls will notify site users about the cap and restrict activities that could damage it.

5.1.2 Subtidal Sediment Dredging and Disposal

Additional remedial work is planned in Phase II for the nearshore subtidal areas adjacent to the intertidal area. The nearshore subtidal areas are defined as the areas located seaward of the intertidal area where eelgrass is absent and where wood waste is greater than 1 foot thick or where the dioxin TEC exceeds 25 ppt (refer to Figure 5-1).

Dredging locations and depths were determined based on dioxin TEC and wood waste thickness (see Section 3.3). Nearshore subtidal areas where the dioxin TEC exceeds 25 ppt will be dredged to native material. Nearshore subtidal areas where wood waste is greater than 1 foot thick will be dredged up to 2 feet below surface grade (these areas typically contain dioxin TECs between 10 and 25 ppt). Approximately 32,000 CY of sediment will be dredged in these subtidal areas during Phase II. Cleanup of the subtidal areas consists of dredging using water-based equipment. The dredging work will be limited to periods when the water depth is sufficient to accommodate the draft of the floating equipment.

Dredged Sediment Disposal

Sediment dredged from the subtidal areas will be loaded directly to barges and allowed to dewater. Solids will be disposed off site at an approved upland disposal facility. Water pumped from the barges will be containerized and treated for POTW discharge and/or disposal off site. The wood waste content and anticipated TEC levels of dioxin preclude open-water disposal options.

Backfilling and Capping

Dredged areas will be backfilled following dredging. In locations where impacted material remains in place, the backfill material will serve as a barrier/cap over these materials. Backfill material consisting of 1-inch minus, sandy gravel will be placed to existing grade in subtidal dredge prisms. Backfill material will be placed using conventional barge-based equipment.

5.1.3 Structure Demolition, Debris, and Piling Removal

The selected remedy includes measures to demolish remaining concrete structures on the Site and to remove surface debris and wooden piles. It is expected that a nominal 2-foot-thick layer of debris will be removed from the surface of the intertidal excavation areas (approximately 4,400 CY), which will be disposed of off site along with excavated sediment. It is assumed that quantity of debris significantly decreases in the subtidal areas with distance from the shoreline.

All concrete structures and wooden piles within the intertidal and subtidal zones, will be removed as part of Phase II. This includes the remaining L-shaped concrete pier and bulkhead that remain at the Site. Because the L-shaped pier is an over-water structure, protective measures such as debris booms, turbidity curtains, and containment systems will be used to prevent concrete from falling into the water. Because the upland interim cleanup work has already been completed, concrete waste materials from demolition in the aquatic area (about 650 CY) will be disposed of off-site and will not be used for upland excavation backfill material, as discussed in the FS.

Work scheduling will likely need to consider periods of low and high tide to remove piles in more distant offshore locations, where water-based equipment is employed. Approximately 1,100 piles will be removed from the intertidal and subtidal areas as part of Phase II.

To reach the intertidal wooden piling, an access road will be constructed through the upland area to the shoreline, where temporary crane foundation pads will be constructed for long-reach cranes to pull piles. Based on previous work at the Site, it is assumed that the entire pile will be pulled. However, there may be instances where piles cannot be pulled. In this case, the piles will be cut or broken at a specified depth below the mudline. The rest of the pile would remain in place. Every effort will be made to pull entire piles before resorting to breaking or cutting. Piles not reachable by land-based equipment will be removed using barge-based equipment.

After all piles have been removed, and when nearshore aquatic excavations require backfilling, the temporary access road and crane pad materials (quarry spalls) will be used as backfill material in the nearshore excavations to the extent practical. Reuse of road and crane pad material eliminates the need for off-site disposal of this material, and reduces the quantity of backfill material that will need to be imported to the Site. It is assumed that the contractor will excavate only enough material per day, shift, or tide cycle that can be backfilled immediately; therefore, not all of the road/pad material can be reused as backfill. However, this material may be used by the property owner as fill or surface course in the uplands.

5.1.4 Contamination Remaining on Site after the Cleanup

The selected cleanup action may leave subsurface sediment with dioxin TEC at concentrations exceeding cleanup action levels where contamination is present below the 6-foot excavation depth. The 50-foot-wide intertidal excavation zone and the subtidal dredging areas will be backfilled with clean imported material following excavation, thus providing separation between the deeper contaminated sediment and the water of the bay. The areas of residual contaminated sediment will be documented following the completion of Phase II and will continue to be addressed using confirmational monitoring and environmental covenants at the Site.

5.2 Post-Cleanup Shoreline Protection and Habitat Improvement

5.2.1 Jetty Extension

An extension of the existing jetty north of the GBH property (Figure 5-1), perpendicular to the predominant wave energy, will allow for placement of protective armoring material of a smaller particle size. The armoring material will shield the remediation area from wind and wave erosion along the northern shoreline of the GBH property. In addition to protecting the remediation area, installation of the jetty extension will include habitat enhancement features such as a sandy, habitat-friendly substrate along the shoreward face of the existing jetty. The sandy substrate will create forage fish spawning habitat and support foraging juvenile salmonids. A breach or notch between the existing jetty and the extension will provide a migratory corridor for juvenile salmonids while still maintaining the protective nature of the feature. This protection measure was evaluated as being optimally consistent with both remediation and habitat enhancement goals for the interim action and will be included as part of the preferred shoreline protection concept for the selected aquatic remediation alternative.

5.2.2 Protective Spit Construction

The jetty extension introduced above will provide shoreline protection only for the northern portion of the shoreline. A second in-water protective feature is needed to protect the remainder of the shoreline. The protective spit (Figures 5-1 and 5-2) is optimally configured to maximize shoreline protection from erosive wave action for the southern half of the GBH property (refer to Appendix D). Configuration of the spit was based on modeled wave and wind energy along the Site's shoreline before and after in-water structure removal to gain a better understanding of the forces influencing the cleanup activities. Hydrodynamic modeling indicated that the already eroding southern portion of shoreline will be subject to increased wave energy once the existing in-water structures are removed. The spit offers an adequate level of protection while also protecting capped contaminated intertidal substrate. For added protection against erosive forces, a portion of the shoreline south of the protective spit will be stabilized (see Figure 5-1 and Appendix D). These structures have been designed to include habitat enhancement features, such as forage fish spawning habitat and habitat that supports juvenile salmonids along the shoreward extent.

The outer seaward face of the spit will be at a 9H:1V slope to dissipate wave energy and minimize the size of material needed to construct the protective feature. The shoreward face will be constructed at a 5H:1V slope. The protective spit will consist of a gravelly sand core material with a layer of habitat-friendly substrate over the top, which is suitable for forage fish spawning habitat. In addition, the spit will feature an 8-foot-wide bench at an elevation suitable for natural colonization of emergent estuarine wetland vegetation. The protective spit will also, as a secondary consideration, protect the new wetland and mitigation buffer area located within the southern portion of the GBH property.

While the spit itself will not include plantings of dunegrass, the wetland restoration area along the existing shoreline will provide a dunegrass planting area between the wetland and the forested upland buffer to attenuate energy and provide additional habitat for shorebirds and other species. Large wood and other features to enhance connectivity between upland and intertidal habitat will be developed further during design and the in-water permitting process. These habitat improvements were not considered as shoreline stabilization features, since they are not suitable for erosion control based on the wave energy analysis.

5.2.3 Continued Wetland Mitigation

During Phase I upland remediation activities, a bench was excavated and graded at suitable elevations for establishing estuarine wetland vegetation. A protective berm was created 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 will be breached to tidally connect the restored wetland with Fidalgo Bay (see Figures 5-1 and 5-2). Design details of the berm breach are presented in Appendix C of this CAP-EDR (for additional background detail, see Appendix B-1 of the Phase I CAP).

5.3 Monitoring

5.3.1 Construction Performance Monitoring

Performance monitoring (WAC 173-340-410(1)(b)) is intended to assure that a remedial action has attained cleanup standards including MTCA and SMS criteria or other performance standards, such as construction quality control measurements, permit conditions, or substantive requirements of other laws.

Performance monitoring following sediment excavation and dredging will begin with topographic elevation surveys or similar grade control measures to verify that the design grades and elevations have been achieved. Sediment samples will be collected and analyzed from the base of the excavation and dredge prism(s) to document the concentration of COCs that remain on the Site. The excavations and dredge prisms will be observed to determine the extent of remaining wood waste. Related monitoring and documentation includes verifying the chemical quality of imported backfill material, placing the backfill to match pre-existing grade, and establishing nominal compaction requirements during the design phase.

Performance monitoring will also be required to document construction of the protective spit, jetty extension, public access, and modifications to the temporary protective berm on the seaward side of the estuarine wetland complex. Monitoring will include demonstrating that the required areal coverage has been met, that appropriate excavation and materials placement have been completed to the planned lines and grades, and that required revegetation and habitat functions have been established.

Remedy performance criteria, quality assurance activities, documentation requirements, and potential corrective actions will be developed during the preparation of project plans and specifications in the design phase. This will further include health and safety protection monitoring as required under WAC 173-340-410(a) in the form of a Health and Safety Plan. A Health and Safety Plan will also be developed for the long-term operation, maintenance, and monitoring of the remedy.

5.3.2 Post-Construction Confirmational Monitoring

Confirmational monitoring (WAC 173-340-410(1)(c)) is a component of compliance monitoring intended to demonstrate the long-term effectiveness of the cleanup action once cleanup levels or other performance standards have been attained. Specific details for post-construction monitoring will be developed in an Operation, Maintenance, and Monitoring Plan (OMMP) following design phase preparation of project plans and specifications. Anticipated monitoring elements of the OMMP are summarized in Section 8.0.

5.3.3 Contingency Actions

Post-construction monitoring will evaluate whether contaminated sediment that is left in place after Phase II poses an unacceptable risk. Similar long-term monitoring programs will be established as part of the post-cleanup shoreline protection and improvement components of the OMMP.

Contingency Beach and Shellfish Bed Closure

Although this measure is not expected to be needed, the Skagit County Public Health Department/Samish Tribe will be alerted and consulted on the potential need for closure of nearby shellfish beds during the intertidal remediation. Section 7.3.1 identifies the need for development of a contingency beach and shellfish bed closure plan.

5.4 Future Land Use and Institutional Controls

The selected aquatic remedial Alternative A-3 addresses MTCA, SMS, and other regulatory requirements to provide a suitable cleanup action that adequately protects human health and the environment as a long-term solution. The remedial action also provides for nearshore habitat restoration and construction of shoreline protection features.

The upland portion of the GBH property is zoned for commercial development. Planned excavation and backfilling for Alternative A-3 in the intertidal zone, which abuts the upland area, is compatible with this future land use, including potential development of vessel storage and related boat manufacturing support activities envisioned by the current property owner. The selected remedial alternative also provides for potential public access near the south end of the GBH property, as anticipated by the City of Anacortes and described above.

Considerations for potential future commercial uses at the Site include the preservation of restored nearshore habitats and the shoreline protection features constructed in Phase II.

5.4.1 Environmental Covenants

One or more environmental covenants (WAC 173-340-440(9)) or similar institutional controls will be required for areas where contaminants at concentrations above cleanup levels or wood waste are left behind at the conclusion of the cleanup action. The covenants will identify sediment locations and depths that will require special management if disturbed, unless the sediment is removed later. Sediment management plans will be required that instruct property owners on Ecology's requirements for performing invasive work in areas of remaining contamination. The environmental covenants will be recorded following completion of Phase II activities described in this CAP-EDR.

5.5 Preliminary Schedule for Phase II

The Draft Final CAP-EDR for Phase II was issued in August 2012 for combined MTCA/SEPA public review. Prior to public review, planned briefing meetings with the resource agencies and Tribes took place in June through July 2012. These briefings were meant to provide further information during the combined MTCA/SEPA public review period for the IAWP including this CAP-EDR for Phase II intertidal and subtidal remediation. Final issuance of the IAWP documents for Phase II is expected in late February 2013.

To support the contract bid and permitting process, the detailed design phase began after the public comment period to develop project plans and specifications. The design phase is scheduled to be completed by the end of February 2013. Related construction management planning documents will also be completed during this period.

Bid solicitation and contracting for Phase II is currently planned for early 2013, with anticipated construction beginning in mid-June 2013. Phase II construction is expected to last the duration of the fish window, from July 16, 2013, through January 31, 2014, per US Army Corps of Engineers' instruction.

Post-construction sampling and analysis will then commence and continue in accordance with the OMMP schedule to be developed during the final design of the remedy.

5.6 Overview and Preliminary Schedule for Phase III Subtidal Remediation

Phase III will consist of dredging and/or capping of contaminated sediment within the subtidal area of the property (see Figure 5-1) that will not be addressed during Phase II. During Phase III, dredging to native material will be completed in the southern portion of the Site where sediment dioxin TEC exceeds 25 ppt. The dredging area will be backfilled with sandy gravel material. The total dredging area is estimated to be approximately 0.5 acres. Areas with dioxin TEC between 10 and 25 ppt will be remediated using thin-layer capping (TLC) methods to achieve ENR.

A separate TLC pilot study is being developed with actual field testing to take place during the spring/summer of 2013. The pilot study[3] will test several

[3] US Army Corps of Engineers permit (NWS-2010-288) for Thin Layer Cap Pilot Study at Custom Plywood Interim Remedial Action under Nationwide Permit 18 was reverified on July 26, 2012.

different thicknesses of capping material and the effectiveness of amending the cap with granular activated carbon (GAC) and sand. During Phase III, a TLC will be placed over approximately 11.1 acres (of which 5.8 acres consists of eelgrass beds) to protect ecological receptors from potential dioxin and other impacts. The TLC will consist of a 3- to 8-inch-thick (depending on pilot study results) sand and granular activated carbon mixture. Results of the pilot study will be necessary to design the Phase III TLC.

The CAP-EDR for Phase III is planned to be issued in late 2015 for combined MTCA/SEPA public review. This will be followed by a planned briefing meeting with the resource agencies, Tribes. These briefing meeting are meant to provide further information during the combined MTCA/SEPA public review period for the IAWP for Phase III. Final issuance of the Phase III IAWP documents is expected in late 2015.

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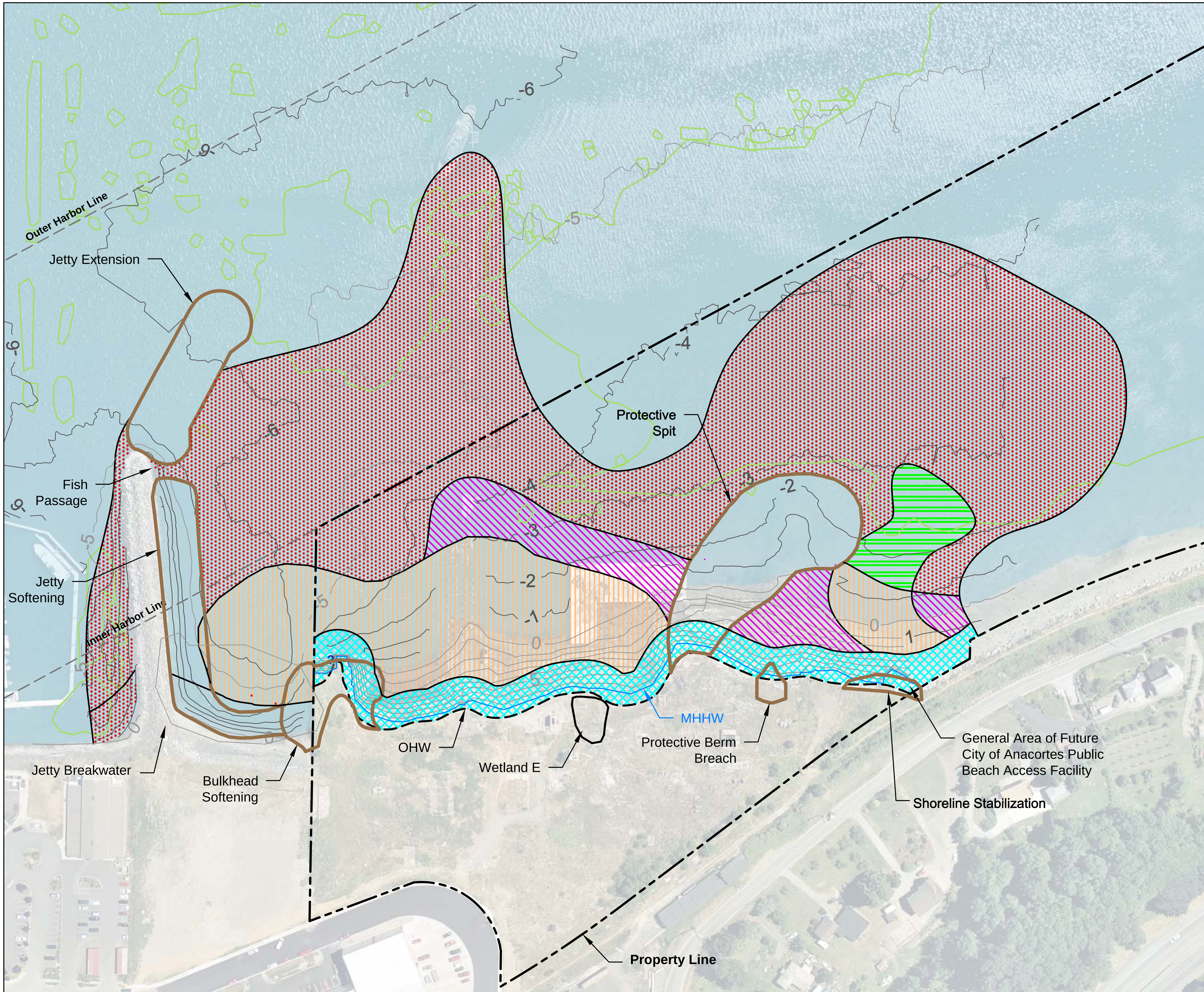

Phase II Remediation Design Features

- Excavate to 6 feet below surface grade or to native sediment, whichever is less
- Dredge wood waste up to 2 feet below surface grade where wood waste > 1 foot thick
- Dredge to contact with native sediment where dioxin TEC > 25 ppt
- Shoreline Protection Feature Footprint

Phase III Remediation Design Features

- Dredge to contact with native sediment where dioxin TEC > 25 ppt
- Place ENR thin cap where wood waste generally > 1 foot thick and dioxin TEC < 25 ppt
- Approximate Extent of Eelgrass Beds

Notes:

1. See Figure 2-7 for sediment sample locations and dioxin TEC analytical results.
2. See Appendices C and D for remediation alternative design details.
3. Seaward of MHHW, elevations in feet (MLLW).
4. Intertidal area north of property defined as region that extends 50 feet seaward from 0-foot elevation line.

Source: Aerial photo courtesy of City of Anacortes, 2003.

N

0 150 300

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Aquatic Remediation Alternative A-3
(Revised per Phase II CAP-EDR)

17800-27 (CAP-EDR) 2/13

HARTCROWSER

Figure **5-1**

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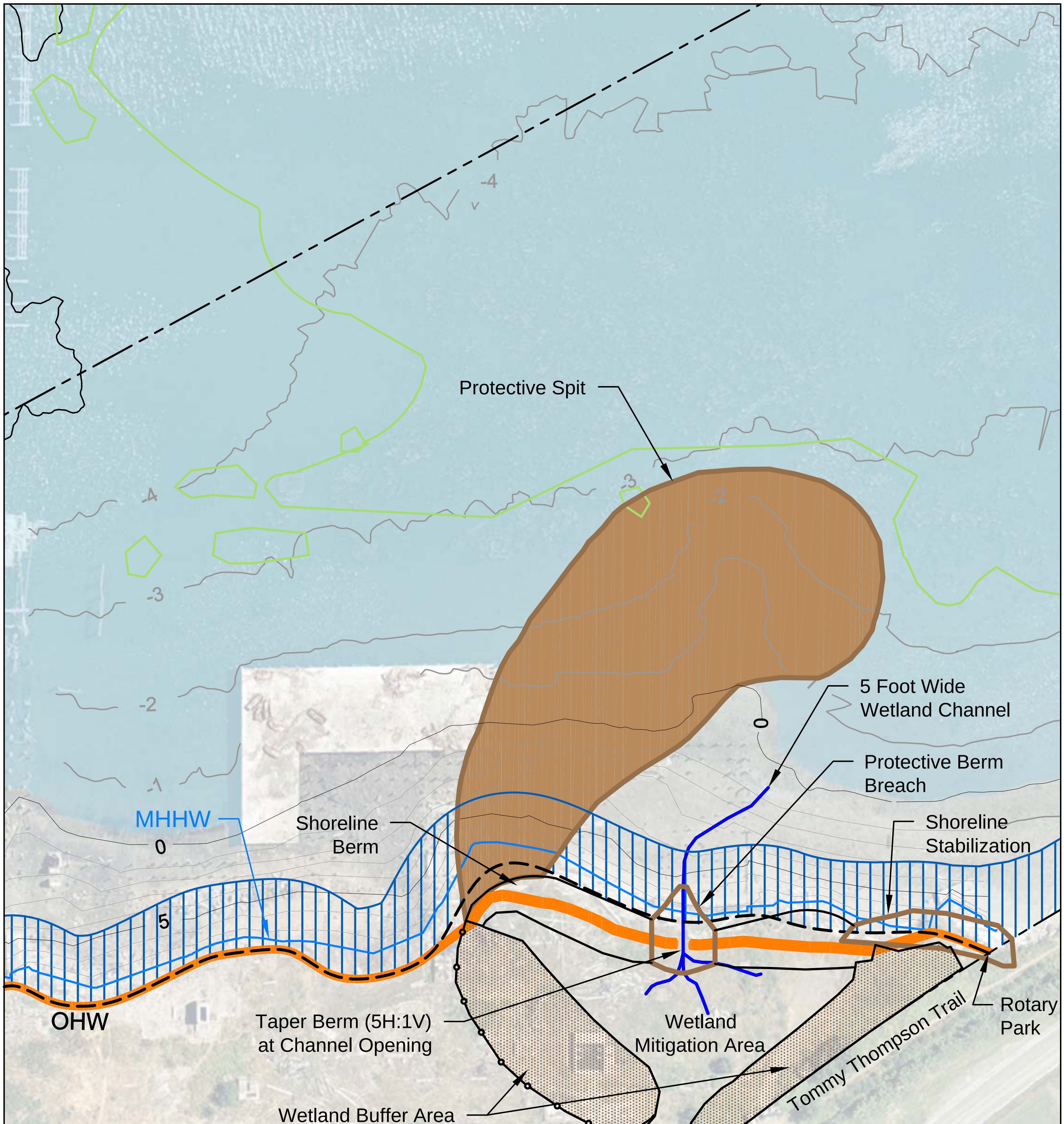

Approximate Extent of Eelgrass Beds

Dunegrass Planting Area

Softshore Armoring

N

0 100 200

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Phase II Post-Construction Remediation Condition (South)

17800-27

2/13

HARTCROWSER

Figure

5-2

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6.0 BASIS OF PHASE II DESIGN

Phase II focuses on the intertidal and nearshore subtidal portions of the Site. Additional contaminated aquatic portions of the Site will be addressed in later cleanup phases. Specific Phase II remedial activities are detailed in this section.

- Section 6.1 describes construction sequencing and controls. Constraints that impact the timing and operation of the variety of construction activities on the Site are discussed.

- Section 6.2 describes site preparation and mobilization.

- Section 6.3 discusses in/overwater structure and piling demolition and removal.

- Section 6.4 describes intertidal sediment excavation, backfilling, and management. General excavation sequencing considerations are summarized.

- Section 6.5 describes subtidal sediment dredging, backfilling, and management.

- Sections 6.6 and 6.7 describe sediment and near-surface debris management and off-site disposal, wet sediment handling, and construction dewatering.

- Section 6.8 describes post-cleanup site protection and improvement. The actions detailed include extension of the jetty, protective spit construction, and public access to shoreline areas.

Appendix C contains the 30-percent conceptual design drawings that detail the design elements discussed in this section. Appendix D provides the hydrodynamic modeling results and coastal engineering design drawings that were developed for the shoreline protection features (i.e., the jetty extension and protective spit construction).

6.1 Construction Sequencing and Controls (Phase II – Spring/Summer 2013)

The overall sequencing of the intertidal and subtidal construction work will be determined by the construction contractor to meet performance requirements (e.g., water quality requirements, erosion control best management practices [BMPs], minimizing cross-contamination) as defined in the forthcoming plans and specifications. The major work items to be completed during Phase II are described below, followed by a brief summary of Phase III work items.

- **Mobilization.** This includes establishing temporary construction facilities, implementing upland construction stormwater BMPs, implementing, aquatic water quality BMPs, establishing temporary haul roads and working platforms, and other preparatory activities.

- **In/Overwater Structure and Debris Removal.** The contractor will use heavy construction equipment (primarily track-mounted excavators) to remove remaining in-water concrete structures and debris, where accessible. Concrete chunks that are too large to handle, such as the bulkhead structure, will be broken using excavator-mounted hydraulic breakers. Concrete and debris will be loaded into trucks and transported to an off-site disposal facility.

- **Pile Removal.** The contractor will pull remaining piles from in-water areas. It is assumed, based on recent upland work, that the contractor will be able to pull the piles using a crane and/or track-mounted excavator. We assume that piles located within the intertidal zone will be removed by land-based equipment, and piles located farther from shore will be pulled using barge-based equipment. Every effort will be made to pull entire piles before resorting to breaking or cutting.

- **Intertidal Excavation.** The contractor will excavate intertidal area sediment between the Phase I/Phase II interface and approximately 50 feet seaward of the OHW line (refer to Figure 5-1). Excavation will extend to native material or to a depth of approximately 6 feet, whichever is reached first. Sediment from the intertidal area will be dewatered on site in a temporary holding cell before it is shipped off-site for disposal at a Subtitle D landfill facility. Water from the dewatering process will be captured for treatment and/or off-site disposal as necessary. It is anticipated that the contractor will excavate during low tides and will excavate only enough volume per tide cycle to facilitate backfilling (see below) before tidal inundation, to the extent practicable.

- **Intertidal Excavation Backfilling.** Immediately after excavation, the contractor will place backfill material to prevent any remaining contaminants or wood waste from being transported to Fidalgo Bay by the tide. To the extent practicable, the contractor will reuse quarry spalls from the access road/working platform located immediately adjacent to the excavations as initial backfill. A minimum of 3 feet of backfill material (specific gradation to be determined, but generally will consist of a locally available granular material designed to resist erosive wave action) will then be placed to generally restore the surface to pre-excavation mudline grades.

- **Subtidal Dredging.** The contractor will dredge locations where dioxin TEC exceeds 25 ppt to a depth that reaches native material (see Figure 5-1). Nearshore subtidal areas where wood waste is greater than 1 foot thick will be dredged up to 2 feet below surface grade (in addition to contamination from wood waste, these areas also typically contains dioxin TECs between 10 and 25 ppt). The dredging work will be limited to periods when the water depth is sufficient to accommodate the draft of the floating equipment. Sediment dredged from the subtidal areas will be loaded directly to barges and allowed to dewater. Solids will be disposed off site at an approved upland disposal facility. Water pumped from the barges will be containerized and treated for POTW discharge and/or disposal off site.

- **Subtidal Dredging Area Backfilling.** The contractor will backfill dredged areas to existing grades using barge-based equipment. In locations where impacted material remains in place, the backfill material will serve as a barrier/cap over these materials. Backfill material consisting of 1-inch minus, sandy gravel will be placed to existing grade in subtidal dredge prisms.

- **Habitat Mix Placement.** At several locations a layer of backfill will be placed to soften existing features and provide habitat enhancements for aquatic species (see Appendices C and D).

- **Protective Spit Construction.** The contractor will construct a new spit approximately one third of the way up the beach from the southern tip of the project boundary. The spit will provide enhanced aquatic habitat and will protect the newly constructed estuarine complex from wave action/erosion. In addition, a portion of the shoreline south of the spit will be stabilized (see Appendix D).

- **Bulkhead Hard Point Restoration.** Following removal of the bulkhead structure, the contractor will place large boulders and cobbles (exact size and distribution to be determined) to provide continued protection of the pocket beach immediately north of the bulkhead and to provide enhanced aquatic habitat.

- **Wetland Temporary Protective Berm Removal.** The contractor will lower the top elevation and regrade the temporary protective berm at the wetland mitigation area. This will create a small opening in the northern end of the berm to allow tidal interaction with the estuarine wetland complex, as planned in the original design (see Figure 5-2).

It is assumed that for the above scope items, land-based conventional heavy construction equipment (excavators, cranes, bulldozers, etc.) will be sufficient to perform the work. However, as described below, barge-based equipment will be used to construct the jetty extension. At the contractor's preference and if advantageous to the client, the contractor may opt to use barge-based equipment for a portion of the nearshore work. Barge-based equipment will be used during the subtidal dredging portion of Phase II.

- **Jetty Extension.** Using barge-mounted equipment, the contractor will construct an approximately 200-foot-long extension to the existing jetty, immediately north of the Site. The jetty will provide additional aquatic habitat and will protect the newly restored beach from erosive wave action. The extension will be constructed generally of the same materials as the existing jetty. A fish passage will be left between the existing jetty and the extension to provide passage for salmonids. (Sequencing of the jetty extension is not necessarily dependent upon previous items and may happen concurrently with intertidal zone work.)

- **Planting.** Vegetation from Wetland E and unmapped wetland patches along the shoreline will be salvaged and planted in the wetland mitigation area before Phase II construction, and before installing cultivated plantings. After the protective berm (see above) has been breached and the channel connecting the wetland to Fidalgo Bay is excavated, the remaining berm will be tapered near the opening of the channel, and the entire berm will be covered with a sandy material and planted with dunegrass (see Figure 5-2). Following Phase II remediation activities, dunegrass will be planted along the OHW line on the property.

- **Demobilization.** The contractor will remove all temporary facilities and controls and restore the uplands portion of the Site to the Owner.

6.1.2 General Considerations for Construction Sequencing

The contractor could sequence the work in several ways: Excavation work could generally proceed from north to south across the intertidal area, shoreward or seaward, or in some other order. Additionally, it is assumed that barge-based activities in the subtidal area (see Section 6.5) would need to happen simultaneously to land-based activities in order for the entire Phase II scope of work to be completed in one construction season.

The contract plans and specifications will be performance based, allowing the contractor to make specific sequencing decisions and adjustments as the work progresses to avoid cross-contamination and to attain maximum work efficiency.

The contractor will be required to submit a construction sequencing approach as part of their pre-construction submittals for approval by Ecology and/or Ecology's Representative. Key construction sequencing considerations include:

- Sequencing must prevent cross contamination of clean, backfilled areas as a key construction performance criterion. This could be accomplished in several ways, such as by generally moving from north to south or shoreward to seaward, etc. The sequencing could be more elaborate, provided that clean access and haul routes across the Site are maintained.

- The contractor may work on different construction tasks in different parts of the Site at the same time. For example, demolition of in/overwater structures in one part of the Site may occur at the same time that excavation is occurring in another portion(s) of the Site.

- The time needed for laboratory testing of sediment samples from the excavation and dredging areas will be long, typically 4 to 6 weeks for dioxin/furan analysis. Because of this time constraint, backfilling will not be delayed by waiting for performance sample analytical results, but will proceed independently of the sample analysis process.

6.1.3 Construction Controls

Turbidity Controls. All construction will comply with State of Washington water quality standards for turbidity. A number of BMPs will be employed during construction activities including, but not limited to debris booms, turbidity curtains, and containment systems.

6.2 Site Preparation and Mobilization

Site preparation and mobilization includes transport of construction equipment to the Site and construction of temporary staging and access facilities. Site preparation activities will begin concurrently with equipment mobilization. Site preparation for demolition, sediment excavation, and dredging will consist of the following:

- Performing a pre-removal site survey to obtain existing grade elevations;

- Installing temporary offices, lighting and other utilities, sanitary facilities, and decontamination stations;

- Installing turbidity control measures;

- Establishing a temporary haul route through the Site and designating staging and lay-down areas for potential excavated sediment dewatering, extracted piles, and material stockpiling; and

- Constructing multiple temporary crane foundation pads for placement of long-reach cranes to pull piles.

Demobilization after construction is completed includes removing temporary facilities and equipment from the Site and cleaning any adjacent areas of the Site that may have been impacted during construction.

6.3 Structure Demolition, Debris, and Piling Removal

The selected remedy includes measures to demolish remaining concrete structures on the Site and to remove surface debris and wooden piles. It is expected that a nominal 2-foot-thick layer of debris will be removed from the surface of the intertidal excavation areas (approximately 4,400 CY), which will be disposed of off site along with excavated sediment. It is assumed that the thickness of the debris layer significantly decreases in the subtidal areas with distance from the shoreline.

Concrete structures and wooden piles seaward of the intertidal zone will also be removed as part of Phase II. The L-shaped concrete pier and bulkhead that remain at the Site will be demolished as part of Phase II. Because the L-shaped pier is an over-water structure, protective measures such as debris booms, turbidity curtains, and containment systems will be used to prevent concrete from falling into the water. Because the upland interim cleanup work has already been completed, concrete waste material from demolition in the aquatic area (about 650 CY) will be disposed of off-site and will not be used for backfill in the upland excavation, as discussed in the FS.

Wooden piles will be removed from the intertidal and subtidal remediation areas as part of Phase II. Work scheduling will likely need to consider periods of low and high tide to remove piles in more distant offshore locations, where water-based equipment is employed. Approximately 1,100 piles will be removed from the intertidal and subtidal areas during Phase II.

To reach the intertidal wooden piling, an access road will be constructed through the upland area to the shoreline, where temporary crane foundation pads will be constructed for long-reach cranes to pull piles. Based on previous work at the Site, it is assumed that the entire pile will be pulled. However, there may be instances where piles cannot be pulled. In this case, the piles will be cut or broken at a specified depth below the mudline. The rest of the pile would remain in place. Every effort will be made to pull entire piles before resorting to breaking or cutting. Piles not reachable by land-based equipment will be removed using barge-based equipment.

After piles have been pulled, and when nearshore aquatic excavations require backfilling, the temporary access road and crane pad materials (quarry spalls) will be recycled on site as backfill material in the intertidal excavations. This is a beneficial reuse of the road and crane pad material, which eliminates the need for off-site disposal of this material, and reduces the quantity of backfill material that will need to be imported to the Site.

6.4 Intertidal Sediment Excavation

Alternative A-3 will remove near-surface debris and relatively thick accumulations of wood waste in the intertidal zone, which is defined as a strip extending along the Site shoreline approximately 50 feet seaward of the OHW line, as shown on Figure 5-1. Excavation will extend to a depth of 6 feet or to native material, whichever is reached first. The extent of contamination during construction will be determined through field screening and performance monitoring.

Wood waste excavation areas will be backfilled to provide a barrier/cap over impacted materials that may be left in place following the interim action and to provide a base for habitat enhancements. A minimum of 3 feet of granular backfill material will be placed to generally restore the surface to pre-excavation mudline grades to resist wave action/erosion. If available, quarry spalls recycled from the temporary access road and crane pad will be used as excavation backfill material in the intertidal area. Recycling the access road and crane pad construction materials on site in this manner will reduce the quantity of imported fill required, providing a cost reduction.

The type and grain size of backfill material depends on proximity to the wave erosion zone. Within the wave erosion zone, graded 1-inch minus sandy gravel material will be placed to within about 1 foot of the existing grade, overlain by protective armor mix consisting of 3-inch minus sandy gravel. In areas outside of the wave erosion zone, the finer grained, fish habitat mix consisting of 1-inch minus material will be used to backfill the excavations to existing grades. Backfilling for intertidal excavations does not anticipate more than nominal, machine-compaction during fill placement.

To access the nearshore excavation locations and to limit the amount of wet sediment work, excavation will be conducted during periods of low tide. The work will progress in successive plots that are sized so that they can be excavated and backfilled during the low-tide window, thus minimizing inundation of the open excavation and release of turbidity to the bay. Similar nearshore and tideflat excavations have been successfully completed elsewhere in Puget Sound to control turbidity and without resulting in cross contamination.

Shoring will be used along the shoreline where the Phase II excavation abuts the already completed Phase I excavation. The use of shoring will minimize the amount of overexcavation of clean fill material placed during Phase I. Shoring will also limit the footprint of the excavation along the southern edge of the Site, where sloping would remove valuable wetland features, and along the northern edge of the Site where available upland area will be needed for staging equipment.

6.4.1 General Excavation Sequencing

The selected intertidal remedy combines in/overwater structure demolition and removal with debris and piles removed in the intertidal area (and in subtidal areas) to provide access to contaminated sediment. The general sequencing of excavation and performance monitoring is envisioned as follows:

- Wood waste and sediment in the intertidal zone will be excavated to 6 feet below surface grade or to contact with native sediment, whichever is reached first, as shown on Figure 5-1. Spatial sequencing and scheduling of the excavations are to be determined by the contractor. However, excavation and backfilling work will be timed to coincide with low tides to prevent release of turbidity to the bay and to minimize excavating in wet conditions.

- Sediment samples will be collected from the bottom of the open excavation cell for laboratory analysis to determine the effectiveness of sediment removal and post-excavation conditions on the leave surface.

- After sample collection, the excavation cell will be backfilled to existing grade using clean imported fill and, if available, quarry spalls recycled from the temporary access road and crane pad. Because of the time required for dioxin/furan laboratory analysis (about 4 to 6 weeks), backfilling of excavation cells will not be dependent on the analytical results for the samples collected.

As excavation areas are completed, surveys will be completed to document the final extent of excavation. A final grading survey will be conducted after backfilling of the excavation areas is completed. These surveys will be used to determine compliance with the specifications and as a potential basis for payment in the event that overexcavation is implemented.

6.5 Subtidal Sediment Dredging

Cleanup of the nearshore subtidal areas addressed in Phase II consists of dredging using water-based equipment seaward of the intertidal excavation area (refer to Figure 5-1). The nearshore subtidal areas are defined as the areas located seaward of the intertidal area where eelgrass is absent and where wood waste is greater than 1 foot thick or where the dioxin TEC exceeds 25 ppt (refer to Figure 5-1).

Dredging locations and depths were determined based on dioxin TECs and wood waste thickness (see Section 3.3). Nearshore subtidal areas where the dioxin TEC exceed 25 ppt will be dredged to native material. Nearshore subtidal areas where wood waste is greater than 1 foot thick will be dredged up to 2 feet below surface grade (these areas typically contain dioxin TECs between 10 and 25 ppt). Approximately 32,000 CY of sediment will be dredged in the subtidal areas during Phase II. The dredging work will be limited to periods when the water depth is sufficient to accommodate the draft of the floating equipment.

Dredged areas will be backfilled following dredging. In locations where impacted material remains in place, the backfill material will serve as a barrier/cap over these materials. Backfill material consisting of 1-inch minus, sandy gravel will be placed to existing grade in subtidal dredge prisms. Backfill material will be placed using conventional barge-based equipment.

6.6 Sediment and Near-Surface Debris Management and Disposal

A target volume of approximately 13,000 CY of excavated surface debris and sediment from the intertidal area, and approximately 32,000 CY of sediment from the subtidal area, will be sent off site for disposal at a permitted Subtitle D landfill. A lower volume of contaminated sediment could be generated if field observation of the excavation and dredging areas indicates that the target areas and/or depths are smaller than projected (for example if native material is encountered at shallower depths).

Excavated intertidal sediment could either be directly loaded into trucks for off-site disposal (if water drainage is not required) or temporarily managed in on-site dewatering cells at the discretion of the contractor. Sediment dredged from the subtidal areas will be loaded directly to barges and allowed to dewater before being transferred to onshore staging areas for transport off site. The wood waste content and anticipated TEC levels of dioxin preclude open-water disposal options for dredged sediment. Additional sediment characterization beyond that available in the RI may be required to meet specific disposal facility requirements.

6.7 Wet Sediment Handling and Construction Dewatering

Provisions for excavating and handling wet material must be considered. Excavated intertidal sediment not passing the standard paint filter test, which is typically required for Subtitle D (lined) landfill disposal, will require draining, either on the ground before loading and transporting off site, or possibly in an on-site upland containment cell (to be further specified during project design). Sediment dredged from the subtidal areas will be loaded directly to barges and allowed to dewater. Water pumped from the barges will be containerized and treated for POTW discharge and/or disposal off site.

It is assumed that intertidal excavation will be done during low tide, but wet conditions may still exist. It is assumed that the site will not be dewatered. The contractor will be required to provide the necessary means to protect the intertidal excavation areas from tidal and sediment intrusion and/or resulting cave-in, such as a moveable shoring system (slide-rail) or sheet piling.

6.8 Post-Cleanup Site Protection and Habitat Improvements

6.8.1 Jetty Extension

An extension of the existing jetty north of the GBH property, perpendicular to the predominant wave energy, will allow for placement of protective armoring material of a smaller particle size (see Figure 5-1 and Appendix D). The armoring material will shield the remediation area from wind and wave erosion along the northern shoreline of the GBH property. In addition to protecting the remediation area, installation of the jetty extension will include habitat enhancement features such as a sandy, habitat-friendly substrate along the shoreward face of the existing jetty. The sandy substrate will create forage fish spawning habitat and support foraging juvenile salmonids. A breach or notch between the existing jetty and the extension will provide a migratory corridor for juvenile salmonids while still maintaining the protective nature of the feature. This protection measure was evaluated as being optimally consistent with both remediation and habitat enhancement goals for the interim action and will be included as part of the preferred shoreline protection concept for the selected aquatic remediation alternative. The jetty extension features are more fully detailed in Appendix D.

6.8.2 Protective Spit Construction

The jetty extension introduced above will provide shoreline protection only for the northern portion of the shoreline. A second in-water protective feature is needed to protect the remainder of the shoreline. The shoreline protective spit is optimally configured to maximize protection of the shoreline from erosive wave action for the southern half of the GBH property (see Figure 5-1 and Appendix D). Configuration of the spit was based on modeled wave and wind energy along the Site's shoreline before and after in-water structure removal to gain a better understanding of the forces influencing the cleanup activities. Hydrodynamic modeling indicated that the already eroding southern portion of shoreline will be subject to increased wave energy once the existing in-water structures are removed (Appendix D). The spit offers an adequate level of protection while also protecting capped contaminated intertidal substrate. In addition, a portion of the shoreline south of the spit will be stabilized. These structures have been designed to include habitat enhancement features, such as forage fish spawning habitat and support habitat for juvenile salmonids along the shoreward extent.

The outer seaward face of the spit will be at a 9H:1V slope to dissipate wave energy and minimize the size of material needed to construct the protective feature. The shoreward face will be constructed at a 5H:1V slope. The protective spit will consist of a gravelly sand core material with a layer of habitat-friendly substrate over the top, which is suitable for forage fish spawning habitat. In addition, the spit will feature an 8-foot-wide bench at an elevation suitable for natural colonization of emergent estuarine wetland vegetation. The protective spit will also, as a secondary consideration, protect the new wetland and mitigation buffer area located within the southern portion of the GBH property.

While the spit itself will not include plantings of dunegrass, the wetland restoration area along the existing shoreline will provide a dunegrass planting area between the wetland and the forested upland buffer to attenuate energy and provide additional habitat for shorebirds and other species. Large wood and other features to enhance connectivity between upland and intertidal habitat will be developed further during design and the in-water permitting process. These habitat improvements were not considered as shoreline stabilization features, since they are not suitable for erosion control based on the wave energy analysis.

6.8.3 Continued Wetland Mitigation

As part of the selected upland cleanup alternative, a 12,000 SF estuarine wetland bench was created landward of OHW with an associated upland buffer that was planted with native vegetation. During the Phase II interim action (after intertidal sediment has been excavated and backfilled), a breach will be made in the temporary protective berm that currently prevents surface water mixing between the wetland complex and Fidalgo Bay as shown in Figure 5-2.

6.8.4 Public Access to Shoreline Areas

Public shoreline access requirements pursuant to the City of Anacortes Shoreline Master Program will be addressed by providing beach access at the southern landward tip of the Site. The general location of the beach access is identified on Figure 5-1. The configuration of these features has not yet been determined and is ultimately subject to an agreement between the City of Anacortes and the property owner. A conceptual design is planned concurrently with the design for the Phase II in-water remediation. Aquatic permitting required for the beach access will also be included with Phase II. Final design and field construction will be completed in coordination with the City of Anacortes and the property owner. Access to the public beach area will require, at a minimum, completion of the Phase II aquatic cleanup.

7.0 COMPLIANCE MONITORING PLAN

Compliance monitoring will be implemented in accordance with WAC 173-340-410 and will include:

- **Protection Monitoring** to confirm that human health and the environment are adequately protected during construction of the interim cleanup action;
- **Performance Monitoring** to confirm that the interim cleanup action has attained cleanup levels and/or other performance standards; and
- **Confirmational Monitoring** to confirm the long-term effectiveness of the interim cleanup action once performance standards have been obtained.

The objective of compliance monitoring is to confirm that cleanup levels have been achieved, and to confirm the long-term effectiveness of interim cleanup actions at the Site. A detailed Operations, Maintenance, and Monitoring Plan (OMMP) will be developed to describe planned monitoring and discuss the duration and frequency of monitoring activities, the trigger for contingency response actions, and the rationale for terminating monitoring (see Section 8.0). Remedy performance criteria, quality assurance (QA) activities, documentation requirements, and potential corrective actions will be developed during the design phase preparation of project plans and specifications.

7.1 Protection Monitoring

Requisite protection monitoring will be performed as a construction health and safety element in accordance with WAC 173-340-410(1)(a). A health and safety plan will also be developed for long-term operation, maintenance, and monitoring of the remedy.

7.2 Construction Performance Monitoring

Performance monitoring (WAC 173-340-410(1)(b)) is intended to assure that a remedial action has attained cleanup standards (including MTCA and SMS criteria) or other performance standards such as construction quality control measurements, permit conditions, or substantive requirements of other laws.

Required contractor performance monitoring will be specified in the construction plans and specifications. Typical contractor requirements will include topographic elevation surveys or similar grade control measures to verify that the design grades and elevations have been achieved.

Performance monitoring is also required to document construction of the shoreline protection features and site improvements. Monitoring includes demonstrating that appropriate excavation and materials placement have occurred to the planned lines and grades, and that required revegetation and habitat functions have been established.

Another aspect of performance monitoring is collection and analytical laboratory testing of sediment samples from the base of the excavation and dredge prism(s) to document the concentration of COCs that remain on the Site. The excavations and dredge prisms will be observed to determine the extent of remaining wood waste. Related monitoring and documentation will include verifying the chemical quality of imported material used for backfilling, placing backfill to match pre-existing grade, and establishing nominal compaction requirements during the design phase.

7.3 Confirmational Monitoring

Confirmational monitoring (WAC 173-340-410(1)(c)) is a component of compliance monitoring intended to demonstrate the long-term effectiveness of the remedial action once cleanup levels or other performance standards have been attained. Specific details for post-construction monitoring will be further developed in a detailed OMMP prepared during or after the design or construction management phases of the project.

Related post-construction monitoring activities include annual inspections of the nearshore area to verify that erosion or other potentially adverse conditions are not damaging the remedy. Inspection and monitoring will be required for the habitat restoration areas for a minimum of 10 years. Routine inspection and maintenance of the shoreline protection features are further components of the long-term maintenance and monitoring program.

7.3.1 Contingency Beach and Shellfish Bed Closure

Although this measure is not expected to be needed, the Skagit County Public Health Department/Samish Tribe will be alerted and consulted regarding the potential need for closure of adjacent beach areas and nearby shellfish beds during the intertidal remediation work. Potential beach and shellfish bed closure would be triggered by a release of contaminants during construction that pose potential human exposure risks. The likelihood of such closures being required is low for several reasons:

- Excavation in the intertidal zone will be conducted during periods of low tide, minimizing contact between surface water and contaminated sediment.

- Water from excavated sediment will be properly treated and managed.

- Turbidity controls will be implemented during the intertidal and subtidal construction work to prevent particulate material from the construction area from entering the bay or migrating from dredging areas.

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8.0 GENERAL APPROACH FOR THE OPERATION, MAINTENANCE, AND MONITORING PLAN

The overall operation, maintenance, and monitoring plan (OMMP) approach is intended to address technical guidance and regulatory requirements to assure effective operations following remedial activities (WAC 173-340-400). Further OMMP details will be developed during the project design phase to describe planned monitoring and discuss the duration and frequency of monitoring activities, the trigger for contingency response actions, and the rationale for terminating monitoring.

Additional OMMP details will establish:

- Monitoring and inspection activities, sampling and testing parameters and protocols, and frequency;
- Appropriate acceptance criteria including MTCA criteria, physical parameters, and other functional criteria;
- Threshold triggering criteria/levels and early warning levels;
- Potential corrective and contingency response actions; and
- Reporting requirements.

8.1 Future Sea Level Rise Considerations

An additional consideration raised during earlier project review is long-term protection of upland areas of the Site from expected sea level rise over the coming decades. Upland surface elevations at the Site range down to about 8 feet elevation (NAVD 88), and portions of the Site may be susceptible to inundation by a rising sea level. The OMMP will include an adaptive approach to identify and evaluate additional surface protection features that could be needed to prevent wave erosion. Backfilled excavation and dredging areas provide an inherent protective layer to prevent exposure of residual contaminated sediment that might remain at depth; however, supplemental surface vegetation, paving, or other armoring may be needed to provide further protection.

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9.0 ECOLOGY PERIODIC REVIEWS

Periodic reviews will be conducted by Ecology to assess post-cleanup site conditions and monitoring data in accordance with requirements of WAC 173-340-420 to assure that human health and the environment are adequately protected. Results of groundwater monitoring and other inspection and monitoring data obtained pursuant to the OMMP and other activities will be reviewed at a minimum of every 5 years. The overall efficacy and progress of remediation may be assessed at more frequent intervals, such as following annual monitoring. Notice of periodic reviews for public comment will be provided as deemed necessary.

Several review criteria are listed under WAC 173-340-420 to evaluate overall remedy effectiveness including engineered and institutional controls, new scientific information regarding hazardous substances, and new legal and regulatory requirements. These review criteria further consider site and resource use, availability and practicability of more permanent remedies, and new and improved analytical techniques.

These review findings will be used to assess the OMMP strategies, determine whether modifications are appropriate, and/or identify potential corrective actions. The scope and breadth of revisions to the OMMP, and potentially to this CAP, will be determined based on results of the 5-year reviews.

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APPENDIX A
JANUARY 2012 SEDIMENT MONITORING REPORT

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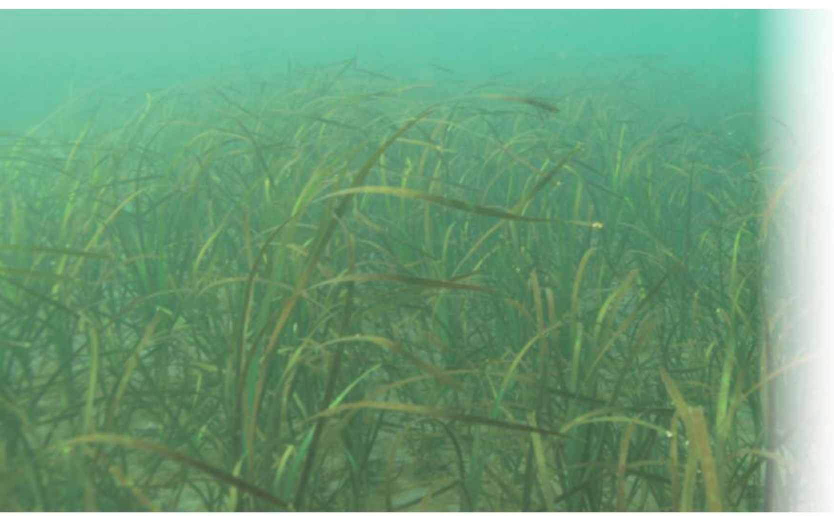
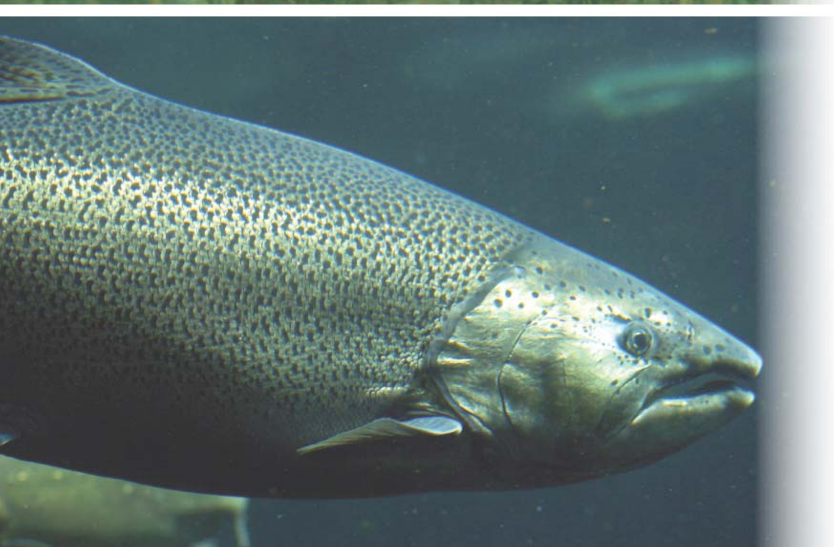

Field Investigation 2012
Sediment Dioxin and Wood Waste
Former Custom Plywood Site
Anacortes, Washington

Prepared for
Washington State
Department of Ecology

February 2013

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Field Investigation 2012
Sediment Dioxin and Wood Waste
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SEDIMENT DIOXIN AND WOOD WASTE
FORMER CUSTOM PLYWOOD SITE
ANACORTES, WASHINGTON

1.0 INTRODUCTION AND BACKGROUND INFORMATION

This report documents an intertidal and subtidal sediment investigation adjacent to the former Custom Plywood Mill property (Site) located on Fidalgo Bay in Anacortes, Washington (Figure 1). This investigation is in support of a Washington State Department of Ecology (Ecology) Interim Action cleanup at the Site, which includes the removal of creosote-treated pilings, an overwater pier, construction debris, and impacted soils.

The scope of work was designed to acquire the necessary data to further characterize dioxin concentrations in sediment within the Site, and to determine the areal and vertical extent of wood waste in the intertidal and subtidal area along the shoreline of the Site. Sediment samples were collected and analyzed in general accordance with our Sampling and Analysis Plan (SAP) dated December 30, 2011 (Hart Crowser 2011b).

Surface sediment samples were collected using a power grab at nine locations. Vibracore samples were collected to depths of up to approximately eight to ten feet at 21 locations, and visually evaluated to determine the thickness, type, and approximate percentage of wood waste. Surface power grab and subsurface vibracore sediment samples were collected between January 23 and 28, 2012. Forty sediment samples were submitted to Analytical Resources, Inc., an Ecology-accredited laboratory, for chemical analysis of dioxins.

1.1 Site Setting and History

The former Custom Plywood Mill was a sawmill and plywood manufacturing facility that operated from the early 1900s until it was largely destroyed by fire in 1992. The property is located on Fidalgo Bay in Anacortes and covers 6.6 acres of upland area and 34 acres of tidal area. Fidalgo Bay is one of Ecology's seven Puget Sound Initiative embayments identified for priority cleanup. Fidalgo Bay supports highly productive habitat and resources including eelgrass, herring, salmon, shellfish, and nursery grounds. Aquatic resources and nearshore habitat are impacted by contamination and the accumulation of debris, including degrading creosote-treated pilings, a crumbling overwater pier, and large industrial construction debris at the site. These structures also present a navigational and public safety threat.

When the plant was operational, plywood veneers were dried in one of two kiln dryers heated by a hog-fuel boiler. Sawdust created by the plant was used to soak up oil spills inside the plant and then used as hog fuel in the boilers. Veneers were glued together and then pressed by three large hydraulic presses. Toluene was used to clean out the glue application nozzles and tips. There is no historical documentation that wood preservatives such as pentachlorophenol (PCP) were used on site. Phenolic resins and caustics were used in the glue-making process.

The Custom Plywood site has a significant history of chemical handling, use, piping, and distribution, as well as waste materials disposal, which consisted of filling tidelands with wood, ash, bricks, metal, and sediments. Potential contamination sources include releases, spills, or on-site disposal of transformer fluid, wash water and sludge, pollution control sludge, glue wash water sludge, knot filler sludge, boiler ash, scrap steel, barrels and drums, aluminum cans, scrap wood, paper, asbestos pipe coverings, creosote-treated pilings, and transformers with PCB oils. The major potential contaminants are:

- Upland Soil – heavy petroleum hydrocarbons, metals, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), polychlorinated biphenyls (PCBs), and wood waste including sawdust.

- Intertidal and Subtidal Soil and Sediment – wood waste sawdust, dioxins, metals, PAHs, and heavy petroleum hydrocarbons.

Ecology investigated the site numerous times in the early 1990s, and the site was added to the Confirmed and Suspected Contaminated Site List in 1993.

1.2 Summary of Previous Sediment Quality Investigations

Since 1993, previous property owners, the City of Anacortes, Ecology, and the US Environmental Protection Agency (EPA) have conducted a series of environmental characterization and sampling investigations near the property, before the Agreed Order process that started in 2008. These investigations were conducted to define the extent of contamination and evaluate the condition of soil, groundwater, and offshore sediments. Each successive investigation targeted data gaps identified in the previous investigations.

Investigations conducted between 1993 and 1995 were generally limited, and concentrated sampling in upland areas with the highest likelihood of contamination.

Investigations conducted between 1995 and 2003 culminated in the development of an Interim Remedial Action Plan for soil removal within the upland excavation areas (Geomatrix 2007). The Interim Remedial Action Plan (IRAP) was conducted under the Voluntary Cleanup Program (VCP) with excavation and disposal of the soil in the northern tracts first, followed by planned excavation and disposal of the soil in the southern tracts a year later. After the interim action in 2007, Ecology required that the subsequent work to be conducted within the Puget Sound Initiative (PSI) program under an Agreed Order to be consistent with the approach at other PSI-led sites in Fidalgo Bay. Consequently, the VCP was not entered, and negotiations for an RI/FS and Agreed Order commenced.

Following the Interim Action in July 2007, an additional remedial investigation was carried out by AMEC in July 2008 with supplemental investigations in April and August 2009. Additional sampling and surveying was conducted to further define the extent of contamination and to evaluate the condition of the soil, groundwater, offshore sediment, and benthic habitat (AMEC Geomatrix 2010).

In June 2010, SAIC conducted a supplementary investigation (SAIC 2010) of Fidalgo and Padilla Bays and areas adjacent to the former Custom Plywood Mill property to determine potential sources of dioxin contamination observed in previous investigations (SAIC 2008, AMEC Geomatrix 2008). The purpose of this supplementary sediment investigation was to determine the bay-wide background concentrations of dioxin/furan in Fidalgo and Padilla Bays and to further characterize and delineate the extent of dioxin/furan in sediment and clam tissue in nearshore sediments adjacent to the former Custom Plywood Mill property.

In August 2010, Hart Crowser performed test pit sampling in the intertidal zone and in December 2010, Hart Crowser sampled subtidally using surface grab samplers and vibracores to define the areal and vertical extent of contamination in the intertidal and subtidal sediments immediately adjacent to the property (Hart Crowser 2010 and 2011a).

1.3 Data Gaps

Review of results from previous investigations indicate that the areal and vertical extent of dioxin/furan concentrations and wood waste distribution in the intertidal and subtidal areas have been adequately defined for the purposes of evaluating impacts and potential remediation measures, but lack sample density to develop remediation designs from an engineering perspective. This new effort was used to provide detailed information needed for producing the subsequent CAP and EDR for the in-water phases of the project. The location, thickness, extent, and estimated percentage by volume of wood debris also required further delineation.

Dioxin Hotspots

Previous surface sampling points shown on Figure 2 were typically hundreds of feet apart and had substantial spatial data gaps. Dioxin concentrations were commonly in the 10 to 20 parts per trillion (ppt) total toxics equivalent concentration (TEC) range. Three hotspot with concentrations greater than 100 ppt total TEC were previously identified. Additional sampling locations were selected to better delineate the extent of the dioxin impacts, occurrence of dioxins at depth within the sediment at previous hotspot locations, and to potentially confirm the dioxin hotspot concentrations.

2.0 SEDIMENT SAMPLING

2.1 Deviations from the 2011 SAP

Minor deviations from the SAP were made to adjust and optimize the number and type of samples collected to obtain the most usable results for the investigation. SAP modifications were also made, as necessary, based on adaptations to the field conditions encountered. Deviations from the Ecology-approved SAP for the Custom Plywood investigation are summarized below and are discussed in more detail in the applicable report sections.

- Twenty-eight to thirty locations for sediment collection were proposed in the SAP. According to the SAP, 24 locations were to be collected for surface sediment using a power grab; and 17 locations were to be collected for subsurface sediment using a vibracore. Thirty locations for sediment were actually collected, including nine surface sediment grabs, and 22 subsurface vibracores (two cores at location SC-50).

- Surface sediment samples were collected from nine locations, rather than from 24 locations, using the power van Veen grab sampler. Seventeen of the proposed surface sediment locations coincided with proposed vibracore locations. Only a small amount of sediment (approximately 8 ounces) was needed from the upper 0 to 10 centimeter (cm) depth for dioxin/furan analysis. Sufficient sediment could be collected from the core tube, and it was deemed unnecessary to collect an additional surface power grab sample from the same location.

- Some actual vibracore collection locations were shifted greater than 25 feet from proposed sediment locations due to refusal caused by subsurface wood debris, rocks, and cobbles on the bottom, or inaccessibility due to pier structures. These locations included SC-40, SC-42, SC-44, SC-45, SC-46, SC-47, and SC-50A. The largest deviations were approximately 160 feet east and 215 feet northeast at sites SC-46 and SC-42, respectively.

- The proposed locations for SC-58 and SC-59 were recorded incorrectly in Table 1 of the SAP. The sample locations were determined in the field based on the proposed locations on Figure 3 of the SAP and discussions with the Hart Crowser project manager. As a result, the actual locations were more than 25 feet from the proposed locations in Table 1 of the SAP.

- Two proposed vibracore locations, SC-22 and SC-23, were sampled using the surface power grab. These two locations had originally been selected for surface sediment collection only, and were later changed to vibracore locations to collect subsurface sediment. Due to time and weather constraints, only the surface sediments were collected at those locations, and the locations were labeled SS-22 and SS-23. No subsurface sediment samples were collected at those locations.

- Due to time and weather constraints, no additional coring was conducted beyond the proposed investigation.

- A sediment core was collected at proposed sample location SC-50 on January 23, 2012, after three attempts. The third attempt was retained and submitted for processing. On January 26, 2012, three additional cores were advanced within 100 feet of the proposed location. The third attempt was labeled SC-50A, and was retained and submitted for processing. Samples from the surface (0 to 10 cm depth) were submitted for dioxin analysis for both cores (SC-50-SRF and SC-50A-SRF). Samples were collected from the bottom of both cores but placed on hold, due to the presence of observable wood waste at the bottom of the cores (SC-50-BTM and SC-50A-BTM).

- According to the SAP, three sediment samples were to be collected from cores SC-45 and SC-46 (surface, 2 to 4 foot depth, and bottom of wood waste). As the bottom of wood waste fell within the 2 to 4 foot depth range, only two samples were collected from these cores (SC-45-SRF, SC-45-BTM, SC-46-SRF, and SC-46-BTM).

- During processing of sediment cores on shore, it was determined that several cores did not actually penetrate below the wood debris layer. Sediment samples were collected from the base of the cores at these locations and placed on hold (SC-41-BTMw/Wood, SC-42-BTMw/Wood, SC-44-BTMw/Wood, SC-50-WOOD, and SC-50A-BTMw/Wood).

- Sediment from the cores was sieved at the laboratory to determine percentages of wood waste present.

- Additional eelgrass rhizome samples were collected from surface power grab samples SS-16, SS-17, and SS-19. The samples were submitted for tissue analysis of dioxins/furans (SS-16-Eelgrass, SS-17-Eelgrass, and SS-19-Eelgrass.)

2.2 Sample Location Control

A differential global positioning system (DGPS) was used aboard the sampling vessel for location positioning (sub-meter accuracy) for vibracore and surface sediment grab sampling. The DGPS receiver was placed on the sampling device deployment boom to accurately record the sampling location position. Once the sampler was deployed, the actual position was recorded when the sampler was on the bottom and the deployment cable was in a vertical position. State Plane (Northing and Easting) coordinates for the actual sampling locations are presented in Table A-1 in Appendix A. Research Support Services, Inc. (RSS), operated the vessel under subcontract to Hart Crowser for the vibracore and surface sediment grab sample activities.

Water depths were measured directly by lead line and converted to mudline elevations using the predictive tide charts. The vessel maintained station using anchors, engine power, or by tying off on remaining piers.

2.3 Sediment Core Sampling

Sediment core samples were collected using a vibracore sampling device. The vibracore device vibrates a core tube or sample barrel into unconsolidated water-saturated sediment. The core tube was constructed of rigid, clear 4-inch-diameter Lexan (polycarbonate) in which the sediment sample is recovered. The core tube was placed in a steel tube barrel, and a stainless steel core catcher was attached to the end of the barrel to hold the undisturbed sediment inside the barrel when withdrawn from the seafloor.

During sampling, a core tube was driven below the surface sediment with the vibracore device until the desired penetration was achieved or to refusal.

Sediment cores were collected to a depth of up to 12 feet below the sediment-water interface. Upon retrieval of the core, the acceptability was assessed relative to the criteria established in the SAP.

After vibracore collection, the exterior of the core tube was cleaned, visually examined, and labeled. The sediment in the core tube was allowed to settle, then the surface water was drained off, the excess tube was cut off, and the core tube was capped. The capped tubes were transported to Analytical Resources, Inc. (ARI), in Tukwila, Washington. Sediment from the cores was extruded at ARI in their sediment processing facility.

Each core was visually examined in general accordance with ASTM D 2488, Standard Practice for the Classification of Soils (Visual-Manual Procedure). Each core was photographed and visual observations and soil descriptions were documented on core logs presented in Appendix A, Figures A-1 through A-23.

Two cores were collected from location SC-50, labeled SC-50 and SC-50A. The location for SC-50 fell within 20 feet of the proposed sample location, but the core did not penetrate below the visible wood waste layer. An additional core was collected and labeled SC-50A, approximately 100 feet from the proposed location. The SC-50A core appeared to penetrate below the visible wood waste layer. Both cores were submitted for processing.

Seventeen subsurface sediment dioxin samples were proposed to be collected from below the visible wood waste layer in the cores. Two of those sample locations were converted to surface grab samples and no subsurface sediment was collected at those locations (SC-22 and SC-23). Sediment samples collected from below the visible wood waste layer were submitted to ARI for dioxin/furan analysis from cores SC-39, SC-40, SC-43, SC-45, SC-46, SC-47, SC-48, SC-49, SC-51, SC-58, and SC-59. Some cores did not penetrate below the bottom of the wood waste, though they appeared to do so in the field. Sediment samples were collected from the bottom of these cores, where wood waste was still present, and placed on hold at the laboratory (SC-41, SC-42, SC-44, SC-50, and SC-50A).

Subsurface sediment dioxin samples were collected from the 2 to 4 foot depth from cores SC-41, SC-42, SC-43, and SC-44. Two additional subsurface dioxin samples were planned to be collected from cores SC-45 and SC-46. The cores were compaction corrected, and sediment was collected from the corrected 2 to 4 foot depth, homogenized, placed in designated containers, and submitted to ARI for analysis of dioxins/furans.

Surface sediment was collected from the upper 0 to 10 cm depth of cores SC-39, SC-40, SC-41, SC-42, SC-43, SC-44, SC-45, SC-46, SC-47, SC-48, SC-49, SC-50, SC-50A, SC-51, SC-58, and SC-59. The samples were individually homogenized, placed in designated containers, and submitted to ARI, for analysis of dioxins/furans.

Six cores were collected to determine the depth and areal extent of wood debris (SC-52, SC-53, SC-54, SC-55, SC-56, and SC-57). Following classification, sediment was collected into containers and placed on hold at ARI. Surface sediment (0 to 10 cm) was collected from cores SC-52, SC-53, SC-54, SC-55, and SC-57. Subsurface sediment collected from 2 to 4 foot depth was collected from core SC-56. Subsurface sediment collected from below the visible wood waste layer was collected from SC-52, SC-53, SC-54, SC-55, and SC-56. Evidence of a petroleum-like sheen was observed in cores SC-43, SC-44, and SC-59.

Following the review of initial results for dioxin/furans, several samples that had been placed on hold at the laboratory were subsequently submitted for dioxin/furan analysis. Samples SC-50-WOOD, SC-56-SUBSRF, SC-54-SRF, SC-55-SRF, SC-52-SRF, SC-42-BTMw/WOOD, SC-44-BTMw/WOOD, and SC-41-BTMw/WOOD were submitted for analysis on April 11, 2012.

2.4 Surface Sediment Grab Sampling

Nine surface sediment grab samples were collected from intertidal and subtidal locations at the Site in Fidalgo Bay (Figure 2). Seventeen of the twenty-four proposed sediment grab locations coincided with core locations, and only cores were collected at those locations. Two locations, SC-22 and SC-23, were proposed for coring locations, but samples were collected at those locations using the power grab, due to time and weather constraints. Those samples were labeled SS-22 and SS-23.

Surface sediment grab samples were collected using a 0.2-square-meter (m^2) pneumatic power surface grab sampler. Samples from each surface grab location were collected from the 0- to 10-cm-depth interval. The sediment was homogenized and submitted to ARI for chemical analysis of dioxins/furans. Three additional samples for eelgrass rhizome analysis were collected at SS-16, SS-17, and SS-19. These samples were submitted to ARI for chemical analysis of dioxins/furans.

Visual sample descriptions of surface sediment grab samples are presented in Table A-2 in Appendix A. The power grab sampler was decontaminated between sampling locations following the procedure in the SAP. Upon retrieval of the surface sediment grab samples, the acceptability of each grab was assessed relative to the criteria established in the SAP.

A petroleum-like odor was observed at location SS-17, but no sheen was noted.

Following the review of initial results for dioxin/furan analysis, sample SS-23-SRF was resubmitted for analysis on April 11, 2012.

3.0 DISTRIBUTION, TYPE, AND ESTIMATED PERCENTAGE OF WOOD WASTE

The sediment cores and surface sediment samples were also used to further delineate the depth, areal extent, type, and estimated percentage of wood waste with a focus on determining the boundaries of the potentially impacted area. After sample collection, sediment cores and surface sediment samples were visually examined to determine the presence, depth, type, and estimated percentage of wood waste. Sediment cores were collected to a depth of up to about 12 feet and surface samples were collected from 0 to 10 cm.

Surface sediment grab samples and sediment core samples from each location offshore of the Site were examined for the presence of wood waste. As noted in the sediment core logs and surface sediment descriptions presented in Appendix A, the samples typically contained large amounts of wood waste, including wood chips, wood chunks and fragments, fine wood particles, sawdust, twigs, sticks, and bark. Identification of wood waste was based primarily on visual interpretation of the surface sediment grab samples and sediment core samples collected in the field and are subjective. All core samples were sieved through a 200-micron sieve in the laboratory to help determine the presence of fine wood waste (i.e., fine wood particles and sawdust) that was otherwise difficult to see.

For purposes of this report, wood waste included wood chips, wood chunks, fragments, fine wood particles, and sawdust, as well as terrestrial wood waste (i.e., twigs, sticks, and bark). The distribution of wood waste offshore of the Site is presented on Figure 3 and the estimated percentage of wood waste for sediment samples are summarized in Table A-3. Figure 3 presents combined near-surface and subsurface distribution of wood waste based on vibracores and surface sediment samples.

Surface sediment grab samples were evaluated in the field for the presence of wood waste. A summary of the surface sediment grab samples are provided in Table A-2, and sediment core sample bore logs are presented in Appendix A, Figures A-1 through A-23. While the type and thickness of wood waste was widely distributed, wood waste was noted at all sample locations (Tables A-3 and A-4). Greater amounts of wood waste (visual and sieve estimates of up to about 95 percent) were generally observed closer to the shoreline of the Site where the historical sawmill and plywood manufacturing operations occurred; however, samples containing large amounts of wood waste were also observed in deeper waters.

Hart Crowser sediment processing team also performed wet sieving on sub-samples from all vibracores (Table A-3) using a 200-micron sieve to determine whether wood waste, which was too small to be observed in bulk sediment, was present.

Wood waste was identified in:

- The surface layer (upper 2 feet) of 21 of the 22 sediment sample locations (approximately 95 percent);

- The subsurface (below 2 feet in depth) of 14 of the 22 subtidal sediment core samples (approximately 64 percent); and

Wood waste was observed with the highest accumulations (50 to 95 percent cover) near the former sawmill and plywood operations near the shoreline by the L-shaped pier and extending out to approximately –3 to –4 feet mean higher high water (MHHW; Figure 3). The wood waste noted in the areas near the former sawmill and plywood operations included wood chips, wood chunks, fragments, fine wood particles, and sawdust, as well as minor amounts of terrestrial wood waste such as twigs, sticks, and bark. In contrast, the wood waste noted further from the shoreline generally contained fewer wood chips, wood chunks, and terrestrial wood waste, and more occurrences of fragments, fine wood particles, and sawdust.

Wood waste distribution cross sections show the extent and depth of wood waste across three cross sections of the Site (Figure 4), based on geologic interpretations using the vibracore logs (Figures A1-A23). The cross sections also show a geologic interpretation of the depth of native soils, when encountered in the vibracores (Figures 5–7). Cross section A-A' shows the presence of wood waste down to approximately –10 feet mean lower low water (MLLW) and native soil and inorganic clays to approximately –13 feet MLLW. The location of native soil can be interpreted as far out as HC-SS-12; however, native soil was not encountered in subsequent cores. A small amount of wood waste was found as far east as HC-SS-14 (Figure 5).

Cross section B-B' indicates the presence of wood waste down to almost –15 feet MLLW in some areas; however it is not uniform in distribution (Figure 6).

Wood waste appears to be prevalent in this cross section, and native soils and inorganic clays were rarely intercepted.

Cross section C-C' indicates the presence of wood waste down to approximately –8 feet MLLW; however, this is not consistent, as shown in Figure 7. The west side of the cross section shows native soil and inorganic clays present to approximately –11 feet MLLW.

According to the geologic interpretations presented in the cross section figures (Figures 5–7), wood waste is more prevalent in cross sections A-A' and B-B' than in C-C'.

4.0 SEDIMENT CHEMICAL ANALYSIS RESULTS

Sediment sample results for dioxins/furans are summarized in Tables 1, 2 and 3. Surface sediment dioxins/furans results are provided in Table 1, while subsurface sediment dioxins/furans results are provided in Table 2. Eelgrass tissue dioxins/furans results are provided in Table 3. Samples were submitted to ARI for dioxins/furans analysis by EPA Method 1613B (EPA 1994). No field duplicates or equipment rinse blanks were collected for analysis. However, sample SS-23-SRF was resubmitted for dioxin/furan analysis following the initial analysis. The results from the reanalysis were comparable to the original results, and the two analyses can be viewed as replicates. The sample depths referenced on the tables, figures, and in the following text have not been corrected for core compaction. Differences between compaction corrected and uncorrected depths are not significant for engineering and remediation design purposes.

4.1 Data Quality Review Summary

Data quality is indicated by assessing the data's precision, accuracy, representativeness, comparability, and completeness. Overall, the data quality objectives as set forth in the SAP were achieved, and the data for this project are acceptable for use, as qualified. Results for several analytes were qualified as estimated concentrations based on exceedances of quality control criteria. A detailed chemical data quality review and chemical laboratory reports are presented in Appendix B.

4.2 Dioxins/Furans

Analytical results for dioxins/furans expressed as 2,3,7,8-TCDD TECs are presented in Tables 1, 2 and 3 and on Figure 2. TECs were calculated using the World Health Organization 2005 toxic equivalency factors (TEF) for mammals. Total dioxin TECs are reported using two conventions: adding only detected congeners, and using 1/2 the detection limit for non-detected congeners. The latter only made a significant difference in reported totals when the concentrations for many congeners were below detection limits. For the presentation of data on Figure 2, the values were calculated using 1/2 the detection limit for non-detected results.

Dioxin/furan congeners were detected in all samples. For the surface (0 to 10 cm) samples, the total TEC concentrations ranged from 2.48 to 95.1 picograms/gram (pg/g; equivalent to parts per trillion; Table 1). The highest concentration was in sample SC-44-SRF, located close to shore (Figure 2). For the subsurface samples (2 to 4 foot depth), the total TEC concentrations ranged from 63.3 to 195 pg/g (Table 2). The highest concentration was in sample SC-43-SUB at 1.5 to 3.0 foot depth (Figure 2). For the subsurface samples collected at the bottom of the observed wood waste layer, the total TEC concentrations ranged from 0.168 to 263 pg/g (Table 2). The highest concentration was in sample SC-43-BTM at 7.0 to 7.5 foot depth (Figure 2). For subsurface samples collected from the bottom of sediment cores with observable wood waste, the total TEC concentrations ranged from 14.1 to 301 pg/g (Table 2). The highest concentration was in sample SC-44-BTMw/WOOD at 8.3 to 8.55 foot depth. All three eelgrass samples had detected concentrations of dioxin/furan congeners. These concentrations ranged from 0.602 pg/g to 1.96 pg/g. The sample depths referenced on the tables, figures, and in the text have not been corrected for compaction.

Dioxin/furan concentrations do not have numerical criteria under SMS for marine sediments. However, for comparative purposes, the detected TEC concentrations exceed the Puget Sound background concentrations, as reported in EPA's 2008 Puget Sound Background Study (EPA 2008). TEC concentrations in the Puget Sound study ranged from 0.24 to 11.63 pg/g with a lognormal mean of 1.35 and a median of 1.0 pg/g. The detected concentrations from the Site generally exceed this range.

5.0 SUMMARY

The highest accumulations of wood waste were observed near the shoreline in the vicinity of the former mill. Wood waste noted further from the shoreline generally contained less wood chips, wood chunks, and terrestrial wood waste, and more occurrences of fragments, fine wood particles, and sawdust. All core and grab samples collected contained at least low percentages of wood waste. Many of the core samples collected from within the inner harbor line contained wood waste over their entire depth (approximately 3 to 9 feet). Surface sediment samples collected in 2012 from the south and southeast area of the site between the inner and outer harbor lines did not contain wood bark and twigs, and may indicate that the outer extent of wood waste in this area extends past the inner harbor line. Wood waste is prevalent throughout the site and often extends to at least –10 feet MLLW. Native soils were often not encountered during vibracoring; instead, fine wood fibers were found where native soils were expected.

High dioxin concentrations were detected in the northern half of the site near the former mill and appear to be associated with wood waste, particularly sawdust. The highest concentrations are within the inner harbor line, especially in the area adjacent to the L-shaped structure.

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TABLES

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Table 1 – Analytical Results for Surface Dioxin Samples

Sample ID Sampling Date Sample Depth	SC-39-SRF 1/27/2012 0 to 10 cm	SC-40-SRF 1/27/2012 0 to 10 cm	SC-41-SRF 2/1/2012 0 to 10 cm	SC-42-SRF 1/31/2012 0 to 10 cm	SC-43-SRF 1/31/2012 0 to 10 cm	SC-44-SRF 1/31/2012 0 to 10 cm	SC-45-SRF 1/27/2012 0 to 10 cm	SC-46-SRF 1/31/2012 0 to 10 cm
Dioxins in pg/g								
2,3,7,8-TCDD	1.09 UK	0.762 UK	2.08 UK	0.833 UK	2.05 T	3.3 UK	1.02 T	1.29 UK
1,2,3,7,8-PeCDD	7.19 U	6.97 U	12.2	4.26 UK	7.11 T	17.2	4.53 U	5.09 T
1,2,3,4,7,8-HxCDD	8.04 T	6.19 T	11.3 T	5.23 T	6.95 T	13.6 UK	3.76 UK	3.28 UK
1,2,3,6,7,8-HxCDD	37.9	32.7	74	25.8 UK	34.3	140	21.4	22.1
1,2,3,7,8,9-HxCDD	16.6 U	15.9 U	26.8	12.2 T	12.6 UK	39.3	9.6 U	7.75 T
1,2,3,4,6,7,8-HpCDD	1030	941	2120	719	827	3110	470	354
OCDD	8970	8180	19200	5400	6060	21800	3190	2280
2,3,7,8-TCDF	4.52	3.82	11.7	2.32 UKJ	2.78	7.47	2.72 UK	2.92 UK
1,2,3,7,8-PeCDF	2.67 UK	2.29 T	6.54 T	1.41 UK	2.56 T	6.2 T	2.23 T	2.25 T
2,3,4,7,8-PeCDF	3.93 UK	2.48 UK	8.5 UK	2.63 UK	3.29 UK	10.4	2.34 UK	2.7 T
1,2,3,6,7,8-HxCDF	4.16 UK	4.87 U	9.05 T	3.5 UK	4.29 T	12.4 T	3.14 U	3.23 T
1,2,3,7,8,9-HxCDF	2.55 UK	1.73 UK	4.22 UK	1.59 UK	1.9 UK	6.97 T	1.45 UK	1.24 T
1,2,3,4,7,8-HxCDF	10.1 T	8.5 T	17.1 T	6.88 T	10.1 T	27.1	4.55 UK	5.16 T
2,3,4,6,7,8-HxCDF	4 UK	9.18 U	18.2 T	6.59 UK	5.33 UK	25.6	3.9 U	2.63 UK
1,2,3,4,6,7,8-HpCDF	242	204	376	197	223	741	216	117
1,2,3,4,7,8,9-HpCDF	12.1 T	10.7 T	21.4	6.61 UK	12.6 T	37.3	9.13 T	5.97 T
OCDF	1070	834	1650	964	816	3140	951	384
Total TCDD	87 J	66.6 J	141 J	79.5 J	96 J	197 J	112 J	70.3 J
Total PeCDD	109 J	57.1 J	199 J	78.7 J	113 J	224 J	91.1 J	69.8 J
Total HxCDD	375	321	724	268 J	309 J	941 J	190 J	194 J
Total HpCDD	2380	2180	4890	1610	1800	6760	954	764
Total TCDF	59.4 J	49.2 J	152 J	36.7 J	52.5 J	150 J	67.3 J	66.6 J
Total PeCDF	89.4 J	67 J	189 J	57.6 J	93.5 J	246 J	54.1 J	67.8 J
Total HxCDF	276 J	230 J	493 J	213 J	279 J	1020 J	186 J	182 J
Total HpCDF	898	742 J	1570 J	763 J	813	3130 J	735 J	441 J
TEC-1/2 MRL	28.0	25.3	63.2	18.5	29.3	95.1	15.5	16.6
TEC-Detects only	21.9	19.5	60.6	13.5	27.8	92.8	11.4	15.5

U = Not detected at the reporting limit indicated.
J = Estimated value.
T = Value is between the EDL and RL.
K = Ion ratios do not meet identification criteria acceptance limits for positive identification.

Table 1 – Analytical Results for Surface Dioxin Samples

Sample ID Sampling Date Sample Depth	SC-47-SRF 2/1/2012 0 to 10 cm	SC-48-SRF 1/31/2012 0 to 10 cm	SC-49-SRF 1/26/2012 0 to 10 cm	SC-50-SRF 1/25/2012 0 to 10 cm	SC-50a-SRF 1/31/2012 0 to 10 cm	SC-51-SRF 1/25/2012 0 to 10 cm	SC-52-SRF 1/30/2012 0 to 10 cm	SC-54-SRF 1/26/2012 0 to 10 cm
Dioxins in pg/g								
2,3,7,8-TCDD	0.575 UK	3.44 UK	1.43 T	0.62 UK	0.642 UK	1.16 T	0.651 UK	0.783 UK
1,2,3,7,8-PeCDD	5.31 UK	11.3	5.82 UK	3.53 U	3.54 T	4.79 U	4.52	2.91
1,2,3,4,7,8-HxCDD	7.91 T	11.3 T	4.46 UK	3.46 T	3.01 T	4.79 T	3.96	2.48
1,2,3,6,7,8-HxCDD	57.7	50.1	34.9	17.6 T	16.1 T	26.3	19.1	10.8
1,2,3,7,8,9-HxCDD	21.4	24.9	12.7 U	7.24 U	6.77 T	10.7 UK	7.52	4.61
1,2,3,4,6,7,8-HpCDD	1900	1120	669	352	332	637	456	189
OCDD	18500	8600	4500	2530	2550	4660	3110	1220
2,3,7,8-TCDF	1.91	3.8	3.16	1.56 UKJ	2.21 UK	3.27	3.09	3.17
1,2,3,7,8-PeCDF	1.3 T	3.36 T	3.09 T	0.6 UK	0.857 UK	1.88 T	1.37 JT	1.35 JT
2,3,4,7,8-PeCDF	1.74 T	6.64 T	4.5 T	1.52 T	1.24 T	2.33 T	2.33	1.79
1,2,3,6,7,8-HxCDF	4.55 UK	8.85 UK	5.21 U	2.48 UK	2.29 UK	3.56 U	2.76	1.65 T
1,2,3,7,8,9-HxCDF	1.42 UK	3.32 T	3.19 UK	1.73 T	0.66 UK	1.17 UK	1.06 T	0.671 T
1,2,3,4,7,8-HxCDF	9.38 T	15.6 T	8.76 T	4.36 UK	3.01 UK	7.33 T	4.61	2.54
2,3,4,6,7,8-HxCDF	11.9 T	15.6 T	10.5 U	2.07 UK	4.17 T	6.53 UK	5.75	3.26
1,2,3,4,6,7,8-HpCDF	347	322	224	110	99.6	171	125	60.7
1,2,3,4,7,8,9-HpCDF	19.9	14.5 UK	11.2 UK	6.41 T	5.87 T	8.4 T	6.02	2.83
OCDF	1230	1110	917	463	469	748	445	217
Total TCDD	59.3 J	101 J	71.5 J	38.7 J	52.9 J	50.8 J	67.1 J	68.2 J
Total PeCDD	276 J	133 J	91.4 J	41 J	52.8 J	60.2 J	71.8 J	51.7 J
Total HxCDD	913	454 J	276 J	143 J	147 J	226 J	249	108
Total HpCDD	3410	2200	1400	754	699	1380	1310	417
Total TCDF	27.8 J	88.6 J	55.3 J	23.1 J	29.2 J	42.7 J	47.7 J	45.7 J
Total PeCDF	64.5 J	167 J	92.2 J	37.3 J	33 J	57.3 J	55.1 J	43.3 J
Total HxCDF	338 J	373 J	300 J	130 J	110 J	184 J	128 J	72 J
Total HpCDF	1230	1010 J	853 J	405 J	376 J	619	406	202
TEC-1/2 MRL	43.4	45.4	22.9	11.3	12.9	19.4	17.3	9.75
TEC-Detects only	40.2	43.2	18.1	8.32	12.2	15.9	17.0	9.36

Table 1 – Analytical Results for Surface Dioxin Samples

Sample ID Sampling Date Sample Depth	SC-55-SRF 1/27/2012 0 to 10 cm	SC-58-SRF 2/1/2012 0 to 10 cm	SC-59-SRF 1/30/2012 0 to 10 cm	SS-15-SRF 1/28/2012 0 to 10 cm	SS-16-SRF 1/28/2012 0 to 10 cm	SS-17-SRF 1/28/2012 0 to 10 cm	SS-18-SRF 1/28/2012 0 to 10 cm	SS-19-SRF 1/28/2012 0 to 10 cm
Dioxins in pg/g								
2,3,7,8-TCDD	0.555 T	0.355 UK	1.5 UK	0.26 UK	0.478 T	0.537 UK	0.772 UK	0.534 UK
1,2,3,7,8-PeCDD	2.67	2.07	12.6	0.805 UK	2.6	3.19	5.5	3.64
1,2,3,4,7,8-HxCDD	2.21	1.79 T	14.1 T	0.73 T	3.05	2.57	4.57	3.12
1,2,3,6,7,8-HxCDD	11.9	10.9	93.5	3.41	10.7	15.7	33.7	25.7
1,2,3,7,8,9-HxCDD	4.84	4.39	33.6	1.59 T	5.13	6.21	11	8.53
1,2,3,4,6,7,8-HpCDD	283	220	1940	68.9	178	353	733	565
OCDD	2220	1450	13900	432	1210	2680	5800	3670
2,3,7,8-TCDF	2.34	0.864 T	4.45	0.276 JT	1.75	1.79	2.03	1.88
1,2,3,7,8-PeCDF	1.06 T	0.645 T	3.3 T	0.144 UK	0.828 T	0.859 JT	1.76 T	1.01 JT
2,3,4,7,8-PeCDF	1.35	0.915 UK	8.53 T	0.339 UK	1.14	1.45	4.12	1.67
1,2,3,6,7,8-HxCDF	1.6 UK	1.66 T	10.9 U	0.55 T	1.53 T	1.76 UK	3.94	2.79
1,2,3,7,8,9-HxCDF	0.626 T	0.647 T	4.42 UK	0.187 T	0.702 T	0.819 UK	2.83	1.27 T
1,2,3,4,7,8-HxCDF	2.83	2.81	22.5	0.769 UK	2.23 J	3.46 J	9.42	5
2,3,4,6,7,8-HxCDF	3.17	3.14	23.1	1.02 T	1.01 JT	1.75 UK	9.18	6.71
1,2,3,4,6,7,8-HpCDF	67.6	69.9	521	22.4	51.6	93.9	195	190
1,2,3,4,7,8,9-HpCDF	3.44	3.84	31.7	1.14 T	3.01 UK	5.66	11.8	9.45
OCDF	253	239	1970	78.6	184	365	833	739
Total TCDD	53.9 J	14.9 J	127 J	8.28 J	133 J	89.2 J	76.7 J	34.3 J
Total PeCDD	57.8 J	29.3 J	205 J	11.6 J	115 J	69.8 J	97.3 J	48.1 J
Total HxCDD	124	111	760	36.3	148	167	306 J	187
Total HpCDD	661	458	3710 J	153	371	760	1420	1090
Total TCDF	31.8 J	15.5 J	94.7 J	5.12 J	28.7 J	27.8 J	38.7 J	30.2 J
Total PeCDF	33.7 J	29.1 J	220 J	11.7 J	29 J	41 J	88.3 J	55.1 J
Total HxCDF	70.1 J	77.3 J	695 J	28.1 J	59.6 J	103 J	263	192
Total HpCDF	237 J	228	1950 J	75.3 J	176 J	341	805	772
TEC-1/2 MRL	10.8	8.47	65.6	2.48	8.78	12.5	26.2	18.9
TEC-Detects only	10.7	8.15	64.1	1.85	8.77	12.1	25.8	18.6

Table 1 – Analytical Results for Surface Dioxin Samples

Sample ID Sampling Date Sample Depth	SS-20-SRF 1/28/2012 0 to 10 cm	SS-21-SRF 1/28/2012 0 to 10 cm	SS-22-SRF 1/28/2012 0 to 10 cm	SS-23-SRF 1/28/2012 0 to 10 cm	SS-23-SRF Reanalysis 1/28/2012 0 to 10 cm
Dioxins in pg/g					
2,3,7,8-TCDD	0.156 UK	0.725 UK	0.552 UK	0.846 UK	0.727 T
1,2,3,7,8-PeCDD	0.771 T	4.32	2.8	4.19 T	3.26
1,2,3,4,7,8-HxCDD	0.787 T	4.58	2.42	3.89 T	2.8
1,2,3,6,7,8-HxCDD	3.53	24	10.4	14.5	13.9
1,2,3,7,8,9-HxCDD	1.67 T	10.7	4.7	6.4 UK	6.04
1,2,3,4,6,7,8-HpCDD	72.6	601	211	283	272
OCDD	533	4900	1450	2240	1920
2,3,7,8-TCDF	0.672 T	2.72	1.75	3.29	3.14
1,2,3,7,8-PeCDF	0.304 UK	1.51 JT	1.06 T	1.73 T	1.39 JT
2,3,4,7,8-PeCDF	0.404 UK	2.49	1.43	2.11 T	1.75
1,2,3,6,7,8-HxCDF	0.546 T	3.44	1.58 UK	2.31 T	1.94 T
1,2,3,7,8,9-HxCDF	0.215 UK	1.37 T	0.803 UK	1.02 UK	0.824 T
1,2,3,4,7,8-HxCDF	0.9 T	6.1	2.56	3.68 JT	3.19
2,3,4,6,7,8-HxCDF	0.881 T	2.56	1.68 T	4.06 JT	3.78
1,2,3,4,6,7,8-HpCDF	20.6	160	52	73.3	72
1,2,3,4,7,8,9-HpCDF	1.09 UK	8.55	3.33	4.45 UK	3.56
OCDF	74.5	682	169	290	257
Total TCDD	12.3 J	44.2 J	19.2 J	178 J	60.4 J
Total PeCDD	13.1	59.3	50.2	124	62.8 J
Total HxCDD	36.8 J	213	130	184 J	139
Total HpCDD	154	1330	577	629	614
Total TCDF	8.9 J	31.6 J	20.7 J	57.6 J	49.6 J
Total PeCDF	10.1 J	55.5 J	31.3 J	45.4 J	45.3 J
Total HxCDF	24.6 J	151	61.4 J	88.6 J	82.3
Total HpCDF	66.6 J	596 J	177 J	250 J	244
TEC-1/2 MRL	2.94	20.4	9.16	13.2	12.2
TEC-Detects only	2.78	20.0	8.76	12.4	12.2

Table 2 – Analytical Results for Subsurface Dioxin Samples

Sample ID Sampling Date Sample Depth in Feet	SC-39-BTM 1/27/2012 4.1 to 4.3	SC-40-BTM 1/27/2012 5.15 to 5.49	SC-41-SUB 2/1/2012 3 to 3.5	SC-41-BTMw/Wood 2/1/2012 6.65 to 6.85	SC-42-SUB 1/31/2012 1.24 to 2.48	SC-42-BTMw/Wood 1/31/2012 4.3 to 4.5
Dioxins in pg/g						
2,3,7,8-TCDD	0.277 UK	0.0519 UK	4.07 UK	0.579 UK	1.47 UK	2.31
1,2,3,7,8-PeCDD	0.649 UK	0.198 UK	27.1	3.22	10.5	14.1
1,2,3,4,7,8-HxCDD	0.193 U	0.166 T	27.8	3.04	11.8 T	12.9
1,2,3,6,7,8-HxCDD	3.07 T	0.593 T	175	16.8	81.5	49.8
1,2,3,7,8,9-HxCDD	1.57 U	0.368 UK	68.2	6.4	30.9	27.1
1,2,3,4,6,7,8-HpCDD	79.2	14.4	4530	395	2010	1130
OCDD	605	124	31300	2950	13900	8380
2,3,7,8-TCDF	0.301 UK	0.0779 U	13.7	1.76	4.35 J	6.7
1,2,3,7,8-PeCDF	0.205 U	0.0739 UK	11.3 T	1.12 JT	3.91 T	4.73
2,3,4,7,8-PeCDF	0.328 UK	0.0559 UK	22.1	1.76	7.55 UK	6.98
1,2,3,6,7,8-HxCDF	0.554 U	0.0859 UK	23.8	2.3	11.1 T	8.73
1,2,3,7,8,9-HxCDF	0.194 U	0.0292 U	11.1 T	0.757 UK	4.6 UK	2.63
1,2,3,4,7,8-HxCDF	0.56 UK	0.108 UK	50.1	3.98	24.7	11.9
2,3,4,6,7,8-HxCDF	0.15 U	0.0314 U	19.6 UK	4.28	19.9 T	13.7
1,2,3,4,6,7,8-HpCDF	26.4	3.45	1040	111	673	278
1,2,3,4,7,8,9-HpCDF	0.878 UK	0.186 UK	43.1	4.66 UK	30.6	12.2
OCDF	98.8	11.6	3490	399	2930	840
Total TCDD	6.16 JT	1.39 J	174 J	38.2 J	90.3 J	141 J
Total PeCDD	5.54 JT	1.65 J	326	44.6 J	134 J	211
Total HxCDD	26.4 J	6.74 J	1660	137 J	591 J	492
Total HpCDD	161	32.7	11200	898	4000	2390
Total TCDF	3.79 JT	0.246 JT	211 J	32.5 J	77.1 J	106 J
Total PeCDF	6.06 JT	1.09 JT	409 J	41 J	174 J	132
Total HxCDF	20.9 J	3.35 J	1220 J	120 J	681 J	280 J
Total HpCDF	83.3 J	11.3 J	3680	383 J	2470	831
TEC-1/2 MRL	2.27	0.465	141	14.1	63.3	49.0
TEC-Detects only	1.57	0.295	138	13.7	61.2	49.0

U = Not detected at the reporting limit indicated.
J = Estimated value.
T = Value is between the EDL and RL.
K = Ion ratios do not meet identification criteria acceptance limits for positive identification.
Note: Sample depths are not corrected for compaction.

Table 2 – Analytical Results for Subsurface Dioxin Samples

Sample ID Sampling Date Sample Depth in Feet	SC-43-SUB 1/31/2012 1.5 to 3.0	SC-43-BTM 1/31/2012 7.0 to 7.75	SC-44-SUB 1/31/2012 1.42 to 2.84	SC-44-BTMw/Wood 1/31/2012 8.3 to 8.55	SC-45-BTM 1/27/2012 1.5 to 1.9	SC-46-BTM 1/31/2012 2.4 to 2.7	SC-47-BTM 2/1/2012 5.0 to 5.5
Dioxins in pg/g							
2,3,7,8-TCDD	4 UK	6.15 T	4.77 T	5.99	0.0912 UK	0.076 UK	0.228 UK
1,2,3,7,8-PeCDD	21.6	41.1	20.7	36.6	0.129 U	0.127 UK	0.193 T
1,2,3,4,7,8-HxCDD	22.7	48	18.4 T	40.6	0.137 UK	0.0332 U	0.0288 U
1,2,3,6,7,8-HxCDD	278	312	154	350	0.278 T	0.0421 U	0.22 T
1,2,3,7,8,9-HxCDD	64.4	120	46	104	0.272 U	0.156 T	0.238 UK
1,2,3,4,6,7,8-HpCDD	7250	9250	4140	9950	4.35	2.47	3.88
OCDD	47100	91900	30100	73700	26.9	17.3	43.3
2,3,7,8-TCDF	8.61 UK	12.1	8.9 J	11.1	0.0575 UK	0.0429 UK	0.0278 UK
1,2,3,7,8-PeCDF	11.1 T	10 T	7.22 T	13.3	0.027 U	0.0204 U	0.197 T
2,3,4,7,8-PeCDF	27.8	17.9	14.4	44.1	0.0357 UK	0.0324 U	0.189 T
1,2,3,6,7,8-HxCDF	25.6	30.7	14.2 T	45.6	0.0203 U	0.0326 U	0.147 UK
1,2,3,7,8,9-HxCDF	18.2 T	13.1 T	6.73 T	26.9	0.027 U	0.0538 U	0.0814 UK
1,2,3,4,7,8-HxCDF	77.1	58.1	31.1	148	0.0317 UK	0.033 U	0.0973 T
2,3,4,6,7,8-HxCDF	51.5	61.5	10.2 UK	79.2	0.0218 U	0.0351 U	0.276 T
1,2,3,4,6,7,8-HpCDF	1840	2110	975	3510	1.66 U	0.368 UK	0.556 T
1,2,3,4,7,8,9-HpCDF	102	115	45.9	131	0.0276 U	0.0438 U	0.155 UK
OCDF	8460	7470	4320	21300	4.73 T	1.51 UK	2.66 T
Total TCDD	223 J	377 J	378 J	181	1.51 J	0.786 JT	0.735 JT
Total PeCDD	294 J	446	396	297	1.35 J	0.583 JT	0.671 JT
Total HxCDD	1570 J	1900	1150	2050	3 J	1.71 JT	2.13 J
Total HpCDD	13800	17700	8780	23100	9.5 J	5.79	8.55
Total TCDF	151 J	266 J	179 J	194	1.58 J	0.862 JT	0.103 JT
Total PeCDF	425 J	483 J	249 J	728 J	0.605 JT	0.0604 JT	0.528 JT
Total HxCDF	2130	1920 J	1090 J	3170	1.41 JT	0.355 JT	0.993 JT
Total HpCDF	8880	7490 J	4350	14500	4.76	1.18 JT	2.25 J
TEC-1/2 MRL	195	263	120	301	0.233	0.168	0.514
TEC-Detects only	193	263	120	301	0.081	0.045	0.373

Table 2 – Analytical Results for Subsurface Dioxin Samples

Sample ID Sampling Date Sample Depth in Feet	SC-48-BTM 1/31/2012 2.6 to 3.3	SC-49-BTM 1/26/2012 3.8 to 5.1	SC-50-WOOD 1/25/2012 2.8 to 3.1	SC-51-BTM 1/25/2012 4.7 to 5.1	SC-56-SUBSRF 1/25/2012 0.33 to 0.66	SC-58-BTM 2/1/2012 2.0 to 2.5	SC-59-BTM 1/30/2012 1.3 to 1.8
Dioxins in pg/g							
2,3,7,8-TCDD	0.148 U	0.0519 UK	2.49	0.181 UK	0.919 T	0.0514 UK	0.116 UK
1,2,3,7,8-PeCDD	0.317 U	0.275 U	16.5	0.15 UK	4.6	0.093 UK	0.0984 UK
1,2,3,4,7,8-HxCDD	1.54 UK	0.369 T	17.7	0.0434 U	4.5	0.0293 U	0.146 T
1,2,3,6,7,8-HxCDD	7.07 T	2.03	98.4	0.939 T	24	0.358 T	0.665 T
1,2,3,7,8,9-HxCDD	2.85 T	0.776 U	37	0.524 U	9.76	0.202 T	0.341 U
1,2,3,4,6,7,8-HpCDD	164	53	2860	20.2	539	8.11	12.8
OCDD	1080	351	22700	146	3880	67.5	90.4
2,3,7,8-TCDF	0.192 U	0.0724 UK	5.6	0.0965 UK	3.17	0.0317 T	0.177 U
1,2,3,7,8-PeCDF	0.212 U	0.0928 UK	4.59 J	0.0571 UK	1.81 JT	0.0455 UK	0.0925 JT
2,3,4,7,8-PeCDF	1.08 UK	0.289 T	8.04	0.154 T	2.51	0.0613 UK	0.126 UK
1,2,3,6,7,8-HxCDF	1.39 UK	0.224 UK	12.9	0.0426 U	3.25	0.0252 U	0.0453 UK
1,2,3,7,8,9-HxCDF	1 T	0.193 UK	5.19	0.0445 U	1.64 T	0.0396 U	0.0362 U
1,2,3,4,7,8-HxCDF	2.66 UK	0.811 T	22.5	0.175 UK	6.41	0.0415 UK	0.175 T
2,3,4,6,7,8-HxCDF	2.26 T	0.479 U	25.9	0.114 UK	7.1	0.0574 UK	0.102 U
1,2,3,4,6,7,8-HpCDF	58.6	29.3	647	7.99	171	2.39	3.47
1,2,3,4,7,8,9-HpCDF	2.97 UK	1.06 T	36.5	0.242 UK	7.89	0.0712 UK	0.177 UK
OCDF	205	121	2420	25.2	595	7.44 UK	10.4
Total TCDD	2.34 JT	1.56 J	173	1.82 J	64.6 J	0.87 JT	2.25 J
Total PeCDD	15 J	2.07 J	252	1.8 J	76.2	0.526 JT	1.98 J
Total HxCDD	108 J	12.6 J	766	7.88 J	215	3.86 J	5.62 J
Total HpCDD	317	106	5250	45.2	1120	17.3	23.6
Total TCDF	2.9 JT	0.941 J	98.3 J	0.939 JT	40.3 J	0.198 JT	2.31 J
Total PeCDF	21.3 J	4.6 J	194 J	2.04 J	57.5 J	0.746 JT	1.69 JT
Total HxCDF	65.1 J	23.3 J	606 J	6.93 J	173 J	2.42 J	4.26 J
Total HpCDF	201 J	109 J	2410	24.1 J	578 J	7.41 J	12.1 J
TEC-1/2 MRL	4.63	1.63	87.0	0.693	20.8	0.278	0.456
TEC-Detects only	3.93	1.38	87.0	0.473	20.8	0.184	0.294

Table 3 – Analytical Results for Eelgrass Dioxin Samples

Sample ID Sampling Date	SS-16-Eelgrass 1/28/2012	SS-17-Eelgrass 1/28/2012	SS-19-Eelgrass 1/28/2012
Dioxins in pg/g			
2,3,7,8-TCDD	0.0731 U	0.0418 UK	0.0437 UK
1,2,3,7,8-PeCDD	0.153 T	0.209 UK	0.472 T
1,2,3,4,7,8-HxCDD	0.151 U	0.153 T	0.185 UK
1,2,3,6,7,8-HxCDD	0.65 T	0.759 UK	2.42
1,2,3,7,8,9-HxCDD	0.167 U	0.376 T	0.708 T
1,2,3,4,6,7,8-HpCDD	15.4	17.6	57.4
OCDD	120	124	509
2,3,7,8-TCDF	0.128 UK	0.233 T	0.165 UK
1,2,3,7,8-PeCDF	0.123 T	0.129 T	0.124 UK
2,3,4,7,8-PeCDF	0.24 UK	0.141 UK	0.217 T
1,2,3,6,7,8-HxCDF	0.087 UK	0.155 T	0.323 T
1,2,3,7,8,9-HxCDF	0.0967 U	0.0264 U	0.0915 U
1,2,3,4,7,8-HxCDF	0.266 T	0.161 UK	0.521 T
2,3,4,6,7,8-HxCDF	0.148 T	0.307 T	0.446 UK
1,2,3,4,6,7,8-HpCDF	4.86 T	5.97	19.2
1,2,3,4,7,8,9-HpCDF	0.129 U	0.347 T	1.13 T
OCDF	14.1	17.5	77.8
Total TCDD	2.41 JT	4.92 J	4.27 J
Total PeCDD	2.41 JT	3.55 J	6.49 J
Total HxCDD	6.53 J	8.13 J	20.9 J
Total HpCDD	32.2	36.5	124
Total TCDF	1.28 JT	2.31 J	2.35 J
Total PeCDF	2.15 JT	3.05 J	6.46 J
Total HxCDF	6.42 J	6.41 J	19.8 J
Total HpCDF	15.2	18 J	61.7 J
TEC-1/2 MRL	0.611	0.602	1.96
TEC-Detects only	0.506	0.408	1.89

U = Not detected at the reporting limit indicated.
J = Estimated value.
T = Value is between the EDL and RL.
K = Ion ratios do not meet identification criteria acceptance limits for positive identification.

FIGURES

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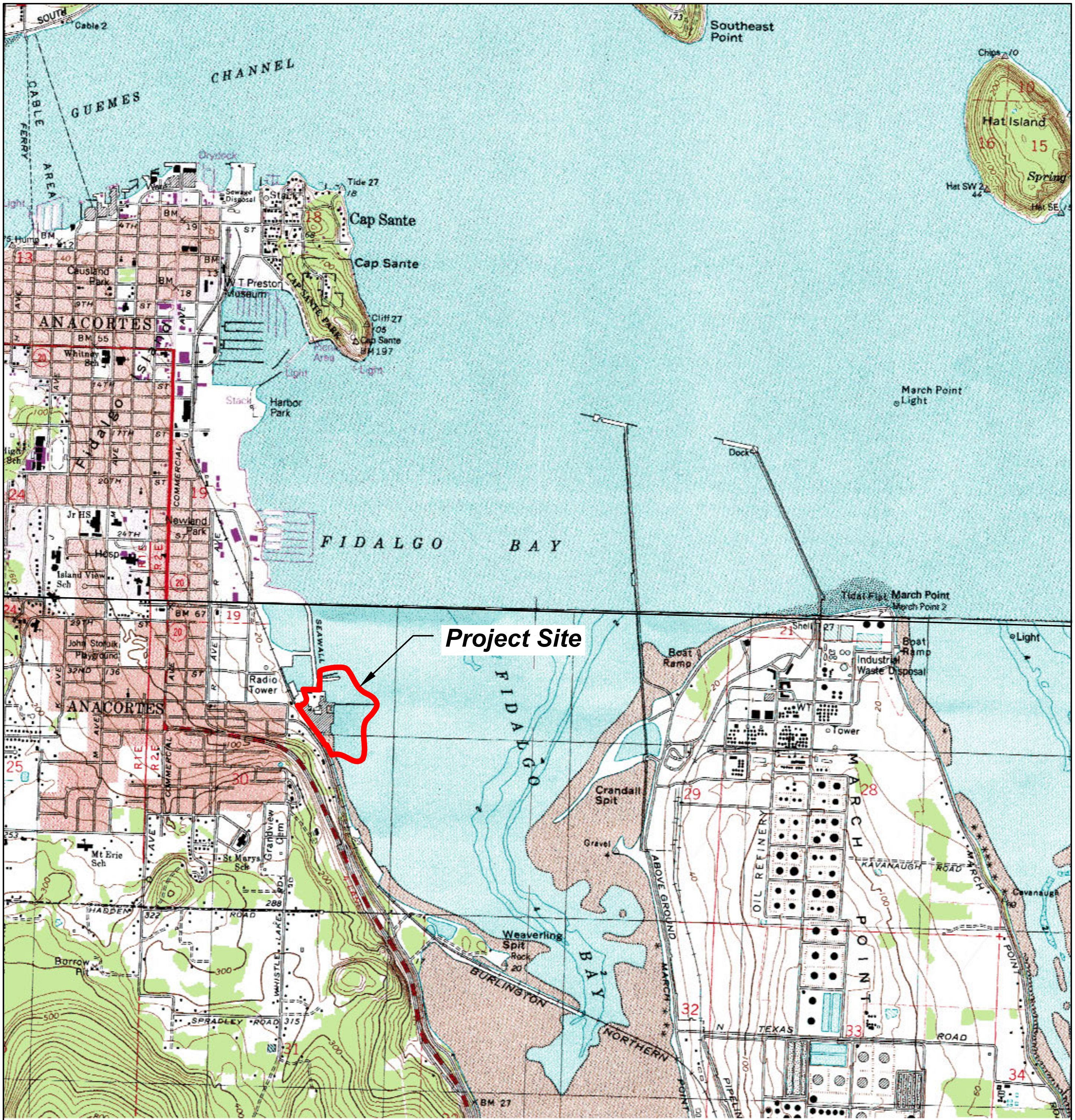
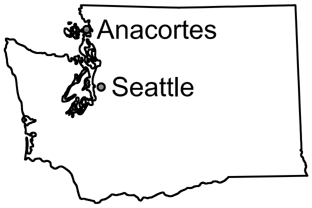


Source: Base map prepared from USGS 7.5-Minute Series Topographic Map, Anacortes North and Anacortes South Quadrangles.



0 0.5 1
Scale in Miles

N

Custom Plywood Site
Anacortes, Washington

Vicinity Map

17800-05 5/12

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Figure
1

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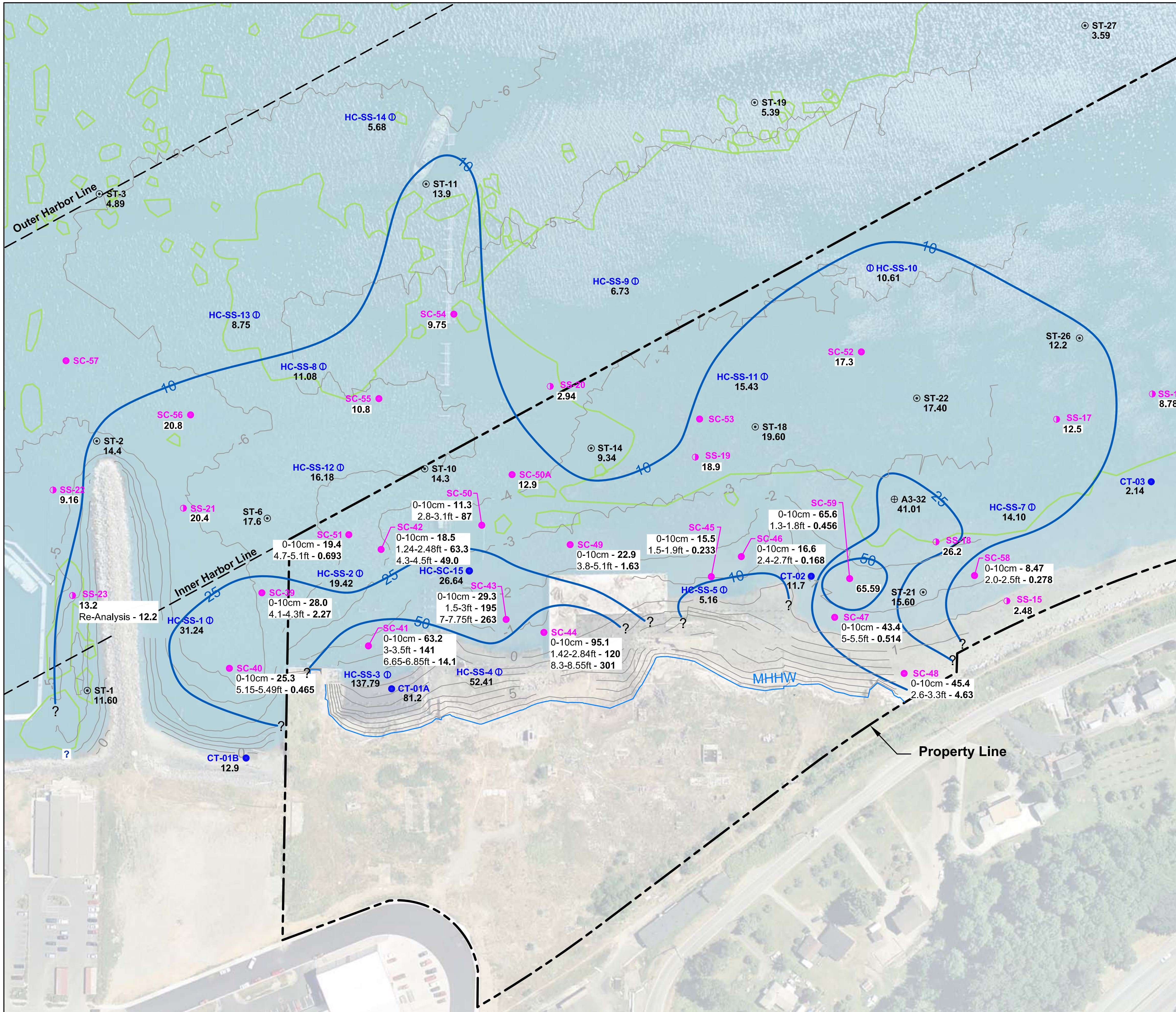

2012 Exploration Location and Number

SS-16 Surface Sediment Sample (Hart Crowser 2012)

SC-40 Vibracore Sample (Hart Crowser 2012)

2010 Exploration Location and Number

HC-SS-2 Surface Sediment Sample (2010 Hart Crowser)

HC-SC-2 Vibracore Sample (2010 Hart Crowser)

CT-01A Surface Sediment Sample (2010 SAIC)

Pre-2010 Exploration Location and Number

A3-23 Surface Sediment Sample (2008 SAIC)

ST-1 Surface Sediment Sample (2008 Geomatrix)

8.99 Discrete Surface Sample Dioxin Concentration in parts per trillion (ppt) TEC (1/2 DL TEC)

Approximate Extent of Eelgrass Beds

10 Dioxin TEC Contour in ppt

MHHW Mean Higher High Water

Notes:

1. Seaward of MHHW, elevations in feet (MLLW).
2. Inferred extent of wood waste shown derived from FS Figure 5-2.
3. Depth intervals not corrected for sediment recovery or compaction.

Source: Aerial photo courtesy of City of Anacortes, 2003.

N

0 150 300

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Sediment Dioxin Sample TEC Results and Locations

17800-05 5/12

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Figure **2**

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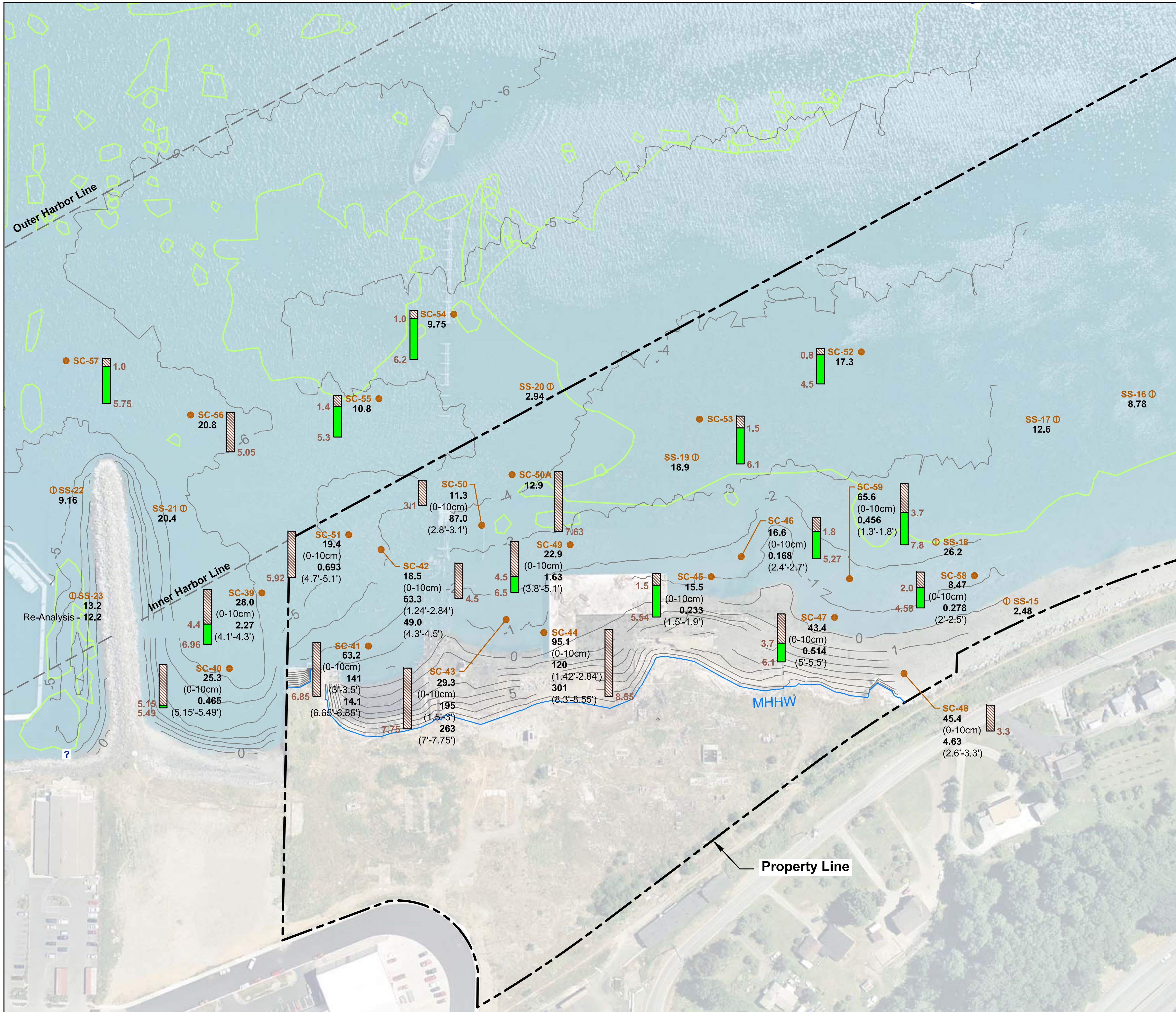

Sediment Dioxin Sample Location and Number

Hart Crowser 2012 Dioxin Sediment Sampling

SS-15 ⦶ Surface Sediment Dioxin Sample

SC-39 ● Vibracore Sample

SC-39 ● Wood Waste Present

10.61 Discrete dioxin analysis with result in parts per trillion (ppt) TEC (1/2 DL TEC)

Vibracore Location

5.3 Length Equivalent to Recovery in Feet (Uncorrected for Compaction)

Wood Waste

No Visual Evidence of Wood Waste

Approximate Extent of Eelgrass Beds

Notes:
1. Seaward of MHHW: Elevations in feet (MLLW).
2. Depth intervals not corrected for sediment recovery or compaction.

Source: Aerial photo courtesy of City of Anacortes, 2003.

N

0 150 300

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Surface Sediment and Vibracore Location Plan Showing Wood Waste Distribution

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Figure **3**

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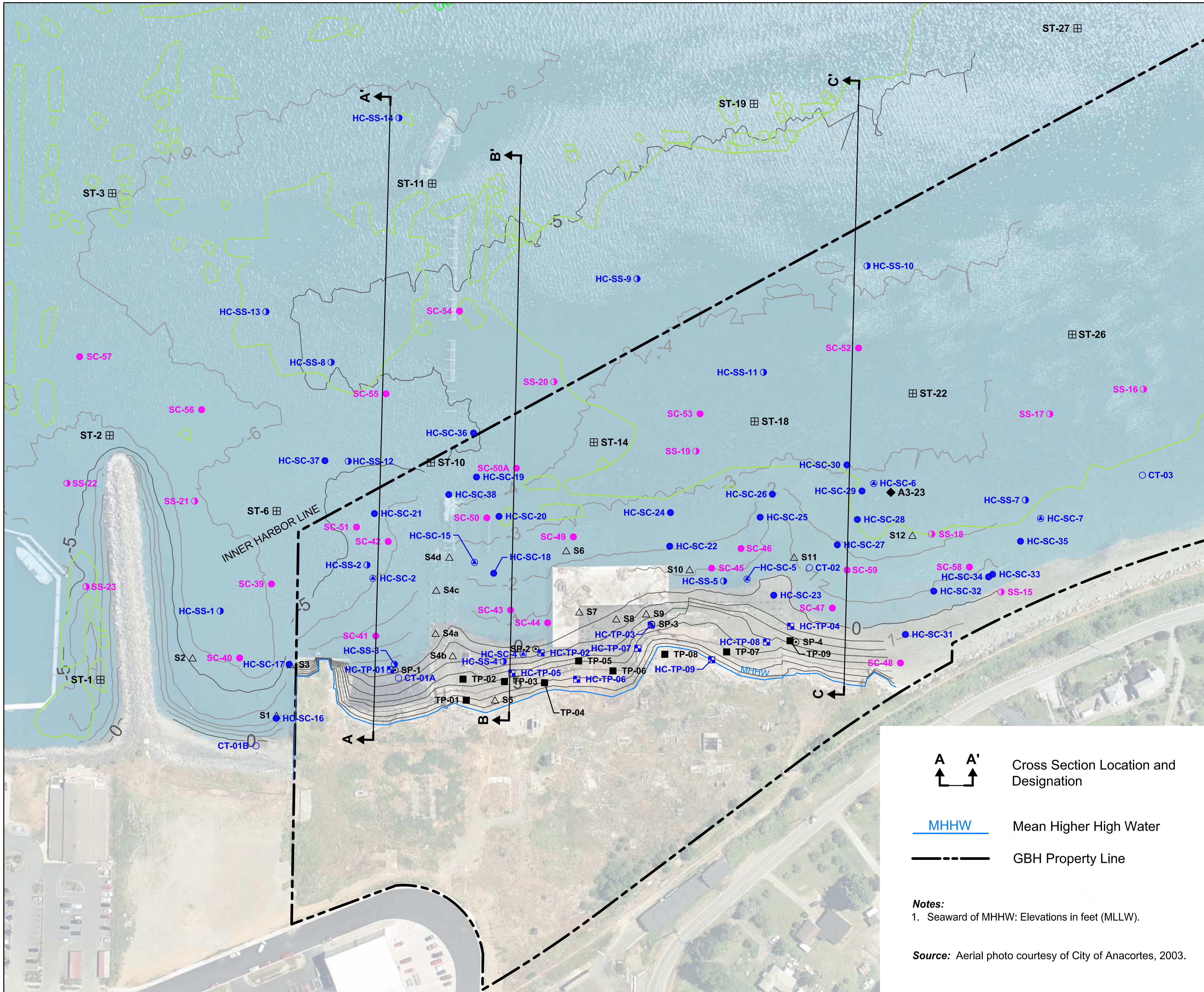

Cross Section Location and Designation

MHHW — Mean Higher High Water

GBH Property Line

Notes:
1. Seaward of MHHW: Elevations in feet (MLLW).

Source: Aerial photo courtesy of City of Anacortes, 2003.

2012 Exploration Location and Number

- SS-16 — Surface Sediment Sample (Hart Crowser 2012)
- SC-40 — Vibracore Sample (Hart Crowser 2012)

2010 Exploration Location and Number

- CT-01A — Sample (SAIC 2010)
- HC-TP-01 — Test Pit (Hart Crowser 2010)
- HC-SS-2 — Surface Sediment Sample (Hart Crowser 2010)
- HC-SC-2 — Subsurface Sediment Sample (Hart Crowser 2010)
- HC-SC-37 — Vibracore Sample (Hart Crowser 2010)

Pre-2010 Exploration Location and Number

- S1 — Sediment Sample (Enviros 1995b)
- TP-01 — Test Pit (Geomatrix 2007; AMEC 2009)
- SP-1 — Seep Sample (AMEC 2009)
- A3-23 — Surface Sediment Sample (SAIC 2008)
- ST-27 — Surface Sediment Sample (Geomatrix 2008)

N

0 150 300
Scale in Feet

Custom Plywood Site
Anacortes, Washington

Exploration Plan

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Figure
4

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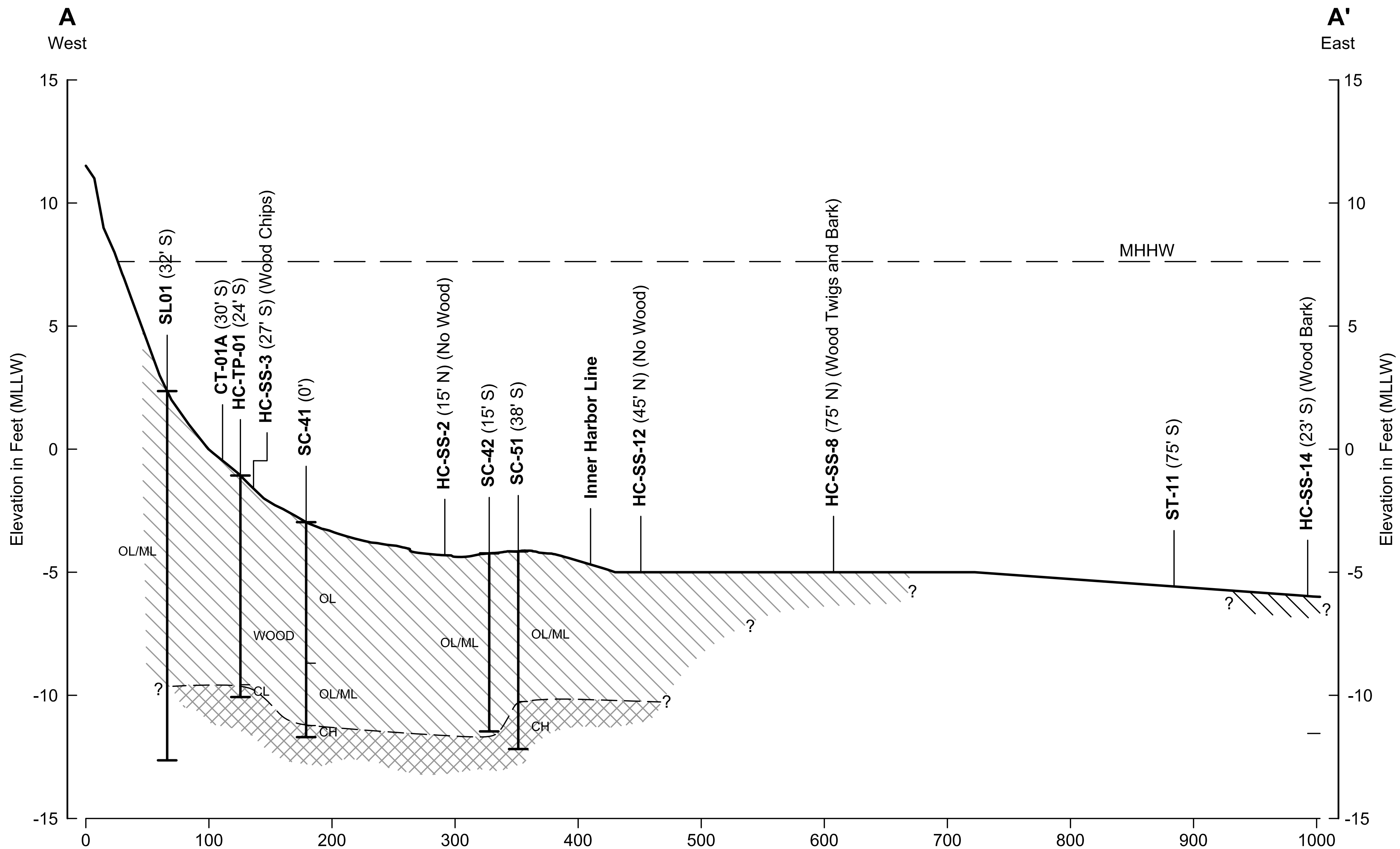

SL01 (32' S) Exploration Number (Offset Distance and Direction)

Exploration Location

Inorganic and Organic Silts with Varying Amounts of Wood Debris

Native (CL/CH), Inorganic Clays

MHHW Mean Higher High Water

Notes:
1. Vibracore logs were corrected for compaction.
2. See Figure 4 for cross section location.

Horizontal Scale in Feet
0 100 200

0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 20

Unified Soil Classification Symbols:

OL	Organic silts and organic silty clays of low plasticity
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
WOOD	Primarily wood debris with some silt

Custom Plywood Site
Anacortes Washington

Wood Waste Distribution Cross Section A-A'

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Figure
5

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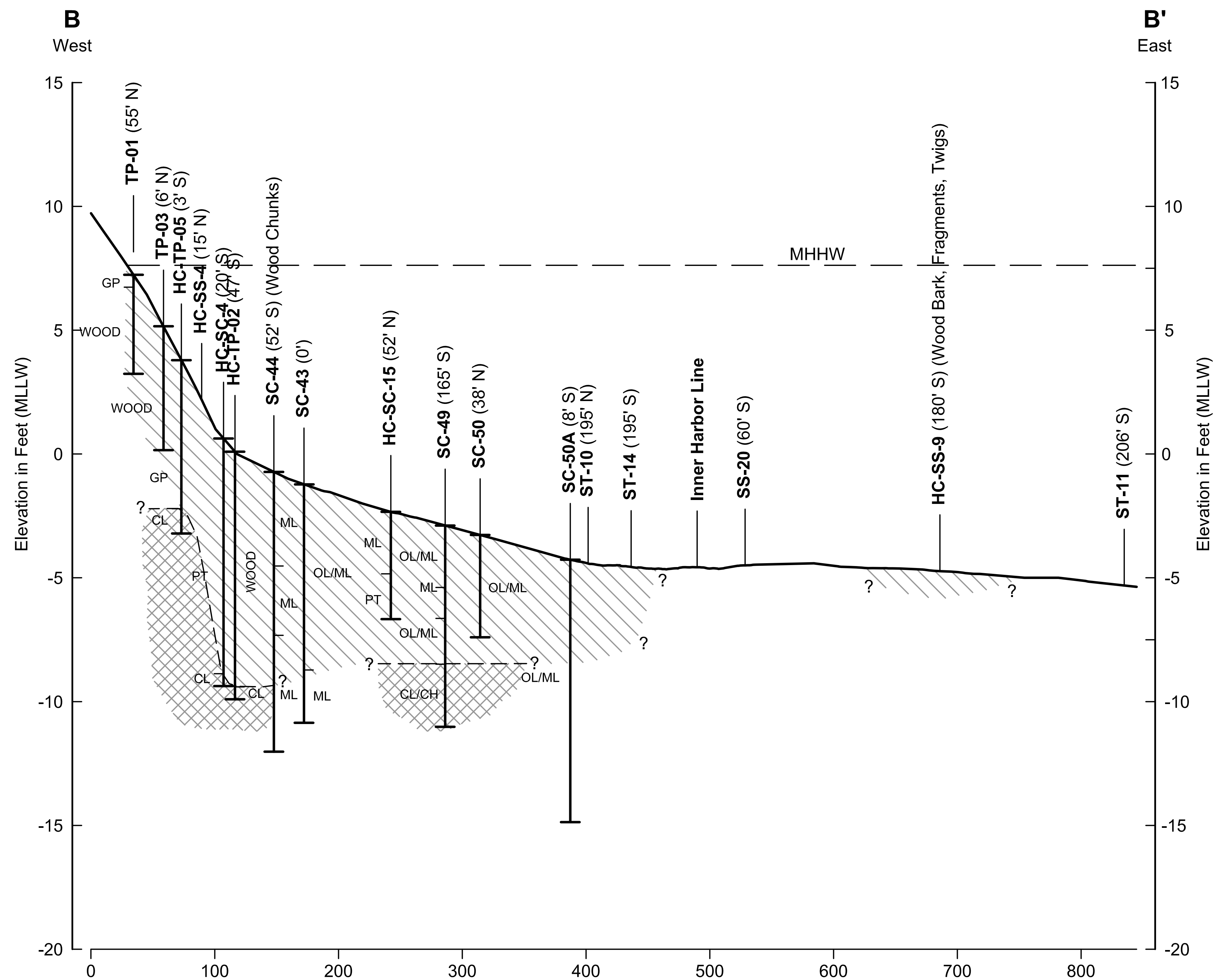

TP-01 (55' N) — Exploration Number (Offset Distance and Direction)

Exploration Location

Inorganic and Organic Silts with Varying Amounts of Wood Debris with Some Poorly-Graded Gravels

Native (CL/CH), Inorganic Clays

MHHW — Mean Higher High Water

Notes:

1. Vibracore logs were corrected for compaction.
2. See Figure 4 for cross section location.

Horizontal Scale in Feet
0 100 200

0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 20

Unified Soil Classification Symbols:

GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
OL	Organic silts and organic silty clays of low plasticity
PT	Peat, humus, swamp soils with high organic content
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
WOOD	Primarily wood debris with some silt

Custom Plywood Site
Anacortes, Washington

Wood Waste Distribution Cross Section B-B'

17800-05 5/12

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Figure
6

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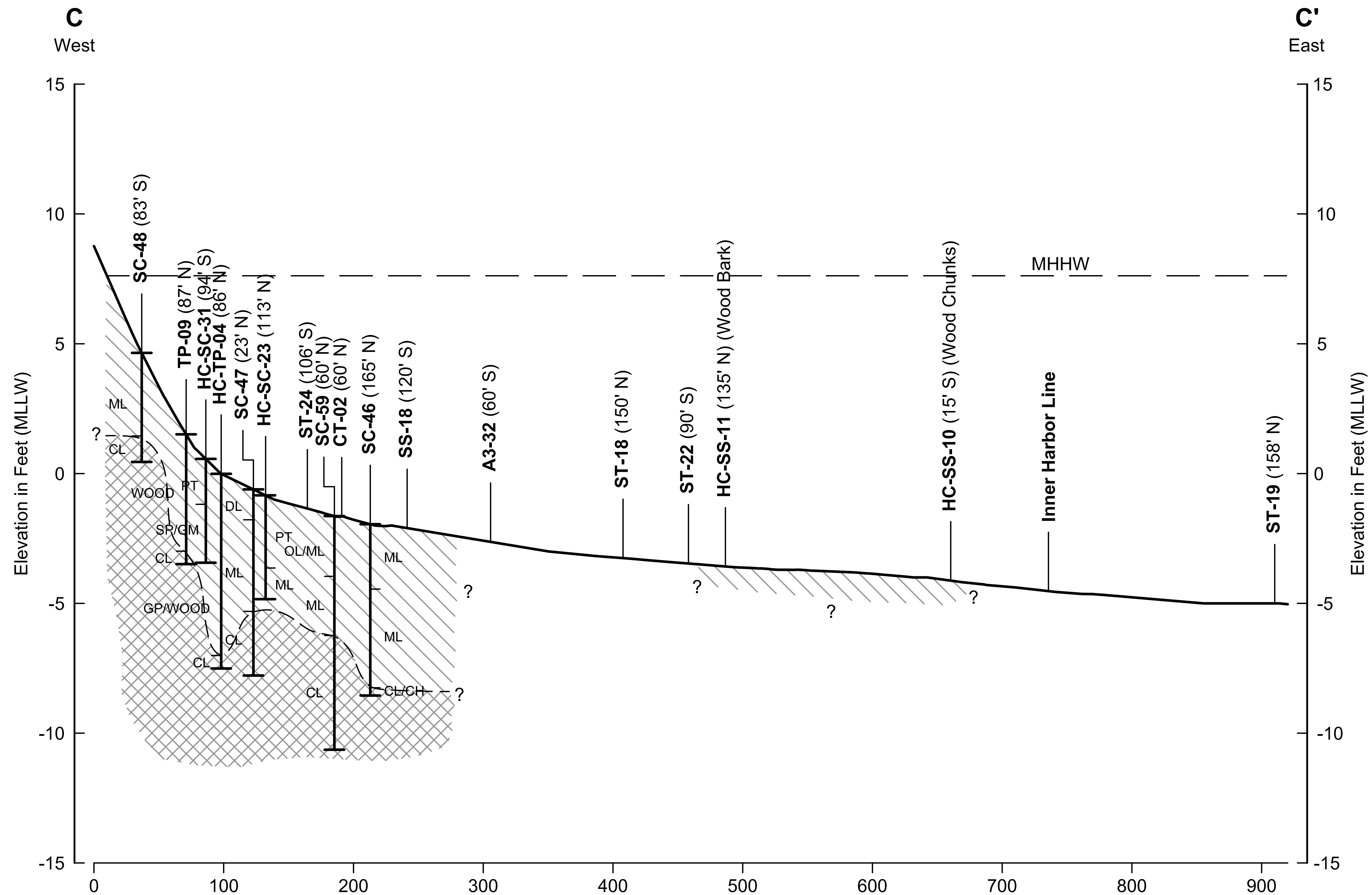

SC-48 (83' S) Exploration Number (Offset Distance and Direction)

Exploration Location

Inorganic and Organic Silts with Varying Amounts of Wood Debris

Native (CL/CH), Inorganic Clays

MHHW Mean Higher High Water

Notes:
1. Vibracore logs were corrected for compaction.
2. See Figure 4 for cross section location.

Horizontal Scale in Feet
0 100 200

0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 20

Unified Soil Classification Symbols:

GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
SP	Poorly graded sands, gravelly sand, little or no fines
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
OL	Organic silts and organic silty clays of low plasticity
PT	Peat, humus, swamp soils with high organic content
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
WOOD	Primarily wood debris with some silt

Custom Plywood Site
Anacortes, Washington

Wood Waste Distribution Cross Section C-C'

17800-05 5/12

HARTCROWSER

Figure
7

EAL 08/14/12 1780005-014.dwg

APPENDIX A
FIELD DOCUMENTATION
VIBRACORE LOGS

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Table A-1 – Sample Location Coordinates

Sample Name	Actual Coordinates			
	Northing	Easting	Latitude	Longitide
Van Veen Power Grabs - Surface Sediment (SS)				
SS-15	549327.4	1212060.5	48 29.54659	122 36.00072
SS-16	549105.1	1212377	48 29.51124	122 35.92116
SS-17	549251.4	1212338.3	48 29.53515	122 35.93157
SS-18	549435.7	1212150.8	48 29.56474	122 35.97899
SS-19	549803.6	1212280.4	48 29.62572	122 35.94902
SS-20	550025.4	1212388.6	48 29.66260	122 35.92352
SS-21	550586.1	1212202.3	48 29.75409	122 35.97279
SS-22	550785.3	1212230.1	48 29.78695	122 35.96704
SS-23	550755.6	1212068.7	48 29.78145	122 36.00680
Vibracores - Sediment Core (SC)				
SC-39	550466.2	1212072.9	48 29.73389	122 36.00412
SC-40	550515.9	1211957.4	48 29.74162	122 36.03297
SC-41	550303.4	1211991.7	48 29.70681	122 36.02328
SC-42	550284.0	1212139.2	48 29.70418	122 35.98668
SC-43	550092.9	1212032.1	48 29.67235	122 36.01209
SC-44	550035.1	1212012.3	48 29.66277	122 36.01666
SC-45	549779.3	1212097.6	48 29.62104	122 35.99411
SC-46	549733.4	1212128.3	48 29.61361	122 35.98625
SC-47	549590.7	1212035.4	48 29.58979	122 36.00842
SC-48	549484.5	1211949.6	48 29.57201	122 36.02904
SC-49	549995.0	1212146.5	48 29.65669	122 35.98323
SC-50	550130.1	1212176.2	48 29.67901	122 35.97665
SC-50A	550083.8	1212253.6	48 29.67169	122 35.95724
SC-51	550333.4	1212161.7	48 29.71239	122 35.98140
SC-52	549549.9	1212441.3	48 29.58462	122 35.90778
SC-53	549797.2	1212338.6	48 29.62489	122 35.93459
SC-54	550172.8	1212499.0	48 29.68725	122 35.89704
SC-55	550287.4	1212369.8	48 29.70561	122 35.92965
SC-56	550575.2	1212345.0	48 29.75284	122 35.93742
SC-57	550765.6	1212427.8	48 29.78445	122 35.91802
SC-58	549376.9	1212099.3	48 29.55488	122 35.99140
SC-59	549567.8	1212094.6	48 29.58625	122 35.99365

Note: Northing and Easting coordinates in NAD83 State Plane North, in US feet.

Table A-2 – Surface Sediment Grab Sample Descriptions

Sample Number	Collection Date	Visual Sediment Description	Comments
SS-15	1/28/2012	Saturated, very loose, black, silty SAND with cobbles and shell fragments.	Power grab.
SS-16	1/28/2012	Saturated, very loose, gray-brown, slightly sandy SILT with shell fragments and green biofilm on sediment surface.	Power grab. Additional sample collected for eelgrass rhizome analysis.
SS-17	1/28/2012	Saturated, very loose, gray-brown to brown, sandy SILT with shell fragments and green biofilm on sediment surface	Power grab. Petroleum odor, no sheen. Polychaetes present. Additional sample collected for eelgrass rhizome analysis.
SS-18	1/28/2012	Saturated, very loose, gray to black, silty SAND with shell fragments and small wood chunks.	Power grab. Additional sample collected for eelgrass rhizome analysis.
SS-19	1/28/2012	Saturated, very loose, brown to black, silty SAND with wood chunks and shell fragments.	Power grab. No sheen, some odor. Eelgrass rhizomes present.
SS-20	1/28/2012	Saturated, very loose, gray-brown to black, silty SAND with shell fragments and green biofilm on sediment surface.	Power grab.
SS-21	1/28/2012	Saturated, very loose, gray-brown to dark brown, silty SAND with brown biofilm on sediment surface	Power grab.
SS-22	1/28/2012	Saturated, very loose, gray-brown, sandy SILT with shell fragments and abundant wood debris	Power grab. One small shrimp and eelgrass blades
SS-23	1/28/2012	Saturated, very loose, brown-gray to black silty SAND with wood chunks.	Power grab. A single eelgrass shoot.

Table A-3 – Presence and Type of Wood Waste in Sediment Samples

					Type of Wood Waste						
						Likely Industrial			Likely Terrestrial		
Sample Number	Exploration Type	Estimated Depth of Wood Waste in Feet *	200 Micron Sieve Sample	Absence of Wood Waste	Wood Waste (general)	Wood Chips	Wood Chunks & Fragments	Fine Wood Particles & Sawdust	Twigs & Sticks	Bark	Notes
Power Grabs - Surface Sediment (SS)											
SS-15	Power Grab	0- to 10-cm			X		X	X			
SS-16	Power Grab	0- to 10-cm			X		X	X			
SS-17	Power Grab	0- to 10-cm			X		X	X			
SS-18	Power Grab	0- to 10-cm			X		X	X			
SS-19	Power Grab	0- to 10-cm			X		X	X			
SS-20	Power Grab	0- to 10-cm			X		X	X			
SS-21	Power Grab	0- to 10-cm			X		X	X			
SS-22	Power Grab	0- to 10-cm			X		X	X			
SS-23	Power Grab	0- to 10-cm			X		X	X			
Vibracores - Sediment Core (SC)											
SC-39	Vibracore	0 to 4.4	X		X			X		X	Approximately 15% wood waste.
SC-40	Vibracore	0 to 5.15	X		X		X	X		X	Approximately 5 - 50% wood waste.
SC-41	Vibracore	0 to 6.85	X		X		X	X		X	Approximately 25 - 50% wood waste.
SC-42	Vibracore	2.5 to 4.51	X		X		X				Approximately 0 - 10% wood waste.
SC-43	Vibracore	0 to 7.75	X		X		X	X			Approximately 5 - 80% wood waste.
SC-44	Vibracore	0 to 8.85	X		X		X	X			Approximately 40 to 70% wood waste.
SC-45	Vibracore	0.2 to 1.4	X		X		X	X		X	Approximately 80% wood waste.
SC-46	Vibracore	0 to 1.8	X		X		X	X		X	Approximately 70% wood waste.
SC-47	Vibracore	0 to 6.07	X		X		X	X		X	Approximately 3 - 95% wood waste.
SC-48	Vibracore	0 to 3.31	X		X			X			Approximately 5 - 20% wood waste.
SC-49	Vibracore	0 to 4.5	X		X		X			X	Approximatley 35 - 95% wood waste.
SC-50a	Vibracore	0 to 7.63	X		X		X	X			Approximately 2 - 25% wood waste.
SC-50	Vibracore	0 to 3.1	X		X			X			Approximately 2 - 60% wood waste.
SC-51	Vibracore	0 to 5.5	X		X		X	X			Approximately 15 - 50% wood waste.
SC-52	Vibracore	0 to 0.8	X		X		X	X			Approximately 20% wood waste.
SC-53	Vibracore	0 to 1.5	X		X		X	X		X	Approximately 15% wood waste.
SC-54	Vibracore	0 to 1	X		X		X	X			Approximately 27% wood waste.
SC-55	Vibracore	0 to 1.4	X		X			X			Approximately 15% wood waste.
SC-56	Vibracore	0 to 5.05	X		X		X	X			Approximately 7 - 75% wood waste.
SC-57	Vibracore	0 to 1	X		X		X				Approximately 10% wood waste.
SC-58	Vibracore	0 to 2	X		X		X				Approximately 5% wood waste.
SC-59	Vibracore	0 to 3.7	X		X		X	X			Approximately 5 - 95% wood waste.

Notes:
* Estimated depth of wood waste in feet is uncorrected for compaction, refer to Appendix A for individual vibracore logs.
NA - Not Available.

Table A-4 – Custom Plywood – Estimated Visual Percentage of Wood Debris by Sample Location

Location ID	Actual Coordinate Locations		Estimated Visual Percentage of Wood Debris from Sieve Analysis			
	Northing	Easting	Segment (in Feet)	Percent	Ranking	Observations
SC-39	550466.207	1212072.859	0 to 4.4	15%	Moderate	Fine fibrous wood and bark, shell fragments
			4.4 to 6.96	0%	No Wood	
SC-40	550515.945	1211957.37	0 to 2.5	5%	Low	Fine fibrous wood and bark, shell fragments
			2.5 to 5.15	50%	High	Large fragments (1- to 4- inch) and fine fibrous wood fragments
			5.15 to 5.49	0%	No Wood	
SC-41	550303.4	1211991.7	0 to 4.4	50%	High	Fine to medium fibrous wood pieces, some bark; whole shells
			4.4 to 6.85	<25%	Moderate	Fine to medium fibrous wood pieces, 1 large piece of wood about 3-inches
SC-42	550284	1212139.2	0 to 2.5	0%	No Wood	
			2.5 to 4.51	<10%	Low	Wood fragments
SC-43	550092.9	1212032.1	0 to 5.5	80%	High	Large fragments to fine fibrous material
			5.5 to 7.75	5%	Low	Small fragments
SC-44	550035.127	1212012.329	0 to 3	70%	High	Large wood chunks to thin fibers, moderate sheen on wood
			3 to 5.1	Trace	Low	Possible small amount of decomposing wood fragments that are no longer solid
			5.1 to 8.55	40%	High	Wood fragments to fine fibers with small shell fragments, slight sheen on wood.
SC-45	549779.312	1212097.572	0.2 to 1.4	80%	High	Small (1/2-inch) fine wood pieces and large (2- to 4- inch) bark chunks, trace shells throughout
			1.5 to 4.9	0%	No Wood	
			4.9 to 5.54	0%	No Wood	
SC-46	549733.4	1212128.3	0 to 1.8	70%	High	Bark, 1/2-inch fragments, fine fibers
			1.8 to 5.27	0%	No Wood	
SC-47	549590.7	1212035.4	0 to 1.0	95%	High	Fine to coarse wood pieces and large bark pieces (2- to 3-inch)
			1.0 to 3.7	5%	Low	Large fibrous pieces with large shells and trace gravel.
			3.7 to 6.07	3%	Low	Stiff clay with trace gravel and shell hash.
SC-48	549484.5	1211949.6	0 to 1.5	20%	Moderate	Small wood fibers to 1/4-inch fragments
			1.8 to 3.31	5%	Low	Grading to less than 5 percent wood at bottom.
SC-49	549995.021	1212146.515	0 to 1.7	35%	High	Fine to 1/4-inch fragments
			1.7 to 2.7	95%	High	Fine to 1/2-inch fragments
			2.7 to 4.5	35%	High	Fine to 2-inch bark pieces
			4.5 to 6.5	0%	No Wood	
SC-50a	550083.8	1212253.6	0 to 4.5	2%	Low	Fine fibrous wood fragments
			4.5 to 7.63	>25%	High	1/4-inchwood pieces and large chunks
SC-50	550130.102	1212176.171	0 to 0.5	13%	Moderate	Fine fragments
			0.5 to 0.9	60%	High	1/8-inch fragments with abundant small shells
			0.9 to 2.4	2%	Low	Fine fragments
			2.4 to 3.1	5%	Low	Fine fragments
SC-51	550333.405	1212161.651	0 to 3	3%	Low	Small wood fragments 1/4-inch pieces
			3' Wood Lens	50%	High	Wood debris consists of 1/4- to 2-inch chips
			3.1 to 4.5	15%	Moderate	Wood debris consists of 1/4-inch pieces
			4.5' Wood Lens	35%	High	Thin to 1/4-inch fragments
			4.7 to 5.5	3%	Low	Fine wood fibers
SC-52	549549.9	1212441.3	0 to 0.8	20%	Moderate	Fine and large wood debris
			0.8 to 4.47	0%	No Wood	Consists of 5 percent shell fragments
SC-53	549797.216	1212338.603	0 to 1.5	15%	Moderate	Small fibers to 2-inch bark pieces, highest concentration in top 3-inches
			1.5 to 6.1	0%	No Wood	
SC-54	550172.76	1212498.95	0 to 1	27%	High	A few 1- to 2-inch fragments, mostly small fibrous pieces
			1 to 6.2	0%	No Wood	
SC-55	550287.441	1212369.849	0 to 1.4	15%	Moderate	Fine fibrous wood debris with shell fragments
			1.4 to 5.3	0%	No Wood	Consists of 5 percent shell fragments
SC-56	550575.169	1212345.004	0 to 0.8	15%	Moderate	Wood debris and trace shells
			0.8 to 1.2	75%	High	Abundant wood debris
			1.2 to 3.4	12%	Moderate	Includes fibrous wood material
			3.4 to 5.05	7%	Low	Small wood fragments
SC-57	550765.642	1212427.815	0 to 1	<10%	Low	Small wood fragments (less than 1/4-inch pieces)
			1 to 5.75	0%	No Wood	
SC-58	549376.898	1212099.288	0 to 2	5%	Low	Two large pieces of wood (2- to 3-inches) and large shells and shell hash
			2 to 4.58	0%	No Wood	Stiff clay and shell hash
SC-59	549567.849	1212094.596	0 to 0.9	95%	High	Slight sheen on wood debris
			0.9 to 3.7	5%	Low	2-inch pieces and trace shells
			3.7 to 7.83	0%	No Wood	

Notes:

0	None - 0 percent
<10	Low - Less than approximately 10 percent
>10 to <25	Moderate - Greater than 10 percent and less than 25 percent
>25	High - Greater than approximately 25 percent

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 to 4	Very soft	0 to 2	<0.125
Loose	4 to 10	Soft	2 to 4	0.125 to 0.25
Medium dense	10 to 30	Medium stiff	4 to 8	0.25 to 0.5
Dense	30 to 50	Stiff	8 to 15	0.5 to 1.0
Very dense	>50	Very stiff	15 to 30	1.0 to 2.0
		Hard	>30	>2.0

Sampling Test Symbols

- ☒ 1.5" I.D. Split Spoon
- Grab (Jar)
- 3.0" I.D. Split Spoon
- Shelby Tube (Pushed)
- Bag
- Cuttings
- Core Run

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS; MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS; MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS; MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS; MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Moisture

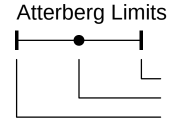
Dry	Little perceptible moisture
Damp	Some perceptible moisture, likely below optimum
Moist	Likely near optimum moisture content
Wet	Much perceptible moisture, likely above optimum

Minor Constituents

Minor Constituents	Estimated Percentage
Trace	<5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Laboratory Test Symbols

GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits

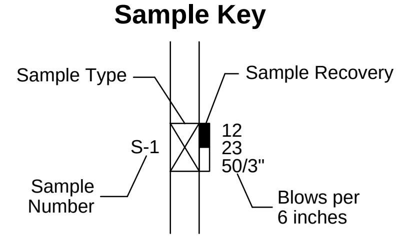


PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	In Situ Density in PCF
OT	Tests by Others

Groundwater Indicators

- Groundwater Level on Date or (ATD) At Time of Drilling
- Groundwater Seepage (Test Pits)

Sample Key



HARTCROWSER

17800-05 *1/12*

Figure A-1

KEY SHEET 1780005-VC.GPJ HC_CORP.GDT 5/23/12

Vibracore Log SC-39

Location: See Figure 2.
Water Depth in Feet: 10.5 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550466.207
Easting: 1212072.859
Logged By: E. Duncanson   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, black, organic SILT with strong sulfur-like odor, moderate wood debris (fine fibrous wood to bark) and trace shell fragments.	0	SC-39-SRF		CA
		Becomes dark gray at 2.5 feet.				
				SC-39-BTM		CA
CL		(Very stiff), wet, gray CLAY.	5			
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 8.5 Feet. Drive length: 8.53 feet, Lab Recovery Length: 6.96 feet. Lab recovery: 82%	10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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17800-05 *1/12*

Figure A-2

Vibracore Log SC-40

Location: See Figure 2.
Water Depth in Feet: 12.4 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550515.945
Easting: 1211957.37
Logged By: E. Duncanson   Reviewed By: C. Rust

USCS Class	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	LAB TESTS
OL ML	(Very soft), wet, black, organic SILT with low wood debris (fine fibrous material) and strong sulfur-like odor.	0	SC-40-SRF	CA
	High wood debris (1- to 4-inch large fragments and fine fibrous wood material) from 2.5 to 4.4 feet.			
	High wood debris (fine fibrous fragments) from 4.4 to 5.15 feet.			
CL	(Stiff), wet, gray CLAY with medium to high plasticity, and mild sulfur-like odor.	5	SC-40-BTM	CA
	Bottom of Sediment in Core Tube.			
	Bottom of Sediment in Core Tube at 7.5 Feet.			
	Drive length: 7.53 feet, Lab Recovery Length: 5.49 feet. Lab recovery: 73%			
		10		

Sediment Recovery in Core Tube

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

HARTCROWSER

17800-05 *1/12*

Figure A-3

Vibracore Log SC-41

Location: See Figure 2.
Water Depth in Feet: 10.1 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550303.4
Easting: 1211991.7
Logged By: C. Rust   Reviewed By: E. Duncanson

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL		(Soft), wet, black SILT with moderate to strong sulfur-like odor and high wood debris (fine fibrous wood and bark). Whole shells (1-inch) at 0.4 feet.	0	SC-41-SRF		CA
				SC-41-SUB		CA
OL ML		(Soft), wet, black to gray SILT with moderate sulfur-like odor and moderate wood debris (wood chips and fibers, ~1-inch pieces).	5	SC-41-BTM w/WOOD		
CH		(Soft to medium stiff), wet, gray CLAY with high plasticity, trace shell hash, and moderate wood debris (fibrous wood chips, 1-inch pieces).				
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 8.7 Feet.				
		Drive length: 8.73 feet, Lab Recovery Length: 6.85 feet. Lab recovery: 82%	10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

HARTCROWSER

17800-05 *1/12*

Figure A-4

Vibracore Log SC-42

Location: See Figure 2.
Water Depth in Feet: 7.6 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550284
Easting: 1212139.2
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, dark gray to black SILT with trace shells, low wood debris (wood fragments and fibers), and very mild sulfur-like odor.	0	SC-42-SRF		CA
				SC-42-SUB		CA
		Becomes soft, with moderate wood debris (wood fragments).				
				SC-42-BTM w/WOOD		
		Bottom of Sediment in Core Tube.	5			
		Bottom of Sediment in Core Tube at 7.2 Feet. Drive length: 7.23 feet, Lab Recovery Length: 4.5 feet. Lab recovery: 62%				
			10			

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

Vibracore Log SC-43

Location: See Figure 2.
Water Depth in Feet: 5.33 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550092.9
Easting: 1212032.1
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	LAB TESTS
OL ML	(Very soft), wet, dark gray SILT with high wood debris, trace shells (1 live clam), strong sulfur-like odor, moderate sheen on wood debris.	0	SC-43-SRF	CA
			SC-43-SUB	CA
	Black layer of wood debris to 5.3 feet.	5		
	Moderate wood debris.			
ML	(Soft), wet, light gray SILT with low wood debris.			
	Piece of aluminum at 7 feet.		SC-43-BTM	CA
	Becomes stiff at 7.5 feet.			
	Bottom of Sediment in Core Tube.			
	Bottom of Sediment in Core Tube at 9.6 Feet.	10		
	Drive length: 9.63 feet, Lab Recovery Length: 7.75 feet. Lab recovery: 75%			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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17800-05   *1/12*

Figure A-6

Vibracore Log SC-44

Location: See Figure 2.
Water Depth in Feet: 3.8 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550035.127
Easting: 1212012.329
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Soil Descriptions (based on Recovered Core)	Depth in Feet
ML	(Soft), wet, dark gray WOOD with SILT, high wood debris (>3-inch wood fragments), strong sulfur-like odor, moderate sheen on wood debris.	0
ML	(Very soft), wet, gray SILT with pink globules.	
ML	(Soft), wet, dark gray to black SILT with high wood debris, shell hash, slight sheen on wood debris. Becomes dark brown to gray with no shells at 8 feet.	5
	Bottom of Sediment in Core Tube.	
		10
	Bottom of Sediment in Core Tube at 11.3 Feet.	

Drive length: 11.33 feet, Lab Recovery Length: 8.55 feet. Lab recovery: 71%

Sample	LAB TESTS
SC-44-SRF	CA
SC-44-SUB	CA
SC-44-BTM w/WOOD	

Sediment Recovery in Core Tube

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

Vibracore Log SC-45

Location: See Figure 2.
Water Depth in Feet: 8.5 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549779.312
Easting: 1212097.572
Logged By: E. Duncanson   Reviewed By: C. Rust

USCS Class	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	LAB TESTS
OL ML	(Very soft), wet, dark gray to black SILT with mild sulfur-like odor throughout. From 0.2 to 1.4 feet, high wood debris (1/2-inch fine wood pieces and large 2- to 4-inch bark segments), with trace shells. Becomes (soft) and gray at 1.5 feet.	0	SC-45-SRF SC-45-BTM	CA CA
CL	(Medium stiff), wet, gray CLAY with medium to high plasticity.	5		
	Bottom of Sediment in Core Tube.			

Bottom of Sediment in Core Tube at 7.5 Feet.

Drive length: 7.53 feet, Lab Recovery Length: 5.54 feet. Lab recovery: 74%

Depth scale: 0, 5, 10

Sediment Recovery in Core Tube

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

Vibracore Log SC-46

Location: See Figure 2.
Water Depth in Feet: 6.3 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549733.4
Easting: 1212128.3
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
ML		(Soft), wet, dark gray WOOD with SILT, high wood debris, moderate sulfur-like odor.	0	SC-46-SRF		CA
ML		(Soft), wet, gray to dark gray SILT with abundant shell fragments, and trace gravel.		SC-46-BTM		CA
CL/CH		(Stiff), wet, gray CLAY.	5			
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 6.6 Feet. Drive length: 6.63 feet, Lab Recovery Length: 5.27 feet. Lab recovery: 79%	10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-9

Vibracore Log SC-47

Location: See Figure 2.
Water Depth in Feet: 7.8 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549590.7
Easting: 1212035.4
Logged By: C. Rust   Reviewed By: E. Duncanson

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL		(Very soft), wet, gray-brown SILT with high wood debris (fine fibrous material), slight sulfur-like odor, and dead polycheate.	0	SC-47-SRF		CA
ML		(Very soft to soft), wet, gray, slightly sandy SILT with trace shell hash, gravel, and cobbles, strong sulfur-like odor, low wood debris. Large shell hash and whole shells from 2 to 2.6 feet. Large cobble at 3.7 feet.				
CL		(Medium stiff to stiff), wet, gray, slightly sandy CLAY with trace gravel, shells, low plasticity and low wood debris, and very slight sulfur-like odor. Wood debris stops and clay becomes stiff at 4.5 feet.	5	SC-47-BTM		CA
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 7.2 Feet. Drive length: 7.17 feet, Lab Recovery Length: 6.1 feet. Lab recovery: 85%	10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-10

Vibracore Log SC-48

Location: See Figure 2.
Water Depth in Feet: 2.5 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549484.5
Easting: 1211949.6
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
ML		(Soft), wet, dark gray-black, slightly sandy SILT with moderate wood debris and shells, slight sheen on wood debris. Becomes (medium dense to loose), dark gray-black, sandy, gravelly SILT with moderate wood debris and shells at 0.6 feet. Red wood lens with fine fibers and chips from 1.5 to 1.8 feet.	0	SC-48-SRF		CA
CL		(Hard), wet, gray, slightly sandy, gravelly CLAY with low wood debris. Cobbles at 2.7 feet.		SC-48-BTM		CA
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 4.2 Feet. Drive length: 4.23 feet, Lab Recovery Length: 3.3 feet. Lab recovery: 68%	5			
			10			

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

Vibracore Log SC-49

Location: See Figure 2.
Water Depth in Feet: 8.3 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549995.021
Easting: 1212146.515
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	LAB TESTS
OL ML	(Very soft), wet, gray to dark gray SILT with trace shells, moderate wood debris, and moderate sulfur-like odor. Wood lens at 0.7 feet.	0	SC-49-SRF	CA
ML	(Soft), wet, brown WOOD with SILT, high wood debris (wood chips and coarse fibrous sawdust). 2-inch rock at 2 feet.			
OL ML	(Soft), wet, gray to dark gray SILT with trace shells, and high wood debris.			
CL/CH	(Medium stiff to stiff), wet, gray CLAY with trace gravel, medium plasticity.	5	SC-49-BTM	CA
	Bottom of Sediment in Core Tube.			
	Bottom of Sediment in Core Tube at 8.1 Feet. Drive length: 8.13 feet, Lab Recovery Length: 6.5 feet. Lab recovery: 80%	10		

Sediment Recovery in Core Tube

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

Vibracore Log SC-50

Location: See Figure 2.
Water Depth in Feet: 11.5 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550130.102
Easting: 1212176.171
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, dark gray to black SILT with trace shells, low wood debris, moderate to strong sulfur-like odor.	0	SC-50-SRF		CA
		High wood debris lens with 1/8-inch wood fragments and abundant shells from 0.5 to 0.9 feet.				
		Becomes soft with high wood debris at 2.4 feet.		SC-50-WOOD		CA
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 4.1 Feet.				
		Drive length: 4.13 feet, Lab Recovery Length: 3.1 feet. Lab recovery: 75%	5			
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-13

Vibracore Log SC-50a

Location: See Figure 2.
Water Depth in Feet: 9.4 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550083.8
Easting: 1212253.6
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, dark gray SILT with low wood debris and shells, moderate sulfur-like odor.	0	SC-50a-SRF		CA
		Becomes soft at 4 feet.				
		Wood debris increases at 4.5 feet, 1/4-inch pieces and large chunks.	5			
		High wood debris at bottom of core.		SC-50a-BTM w/WOOD		
		Bottom of Sediment in Core Tube.				
			10			
		Bottom of Sediment in Core Tube at 10.6 Feet. Drive length: 10.6 feet, Lab Recovery Length: 7.63 feet. Lab recovery: 72%				

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

Vibracore Log SC-51

Location: See Figure 2.
Water Depth in Feet: 12.7 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550333.405
Easting: 1212161.651
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, black to gray SILT with low wood debris (1/4- to 2-inch wood chips), moderate sulfur-like odor.	0	SC-51-SRF		CA
		Becomes soft at 3 feet.				
		High wood debris (1/4 to 2-inch wood chips) and shells from 3 to 3.1 feet.				
		Moderate wood debris (1/4-inch wood chips) from 4.5 to 4.6 feet.				
CH		(Medium stiff to stiff), wet, gray CLAY with medium to high plasticity, trace gravel (fine, rounded to sub-rounded).	5	SC-51-BTM		CA
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 8.0 Feet.				
		Drive length: 8.03 feet, Lab Recovery Length: 5.92 feet. Lab recovery: 74%				
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Vibracore Log SC-52

Location: See Figure 2.
Water Depth in Feet: 8 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549549.9
Easting: 1212441.3
Logged By: E. Duncanson   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, black SILT with moderate wood debris (large pieces 3- to 4-inch size and fine, fibrous fragments), with moderate sulfur-like odor.	0	SC-52-SRF		
		Live clam present at 0.3 feet.				
		From 0.8 to 4.47 feet abundant shells throughout.		SC-52-BTM		
		Becomes slight sulfur-like odor.				
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 4.8 Feet. Drive length: 4.83 feet, Lab Recovery Length: 4.5 feet. Lab recovery: 93%	5			
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Vibracore Log SC-53

Location: See Figure 2.
Water Depth in Feet: 9 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549797.216
Easting: 1212338.603
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, dark gray SILT with trace shells, moderate wood debris, moderate sulfur-like odor.	0	SC-53-SRF		
		No wood debris from 1.5 to 5.2 feet.		SC-53-BTM		
		Becomes soft at 2 feet.				
		Becomes gray at 2.5 feet.				
			5			
GP		(Medium dense), wet, gray, clayey GRAVEL.				
CL/CH		(Medium stiff to stiff), wet, gray CLAY with trace shells, low to high plasticity.				
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 6.6 Feet. Drive length: 6.63 feet, Lab Recovery Length: 6.1 feet. Lab recovery: 92%				
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

HARTCROWSER

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Figure A-17

Vibracore Log SC-54

Location: See Figure 2.
Water Depth in Feet: 11.8 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550172.76
Easting: 1212498.95
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, dark gray SILT with trace shells, high wood debris (1- to 3-inch fragments and fibrous pieces).	0	SC-54-SRF		
		No wood debris observed below 1 foot.		SC-54-BTM		
			5			
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 6.7 Feet.				
		Drive length: 6.73 feet, Lab Recovery Length: 6.2 feet. Lab recovery: 92%				
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Vibracore Log SC-55

Location: See Figure 2.
Water Depth in Feet: 10.2 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550287.441
Easting: 1212369.849
Logged By: E. Duncanson   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, black SILT with trace shells throughout, and moderate wood debris (fine fibrous fragments).	0	SC-55-SRF		
				SC-55-BTM		
		Becomes (soft) and gray at 1.4 feet.				
		Increase in the amount of shell fragments at 3.4 feet.				
			5			
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 6.1 Feet. Drive length: 6.13 feet, Lab Recovery Length: 5.3 feet. Lab recovery: 86%				
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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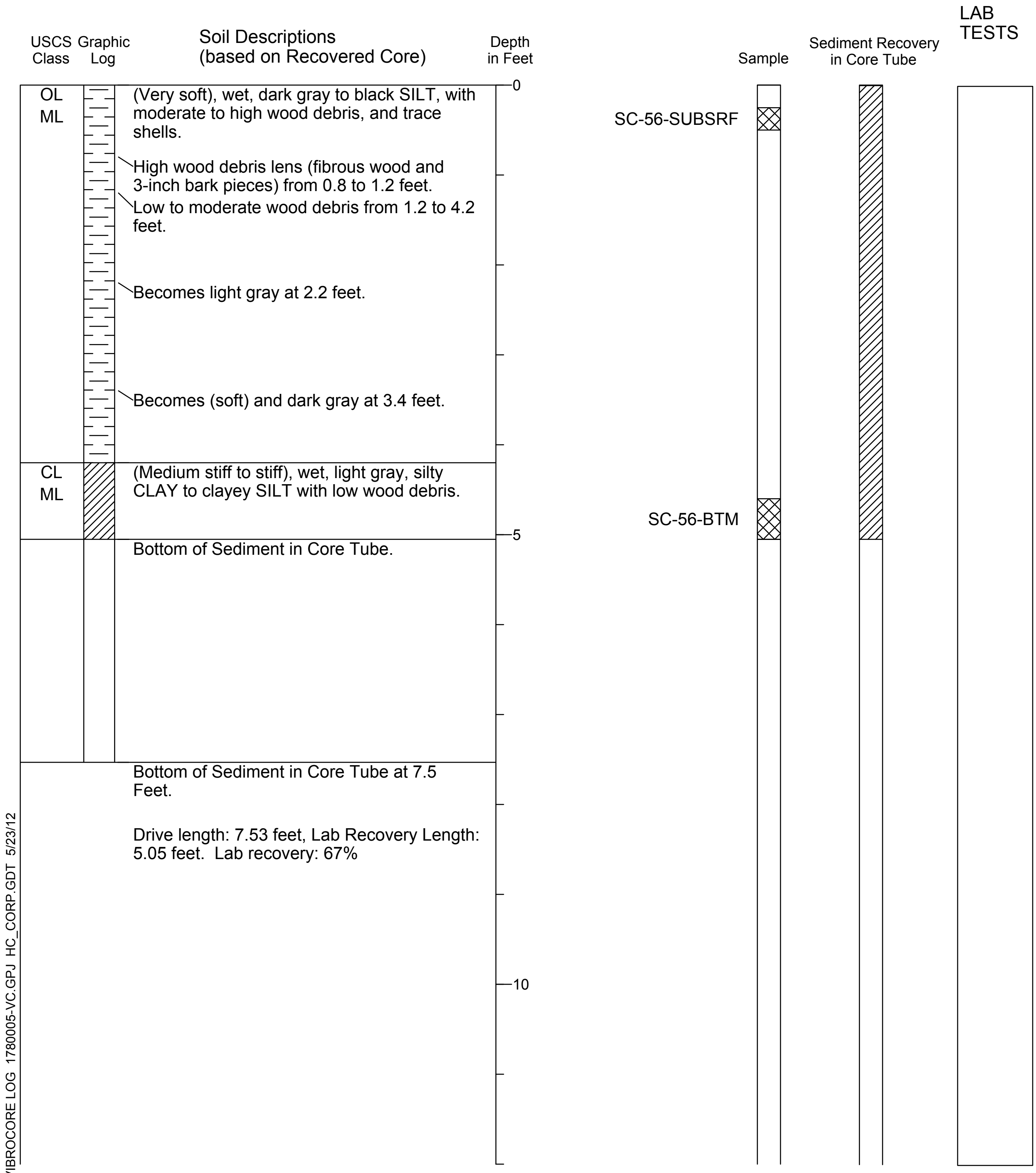
Vibracore Log SC-56

Location: See Figure 2.
Water Depth in Feet: 14 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550575.169
Easting: 1212345.004
Logged By: P. Cordell   Reviewed By: C. Rust



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-20

Vibracore Log SC-57

Location: See Figure 2.
Water Depth in Feet: 13.25 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 550765.642
Easting: 1212427.815
Logged By: P. Cordell   Reviewed By: C. Rust

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Soft to very soft), wet, light gray SILT, with low wood debris, trace shells, and moderate sulfur-like odor.	0	SC-57-SRF		
		No wood debris observed below 1 foot.				
		Trace gravel and abundant shells from 4.5 to 5.75 feet.	5			
		Bottom of Sediment in Core Tube.				
		Bottom of Sediment in Core Tube at 7.6 Feet. Drive length: 7.63 feet, Lab Recovery Length: 5.75 feet. Lab recovery: 75%				
			10			

VIBROCORE LOG 1780005-VC.GPJ HC_CORP.GDT 5/23/12

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-21

Vibracore Log SC-58

Location: See Figure 2.
Water Depth in Feet: 6.8 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549376.898
Easting: 1212099.288
Logged By: C. Rust   Reviewed By: E. Duncanson

USCS Class	Graphic Log	Soil Descriptions (based on Recovered Core)	Depth in Feet	Sample	Sediment Recovery in Core Tube	LAB TESTS
OL ML		(Very soft), wet, gray, slightly sandy SILT with large shell pieces, low wood debris, moderate sulfur-like odor.	0	SC-58-SRF		CA
CL		(Soft to stiff), wet, gray, slightly sandy CLAY with low plasticity, trace shell hash, and no wood debris. Becomes stiff at 3 feet.		SC-58-BTM		CA
		Bottom of Sediment in Core Tube.	5			
		Bottom of Sediment in Core Tube at 6.7 Feet. Drive length: 6.73 feet, Lab Recovery Length: 4.58 feet. Lab recovery: 68%	10			

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-22

Vibracore Log SC-59

Location: See Figure 2.
Water Depth in Feet: 4.6 Feet

Type of Sample: Vibracore
Core Diameter: 4 inches
Northing: 549567.849
Easting: 1212094.596
Logged By: E. Duncanson Reviewed By: C. Rust

USCS Class	Soil Descriptions (based on Recovered Core)	Depth in Feet
OL ML	(Very soft), wet, dark gray SILT with trace shell fragments and high wood debris (fine fibrous fragments to 2-inch pieces), strong sulfur-like odor, slight sheen on wood debris. Becomes low wood debris at 0.9 feet.	0
ML	(Very soft), wet, dark gray, sandy SILT, low wood debris.	
CL	(Very stiff to hard), wet, gray to dark gray CLAY with trace shells throughout.	5
	Bottom of Sediment in Core Tube.	
	Bottom of Sediment in Core Tube at 9.0 Feet. Drive length: 9.0 feet, Lab Recovery Length: 7.8 feet. Lab recovery: 93%	10

Sample	LAB TESTS
SC-59-SRF	CA
SC-59-BTM	CA

Sediment Recovery in Core Tube

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Sediment descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Vibracore not corrected for compaction.

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Figure A-23

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APPENDIX B
CHEMICAL DATA QUALITY REVIEW
LABORATORY REPORTS

APPENDIX B
CHEMICAL DATA QUALITY REVIEW AND LABORATORY REPORTS

Chemical Data Quality Review for Sediment Samples

Nine surface sediment samples and 21 sediment core samples were collected from the former Custom Plywood Mill Site during the week of January 23 through 28, 2012. The sediment cores were transported to Analytical Resources, Inc. (ARI), in Tukwila, Washington, for storage in a walk-in refrigerator prior to processing. The sediment cores were processed between January 25 and February 1, 2012. Thirty-one samples collected from the cores and nine surface sediment samples collected in the field were submitted to ARI for analysis of dioxins/furans and total solids. Three eelgrass rhizome samples were submitted for tissue analysis of dioxins/furans. The remaining samples were placed on hold at the laboratory. On April 11, 2012, eight samples were removed from hold and analyzed for dioxins/furans. One additional sample, SS-23-SRF, was re-extracted and reanalyzed. A summary of the samples, depths, and associated laboratory reports is provided in Table B-1.

Quality assurance/quality control (QA/QC) reviews of laboratory procedures are performed on an ongoing basis by the laboratory. Hart Crowser performed the data review, using laboratory quality control results summary sheets and raw data, as required, to ensure they met data quality objectives for the project. Data review generally followed the format outlined in the National Functional Guidelines for Chlorinated Dibenzo-p-Dioxin (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (EPA 2005). The following criteria were evaluated in the standard data quality review process:

- Holding times;
- Method blanks;
- Labeled compound recoveries;
- Ongoing Precision and Recovery sample (OPR) recoveries;
- Calibration criteria; and
- Reporting limits (RL).

The data were determined to be acceptable for use, as qualified. Full laboratory results are presented at the end of this appendix. Results of the data reviews follow.

Conventional Sediment Parameters

Analytical Methods

Total solids were determined by modified EPA Method 160.3.

Sample Holding Times

The samples met holding time limits for total solids.

Laboratory Detection Limits

Reported detection limits were acceptable.

Dioxins/Furans

Analytical Methods

Sediment samples for dioxins/furans analysis were prepared and analyzed by EPA Method 1613.

Sample Holding Times

The samples were prepared and analyzed within holding time limits.

Laboratory Detection Limits

Reported detection limits and analytical results were adjusted for moisture content and any required dilution factors. Detections that fell between the reporting limit (RL) and the Estimated Detection Limit (EDL) were qualified by the laboratory as "J." The laboratory "J" qualifier was changed to "T" to be consistent with Ecology's EIM database.

Blank Contamination

The method blanks had detections for multiple congeners between the EDL and the RL. The laboratory qualified congener results in the associated samples with B, when the results were less than ten times the amount in the method blank. Method blank results that did not meet ion ratio criteria (EMPC results qualified as K) were treated as non-detected. The detections in the associated samples were evaluated and results modified as follows:

- MB-020112: The method blank had the following detections, which met ion identification criteria, between the EDL and the RL.

  - 2,3,7,8-TCDF – 0.0520 pg/g
  - 1,2,3,7,8-PeCDD – 0.0460 pg/g
  - 1,2,3,6,7,8-HxCDF – 0.0280 pg/g
  - 2,3,4,6,7,8-HxCDF – 0.0600 pg/g
  - 1,2,3,7,8,9-HxCDD – 0.0460 pg/g
  - 1,2,3,4,6,7,8-HpCDF – 0.102 pg/g
  - OCDD – 1.02 pg/g

  Results for those congeners in the associated samples that fell between the EDL and the RL were qualified as non-detected (U) at the value reported by the laboratory, and had the B qualifier removed, if present, as indicated below:

  - SC-50-SRF: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-51-SRF: 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-51-BTM: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-49-SRF: 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-49-BTM: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-45-SRF: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-45-BTM: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,7,8,9-HxCDD, and 1,2,3,4,6,7,8-HpCDF
  - SC-39-SRF: 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-39-BTM: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-40-SRF: 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-40-BTM: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD
  - SC-59-SRF: 1,2,3,6,7,8-HxCDF
  - SC-59-BTM: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,7,8,9-HxCDD

Results for those congeners in the associated samples with detections above the RL and greater than five times the amount in the method blank had the B qualifier removed, if present, as indicated below:

- SC-50-SRF: 1,2,3,4,6,7,8-HpCDF and OCDD
- SC-51-SRF: 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-51-BTM: 1,2,3,4,6,7,8-HpCDF and OCDD
- SC-49-SRF: 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-49-BTM: 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-45-SRF: 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-45-BTM: OCDD
- SC-39-SRF: 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-39-BTM: 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-40-SRF: 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-40-BTM: 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-59-SRF: 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 2,3,4,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDF, and OCDD
- SC-59-BTM: 1,2,3,4,6,7,8-HpCDF and OCDD

Detections for 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDD, and OCDF did not meet the ion identification criteria in the method blank. Results for those congeners in the associated samples that were less than ten times the amount in the method blank were qualified by the laboratory with B, and the B qualifier was removed in samples SC-51-BTM, SC-49-BTM, SC-45-BTM, SC-39-BTM, SC-40-BTM, and SC-59-BTM.

- MB-020312: The method blank had the following detection, which met ion identification criteria, between the EDL and the RL.

    - OCDD – 0.676 pg/g

Results for OCDD in the associated samples were detected above the RL and greater than ten times the amount in the method blank, and were not qualified.

Detections for 1,2,3,4,6,7,8-HpCDD did not meet the ion identification criteria in the method blank. Results for that congener in the associated samples were greater than ten times the amount in the method blank, and the laboratory did not qualify the data. Results for that congener in the associated samples were not qualified due to blank contamination.

- MB-020712: The method blank had the following detection, which met ion identification criteria, between the EDL and the RL.

- OCDD – 1.66 pg/g

Results for OCDD in the associated samples were detected above the RL and greater than ten times the amount in the method blank, and were not qualified.

Detections for 2,3,7,8-TCDF, 2,3,7,8-TCDD, 2,3,4,7,8-PeCDF, 1,2,3,4,6,7,8-HpCDF, and 1,2,3,4,6,7,8-HpCDD did not meet the ion identification criteria in the method blank. Results for those congeners in the associated samples that were less than ten times the amount in the method blank were qualified by the laboratory with B, and the B qualifier was removed in samples SC-46-BTM, SC-47-BTM, and SC-58-BTM.

- MB-041612: The method blank had the following detections, which met ion identification criteria, between the EDL and the RL.

  - 1,2,3,4,6,7,8-HpCDF – 0.046 pg/g
  - OCDD – 0.676 pg/g

Results for those congeners in the associated samples were detected above the RL and greater than ten times the amount in the method blank, and were not qualified.

Detections for 2,3,4,8-TCDD, 1,2,3,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDD did not meet the ion identification criteria in the method blank. Results for those congeners in the associated samples were greater than ten times the amount in the method blank, and the laboratory did not qualify the data. Results for those congeners in the associated samples were not qualified due to blank contamination.

Labeled Compound Recoveries

The labeled compound recoveries were within method control limits.

Ongoing Precision and Recovery

OPR recoveries were within QC limits.

Initial Calibration Curves and Continuing Calibration Verification Checks (CCVs)

The initial calibration curves and CCVs were within acceptance criteria.

Sample Qualifiers

Multiple congeners in the samples were qualified by the laboratory with EMPC (Estimated Maximum Possible Concentration) due to failure to meet identification criteria. The EMPC qualifiers were reported as non-detect for individual analytes, and qualified as UK.

Multiple congeners in the samples were qualified by the laboratory with X due to interference from polychlorinated diphenyl ethers. The X qualifiers were changed to J (estimated) in the following samples:

- SS-23-SRF: 1,2,3,4,7,8-HxCDF and 2,3,4,6,7,8-HxCDF
- SS-16-SRF: 1,2,3,4,7,8-HxCDF and 2,3,4,6,7,8-HxCDF
- SS-17-SRF: 1,2,3,7,8-PeCDF and 1,2,3,4,7,8-HxCDF
- SS-15-SRF: 2,3,7,8-TCDF
- SS-19-SRF: 1,2,3,7,8-PeCDF
- SS-21-SRF: 1,2,3,7,8-PeCDF
- SC-50-SRF: 2,3,7,8-tcdf
- SC-59-BTM: 1,2,3,7,8-PeCDF
- SC-42-SRF: 2,3,7,8-TCDF
- SC-42-SUB: 2,3,7,8-TCDF
- SC-44-SUB: 2,3,7,8-TCDF
- SC-50-WOOD: 1,2,3,7,8-PeCDF
- SC-56-SUBSRF: 1,2,3,7,8-PeCDF
- SC-54-SRF: 1,2,3,7,8-PeCDF
- SS-23-SRF: 1,2,3,7,8-PeCDF
- SC-52-SRF: 1,2,3,7,8-PeCDF
- SC-41-BTMw/WOOD: 1,2,3,7,8-PeCDF

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Table B-1 – Sampling Locations & Analyses

Station	Sample ID	Depth Interval	Field % Recovery	Lab % Recovery	Sample Date	Sample Time	Lab SDG	Dioxin	Notes
Van Veen (SS)									
SS - 15	SS-15-SFC	0-10 cm	--	--	1/28/2012	1456	UG13	x	
SS - 16	SS-16-SFC	0-10 cm	--	--	1/28/2012	1419	UG13	x	
	SS-16-Eelgrass	Eelgrass	--	--	1/28/2012	1419	UG13	x	Eelgrass tissue
SS - 17	SS-17-SFC	0-10 cm	--	--	1/28/2012	1431	UG13	x	
	SS-17-Eelgrass	Eelgrass	--	--	1/28/2012	1431	UG13	x	Eelgrass tissue
SS - 18	SS-18-SFC	0-10 cm	--	--	1/28/2012	1442	UG13	x	
SS - 19	SS-19-SFC	0-10 cm	--	--	1/28/2012	1509	UG13	x	
	SS-19-Eelgrass	Eelgrass	--	--	1/28/2012	1509	UG13	x	Eelgrass tissue
SS - 20	SS-20-SFC	0-10 cm	--	--	1/28/2012	1524	UG13	x	
SS - 21	SS-21-SFC	0-10 cm	--	--	1/28/2012	1537	UG13	x	
SC - 22	SS-22-SFC	0-10 cm	--	--	1/28/2012	1330	UG13	x	
SC - 23	SS-23-SFC	0-10 cm	--	--	1/28/2012	1348	UG13 UP99	x	Reanalyzed
Vibracores (SC)									
SC - 39	SC-39-SRF	0-10 cm	82%	82%	1/27/2012	1100	UF98	x	
	SC-39-BTM	Bottom of wood			1/27/2012	1125	UF98	x	
SC - 40	SC-40-SRF	0-10 cm	74%	73%	1/27/2012	1150	UF98	x	
	SC-40-BTM	Bottom of wood			1/27/2012	1210	UF98	x	
SC - 41	SC-41-SRF	0-10 cm	82%	82%	2/1/2012	905	UG76	x	
	SC-41-SUB	2-4 ft			2/1/2012	930	UG76	x	
	SC-41-BTMw/WOOD	Bottom with wood			2/1/2012	1000	UP99	x	
SC - 42	SC-42-SRF	0-10 cm	66%	62%	1/31/2012	1125	UG68	x	
	SC-42-SUB	2-4 ft			1/31/2012	1130	UG68	x	
	SC-42-BTMw/WOOD	Bottom with wood			1/31/2012	1135	UP99	x	
SC - 43	SC-42-SRF	0-10 cm	82%	75%	1/31/2012	1000	UG68	x	
	SC-42-SUB	2-4 ft			1/31/2012	1015	UG68	x	
	SC-42-BTM	Bottom of wood			1/31/2012	1020	UG68	x	
SC - 44	SC-42-SRF	0-10 cm	77%	71%	1/31/2012	1250	UG68	x	
	SC-42-SUB	2-4 ft			1/31/2012	1320	UG68	x	
	SC-42-BTMw/WOOD	Bottom with wood			1/31/2012	1330	UP99	x	
SC - 45	SC-45-SRF	0-10 cm	76%	74%	1/27/2012	945	UF98	x	
	NA	2-4 ft							Not Collected, see field notes
	SC-45-BTM	Bottom of wood			1/27/2012	1020	UF98	x	
SC - 46	SC-45-SRF	0-10 cm	81%	79%	1/31/2012	1410	UG68	x	
	NA	2-4 ft							Not Collected, see field notes
	SC-45-BTM	Bottom of wood			1/31/2012	1430	UG68	x	

Table B-1 – Sampling Locations & Analyses

Station	Sample ID	Depth Interval	Field % Recovery	Lab % Recovery	Sample Date	Sample Time	Lab SDG	Dioxin	Notes
SC - 47	SC-47-SRF	0-10 cm	87%	85%	2/1/2012	1000	UG76	x	
	SC-47-BTM	Bottom of wood			2/1/2012	1020	UG76	x	
SC - 48	SC-48-SRF	0-10 cm	86%	68%	1/31/2012	1050	UG68	x	
	SC-48-BTM	Bottom of wood			1/31/2012	1110	UG68	x	
SC - 49	SC-49-SRF	0-10 cm	80%	80%	1/26/2012	1310	UF80	x	
	SC-49-BTM	Bottom of wood			1/26/2012	1350	UF80	x	
SC - 50	SC-50-SRF	0-10 cm	79%	75%	1/25/2012	1115	UF30	x	
	SC-50-WOOD	Bottom with wood			1/25/2012	1126	UP99	x	
SC - 50a	SC-50a-SUB	0-10 cm	79%	72%	1/31/2012	1505	UG68	x	
	SC-50a-BTMw/WOOD	Bottom with wood			1/31/2012	1520	UG68		HOLD, still within wood debris
SC - 51	SC-51-SRF	0-10 cm	74%	74%	1/25/2012	926	UF30	x	
	SC-51-BTM	Bottom of wood			1/25/2012	1020	UF30	x	
SC - 52	SC-52-SRF	0-10 cm	95%	93%	1/30/2012	1400	UP99	x	
	SC-52-BTM	Bottom of wood			1/30/2012	1420	UG30		HOLD, may potentially be analyzed
SC - 53	SC-53-SRF	0-10 cm	92%	92%	1/26/2012	1435	UF80		HOLD, may potentially be analyzed
	SC-53-BTM	Bottom of wood			1/26/2012	1455	UF80		HOLD, may potentially be analyzed
SC - 54	SC-54-SRF	0-10 cm	93%	92%	1/26/2012	1545	UP99	x	
	SC-54-BTM	Bottom of wood			1/26/2012	1600	UF80		HOLD, may potentially be analyzed
SC - 55	SC-55-SRF	0-10 cm	88%	86%	1/27/2012	1345	UP99	x	
	SC-55-BTM	Bottom of wood			1/27/2012	1400	UF98		HOLD, may potentially be analyzed
SC - 56	SC-56-SUBSRF	10-20 cm	68%	67%	1/25/2012	1400	UP99	x	
	SC-56-BTM	Bottom of wood			1/25/2012	1405	UF30		HOLD, may potentially be analyzed
SC - 57	SC-57-SRF	Visual wood	76%	75%	1/25/2012	1413	UF30		HOLD, may potentially be analyzed
SC - 58	SC-58-SRF	0-10 cm	71%	68%	2/1/2012	1046	UG76	x	
	SC-58-BTM	Bottom of wood			2/1/2012	1058	UG76	x	
SC - 59	SC-59-SRF	0-10 cm	93%	93%	1/30/2012	1520	UG30	x	
	SC-59-BTM	Bottom of wood			1/30/2012	1545	UG30	x	
								51	

LABORATORY REPORTS
ANALYTICAL RESOURCES, INC.

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APPENDIX B
ARCHAEOLOGICAL MONITORING AND INADVERTENT DISCOVERY PLAN

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Final

Archaeological Monitoring and Inadvertent Discovery Plan for the Custom Plywood Interim Remedial Action, Phase II Intertidal and Subtidal Zones Skagit County, Washington

Prepared for

Hart Crowser, Inc. and

The Washington State Department of Ecology

Submitted by

HRA
HISTORICAL RESEARCH ASSOCIATES, INC.

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February 14, 2013

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1.0 Introduction

The Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) is conducting remediation activities associated with the former Custom Plywood Mill facility located in Anacortes, Washington (Figure 1). The Area of Potential Effects (APE) includes locations of planned or potential ground disturbance within the intertidal and subtidal zones of the property that are currently owned by GBH Investments, LLC (GBH). These areas are part of a larger Washington State Model Toxics Control Act (Chapter 173-340 WAC) cleanup site that includes aquatic areas to be remediated in the future. Ecology is completing this cleanup as part of an MTCA interim remedial action. The property is located in Section 30 of T35N, Range 2E, and shown on the 1980 U.S.G.S. Anacortes South 7.5-minute quadrangle map.

Dr. James Chatters previously conducted a cultural resources assessment of remediation activities in the APE and filed a report with the State Department of Archaeology and Historic Preservation (DAHP), dated June 18, 2010. He noted an archaeological shell midden that appeared to have been moved out of context and redeposited to the west of the property (Chatters 2010:15). Dr. Chatters also recorded and evaluated the remains of the Custom Plywood Mill (45SK436) and recommended it as not eligible for listing in the National Register of Historic Places. The intertidal area of the property is sensitive for the occurrence of archaeological materials, due to continuity of prehistoric and historic-period use of the area, as well as variations in past sea level. Ground disturbance for planned remediation activities have prompted the development of this Monitoring Plan for the APE.

This Archaeological Monitoring Plan (Monitoring Plan) addresses activities associated with the Phase IIA intertidal remediation component planned for the summer of 2013. The Monitoring Plan will be revised to address future Phase IIA subtidal cleanup. This Monitoring Plan supports an Interim Action Work Plan that also includes Remediation Investigation (RI), Feasibility Study (FS), and Cleanup Action Plan (CAP) documents for the project. The RI, FS, and CAP provide further detail on the site description, history, extent of contamination, planned remedial activities, and schedule.

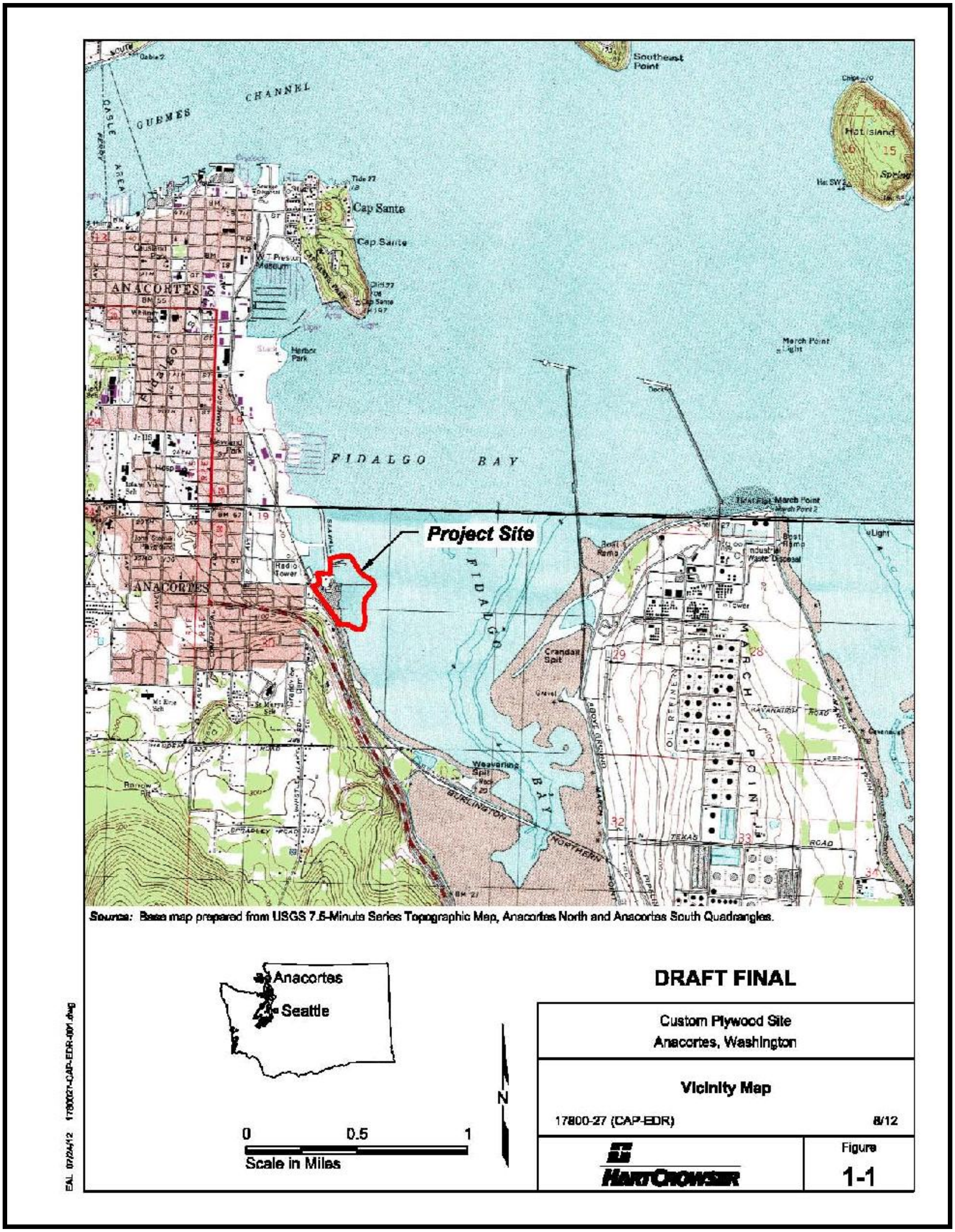

Figure 1. Project location and Area of Potential Effect.

1.1 Project Description

Ground disturbance within the APE will be confined to the intertidal and subtidal portions of the GBH property. The intertidal area is defined as a strip along the site shoreline, which extends approximately 50 feet seaward of the OHW line. The immediate subtidal portion of the property is a low-slope mudflat that contains large amounts of wood debris and sawdust, and is partially covered by overwater structures. The planned cleanup activities for the intertidal and subtidal portions of the Custom Plywood Site are summarized as follows.

- Abandoned in-water concrete structures in the intertidal and subtidal areas will be demolished and disposed of off site. Demolition of structures in the subtidal area is included in the Phase IIA cleanup work because of the cost benefit of completing the work in one contractor mobilization. Near-surface debris generally consisting of concrete, brick, wood, and other materials will be removed from the planned intertidal excavation area where needed to access contaminated sediment. Available site information indicates that it would not be practical or cost-effective to screen the near-surface debris for on-site or off-site recycling. Plans call for shipping debris off site for landfill disposal with contaminated sediment.

- Wooden piles that remain in the intertidal area will be completely extracted or sawed off at the excavation bottom, depending on projected pile lengths and target sediment excavation depths. Along with concrete structure demolition, wood piles will be removed from the subtidal area as part of the Phase IIA cleanup effort. The piles will be disposed of off site at a permitted landfill.

- The intertidal location where the toxic equivalent concentration (TEC) for dioxin exceeds 25 parts per trillion (ppt) will be excavated to native material, assumed to be about 6 feet below grade. Remaining locations will be excavated to a maximum depth of 6 feet where dioxin TEC is greater than 10 ppt and wood waste is greater than 1 foot thick.

- Excavated material from the intertidal area will be dewatered on site in a temporary holding cell before off-site disposal at a Subtitle D landfill facility. Water from the dewatering process will be captured for settling and other treatment as necessary before assumed return discharge to Fidalgo Bay.

- Shoreline protection features will be constructed as part of Phase IIA. These features include 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. In addition, the berm constructed in Phase I to protect the wetland area will be partially breached to connect the wetland area to the bay.

- The interim remedial action will provide shoreline enhancements, which will improve habitat for juvenile salmonids, forage fish spawning, shorebirds and waterfowl, and other aquatic species on and adjacent to the Site.

- Confirmational monitoring consisting of groundwater sampling and analysis will be conducted to assess the long-term effectiveness of the interim cleanup action.

1.2 Monitoring Plan Organization and Intent

This Monitoring Plan provides information on the environmental and cultural context as well as the archaeological potential of the APE (Sections 3.0-5.0). The Monitoring Plan then describes procedures for archaeological monitoring (Section 6.0) and those for treating unanticipated discoveries of archaeological remains (Section 7.0) and human remains (Section 8.0) during ground disturbance. A list of references cited (Section 9), an Archaeological Monitoring Supervisory Plan (Appendix A), and a list of contacts (Appendix B) complete the Monitoring Plan.

This document is intended to:

- Describe planned monitoring and other activities consistent with anticipated forthcoming permit and approval conditions, and other substantive requirements.
- Comply with applicable laws and regulations, particularly 36CFR Part 800 "Protection of Historic Properties," which implements Section 106 of the National Historic Preservation Act of 1966, as amended, and Title 27 Revised Code of Washington, Chapter 27.44 Indian Graves and Records, and Chapter 27.53, Archaeological Sites and Resources.
- Describe to the Samish Indian Tribe, Swinomish Tribal Community, DAHP, and other affected parties and stakeholders planned procedures for archaeological monitoring, and addressing unanticipated discoveries of archaeological resources or human remains.
- Provide direction and guidance to project personnel about the procedures to be followed should the discovery of archaeological resources or human remains occur.

2.0 Area of Impact

The APE consists of the area within which ground disturbance could affect human remains or archaeological remains that are eligible for listing in the National Register of Historic Places, if such remains are present. The APE for the purposes of this plan consists of the intertidal and subtidal areas of the GBH property identified on Figure 1. The upper 6 feet of sediments will be excavated between the Phase I/Phase IIA interface and approximately 50 feet seward of the OHW line. The actual lateral and depth extent of soil disturbance will be determined at the time of the work based on the presence of contamination and other factors.

3.0 Environmental Setting

The potential for the APE to contain archaeological remains depends on its geological setting, its prehistory, and the ethnographic and historic use of the area. This information can reveal the potential types and locations of archaeological remains in the APE. The following sections summarize information that HRA reviewed or developed about the geological setting, prehistory, ethnographic land use, and history of the Custom Plywood site vicinity.

3.1 Geological Setting

The APE is located on the western shore of Fidalgo Bay near the Skagit River Delta in Puget Sound. Late Pleistocene glacial and Holocene processes have been the primary influences on the geological setting of the APE. The Pleistocene glacial retreat freed the area from ice by about 16,000 years Before Present (BP), depositing glacial till and outwash (Boswell et al. 2000, based on Bucknam et al. 1992, Porter and Swanson 1998, and Waitt and Thorson 1982).

As the weight of the ice was removed, the land rebounded rapidly, relative to sea level, across the northern Puget Sound area. Various factors caused submergence and re-emergence of the land until 11,000 BP. Sea level then rose more slowly, until it reached its near modern elevation at about 5,000 BP. Tectonic activity has affected local shorelines in recent times, lifting some and lowering others. The APE is on a narrow shoreline that slopes gently upward towards the west and steeply southward. Archaeological materials are likely along the natural shoreline near the APE. These are most likely to be found at the surface, or just below it in the gently sloping areas, and may have been covered by sediments in the steeper areas.

The saline environment of the Fidalgo Bay inlet formerly contained a diverse population of invertebrates, fish and fowl. Mussels, chitons, clams, crabs and gastropods, as well as surfperch, flatfish and sculpin, are common in the shallower areas. Off shore, salmon, herring and dog fish seasonally inhabit the area. Diving birds are present year round and their population increases during the migration season.

The nearest source of fresh water, prior to Euroamerican settlement, was a small creek located in the northern half of the northwest quarter of Township 35 North, Range 2 East, Section 30 (US Surveyor General 1884). It entered the bay approximately 200 feet north of the property. The stream was covered in the late 1960's (Chatters 2010:5). Shell midden sites are common in such areas.

3.2 Site Fill Soils

Soils within the APE generally consist of fill to approximately 8 to greater than 15 feet below ground surface. Fill soils contain abundant wood waste from historical plywood milling operations along with concrete, brick, and other debris. Wooden pilings and concrete building foundations remain in-place.

4.0 Cultural Setting

The following sections provide a brief overview of the cultural background for the Custom Plywood remediation project vicinity. This information is drawn from HRA's Archaeological Monitoring Report for the Custom Plywood Remediation Project (Compas and Schau 2010).

4.1 Prehistory

Most archaeologists agree that human occupation and use of western Washington has been continuous from approximately 11,500 years ago. The earliest sites consist of lithic scatters, possibly including leaf-shaped projectile points (called Cascade points within Old Cordilleran or Olcott occupations), which may be the remains of broad-spectrum foraging camps or hunting and gathering activity areas. Over time, changing aboriginal technology and site locations suggest increased sedentism and specialization in the use of particular environments and resources (Ames and Maschner 1999; Blukis Onat 1987).

Researchers have created several chronological sequences that describe the timing and nature of cultural change in the Pacific Northwest. Kenneth Ames and Herbert Maschner (1999:66) divide their chronology of prehistoric occupation into five developmental periods: Paleo-Indian, Archaic, Early Pacific, Middle Pacific, and Late Pacific. They suggest a gradual shift from small nomadic groups relying on generalized hunting and gathering to larger sedentary groups with increasing social complexity and specialized reliance on marine and riverine resources.

In the Anacortes region, Late Prehistoric people focused on salmon, which they trolled for in spring, reef-netted in summer, and trapped at river weirs in fall. They also used other finfish; shellfish; plants, such as camas and berries; waterfowl; and land and sea mammals. Large midden sites represent winter villages and smaller sites resulted from camping and resource processing. Several archaeological midden sites have been recorded within an approximate 2 mile (3.2 kilometer) radius of the APE, including shell midden sites 45SK13 at the Guemes Island ferry dock (Bryan 1953); 45SK42, located just over 2 miles (3.2 kilometers) southeast (Blukis Onat 1981; Bryan 1954a); 45SK43, located approximately 1.5 to 2 miles (2.4 to 3.2 kilometers) southeast (Bryan 1954b; Moura 2003; Schalk 2004; Trost 2005); 45SK44, located just over 2 miles (3.2 kilometers) southeast (Bryan 1954c; Conca 1985); and 45SK294, located around 0.75 mile (1.2 kilometers) southwest (Barsh 2003). Midden site 45SK299 was recorded in the vicinity of the Anacortes Ferry terminal on the western side of Anacortes, approximately 3.1 miles (5 kilometers) from the former Custom Plywood facility (Robinson 1996). Dates from some of these sites indicate that this specialized native subsistence economy had been established for about 1,500 years by the time of initial Euro-American contact in the 18th and 19th centuries.

4.2 Ethnographic Land Use

The APE is located within the traditional territory of the Samish Indians, which included the northern part of Fidalgo Island, Samish Island, and the eastern San Juan Islands (Suttles 1974:97; Suttles and Lane 1990). Swinomish territory is located to the south and east of the Samish, and the two groups have close economic, social, and historical ties.

The Samish ranged widely in canoes to fish, gather, and hunt for a variety of resources. Their subsistence activities included fishing for sockeye, spring, silver, and dog salmon, as well as herring and halibut; collecting horse and other clams and oysters; digging camas; and hunting deer, ducks, and seal.

Suttles (1974:97) shows the location of a Samish winter village to the west of the APE. The original village was located on Guemes Island, on the northern shore of Guemes Channel, west of the ferry landing. In 1792, Spanish explorers reported two large houses standing on the northwest point of the channel. Conditions became crowded there, and some of the people moved across the channel to a village called “ironwoods,” or *Ke-LEH-tsilch* in the Straits Salish language, on the northern shore of Fidalgo Island. Another village, called "camas", or *Quh-hwulh-AW'k-awl*, was located at the eastern end of the railroad bridge across Fidalgo Bay, at the place that later became the town of Fidalgo. Although the Samish abandoned that village in the 19th century, they continued camping there when gathering camas on the prairie around the head of the bay (Suttles 1974:99). Swanton (1984:437) lists a Samish village named *Hwaibathl* at Anacortes, but this location does not match the far more detailed information that Suttles reported.

The Samish used seasonal camps in various areas, including the eastern shore of Fidalgo Bay and southeast of Fidalgo Head (Suttles 1974:97). In spring and early summer, they trolled for salmon in San Juan Channel, located between San Juan Island and Shaw/Orcas Islands, and around Cattle Point, located at the southern end of San Juan Island (Suttles 1974:190-191).

The geographer T. T. Waterman noted several ethnographic place-names in the vicinity of the APE, including *K!aix* for "a promontory at the town of Anacortes" (Cap Sante) and *d¢¨al▯*, "enclosed water," for Fidalgo Bay (Hilbert et al. 2001:349, 354; Waterman circa 1920).

4.3 Historic Period

4.3.1 Anacortes Area Development

This section summarizes historical development of the Anacortes area as general background for Monitoring Plan. A group of local residents and speculators, including Hazard Stevens, son of the former Territorial Governor, and other members of the Stevens family, bought or claimed land between Ship Harbor and the present day Anacortes in 1870. At this time, the Northern Pacific Railroad was still considering the location for their Puget Sound terminus. After the economic downturn of the 1870s and the choice of Tacoma as the railroad terminus, these investors sold their land (Boswell et al. 2000). The 1872 General Land Office mapped the Project area shoreline as part of Township 35N Range 2E.

In 1876, Amos and Annie Bowman bought waterfront land from a member of the Stevens family and built a cabin near the modern intersection of 3rd Avenue and Q Avenue (Bowman 1890). Amos named the fledgling settlement that grew there after his wife Annie, or Anna, Curtis Bowman, in 1879, when he opened the first post office and store on the wharf he completed that same year (Bourasaw 2006). Amos was a civil and mining engineer and, with his wife and sons, ran their store in Anacortes. The sale of timber to Tacoma mills was one of the first sources of income for the settlement (Bowman 1890). On the 1880 census, most of the residents listed occupations, such as farmer, miner, and carpenter. The two census precincts enumerated that year on Fidalgo included 290 people (U.S. Census 1880).

The Oregon Improvement Company (OIC) began construction of the Seattle & Western Railroad in 1888, laying tracks between Anacortes and Sedro by the end of 1890 (Armbruster 1999:190; Bowman 1890). This stimulated the growth of Anacortes, leading to the platting of the town in 1889. According to the Sanborn maps (1892-1950) the northern end of Anacortes was platted and developed first. The OIC constructed what became known as Ocean Dock at the end of P Avenue, now Commercial Avenue (Sanborn 1890). By 1892, the Union Wharf Company Dock replaced an old wharf, probably Bowman's wharf, at the end of Q Avenue. The Anacortes Saw Mill dock, at the foot of T Avenue, first appears by this time as well (Sanborn 1892).

Despite succeeding in laying track as far as Sedro, the OIC was unable to secure enough business for the Seattle & Western to operate profitably. Economic difficulties forced them to lease the line to the Northern Pacific, beginning in 1890 (Armbruster 1999:148). Regardless of the railroad's difficulties, the town of Anacortes grew. The 1897 Sanborn map is the first one to show the railroad connecting to Ocean Dock. The map also indicates an enlarged and expanded Ocean Dock, with a coal platform and railroad office providing connections to the mainland (Sanborn 1897). Grain warehouses were located on both Ocean Dock and Union Wharf. The land in the vicinity of the former Custom Plywood facility had not been platted in 1897, although the Skagit saw mill was on the shore of Fidalgo Bay, west of the end of 15th Street, about 1 mile to the north of the APE.

Gradually the town expanded, and the Skagit Saw Mill had changed hands by 1905. It was renamed the Rodgers Saw Mill and Box Factory. The Baty Shingle Mill and Burpy Brothers Shingle Mill were located near the foot of 17th Street. A spur of the Northern Pacific was constructed from 22nd Street northward along R Avenue (Sanborn 1905).

By 1907, the Sanborn maps show the town as being platted southward to 30th Street. Four more shingle mills had developed along Fidalgo Bay. The Vincent Owens and Burke Shingle Mills were at the foot of 25th Street, while the J.H. Cavanaugh Shingle Mill was located on the shore between 27th and 28th Street. The Bernard Shingle Mills was on the shore between 28th and 29th Street.

4.3.2 Custom Plywood Mill Facility

Research for the Custom Plywood Factory, conducted by Chatters (2010), indicated that the site of the facility was "originally a saw and planing mill operated by Fidalgo Mill Company after 1907 until it burned down sometime after 1925 and prior to 1937" (Chatters 2010:PG 10). The land was acquired by Bill Morrison in 1913, who sold it to the Anacortes Plywood Company circa 1937. The company reorganized in 1939 as the Anacortes Veneer Company and was sold to Publisher's Forest Products in 1969. The company eventually failed, as the local timber supplies decreased. In 1984, Anacortes Plywood assumed control. In 1991, Custom Plywood took over after bankruptcy proceedings and was in operation until 1992. A fire consumed many of the wooden structures on the property that same year.

The main portion of the property has remained unused since 1992; however, Anacortes Joint Venture gained ownership of the mill in 1999 and sold it to Concorde, Inc in 2006. The plant was sold again to GBH, who owns parcels P33196, P33198, P33199, P33208, P33209, and P33210.

Other portions of the property were sold to various owners after the 1992 fire, including Northern Marine and Cimarron Trucking. For further information about the plant, see Chatters' 2010 report.

5.0 Reported and Anticipated Archaeological Remains

The following sections discuss the background research and its findings, including previous cultural resources within the vicinity of the APE, recorded archaeological sites, and historical buildings and structures. The section ends with a description of the types of archaeological resources that could be expected during ground disturbance for component of remediation for the Custom Plywood site.

5.1 Previous Cultural Resources Studies

Two cultural resources surveys have been conducted in the vicinity of the APE (Table 1). During these previous studies, two historic sites were recorded – one adjacent to the APE, and one within the APE. One Pre-Contact site was also noted, but is located outside of the APE.

Table 1. Previous Cultural Resources Studies Within the APE Vicinity.

Author(s)	Date	Title	Cultural Resource Identified	Eligibility Status*
Hodges, Charles M.	2003	*A Cultural Resources Reconnaissance for the Thompson Trail Project, Phase 2, City of Anacortes*	45SK43 – shell midden, not located within APE vicinity; 45SK296 – railroad grade located adjacent to APE	Not Yet Evaluated
Chatters, James	2010	*Archaeological Monitoring of Remedial Investigation Activities at Former Custom Plywood Mill*	45SK436 – historic Custom Plywood Mill, within APE Out of Context Shell Midden	Evaluated, Formal determination of eligibility is pending DAHP review. Noted, not recorded because it was out of context

*National Register of Historic Places and Washington Heritage Register

Site 45SK296 is a BNSF railroad grade that runs along the Tommy Thompson Trail, along the west edge of the APR. The majority of the ties and rail that ran along the APE area were previously removed, but a short section of railway spur and the manual spur switch remain just south of the APE area (Hodges 2003).

Site 45SK436 is the Custom Plywood Mill site. Recorded features located within the APE area include 4 unidentified concrete foundations, 3 press pits, and historic debris. The site was inventoried and evaluated in 2010 by Chatters, who recommended the site as ineligible for listing on the National Register of Historic Places (Chatters 2010). DAHP concurred with this finding in 2011.

Chatters (2010:15) noted shell midden soils in a bore west of the current APE. According to Chatters (2010:15), midden appeared to have been moved from another area and had been redeposited, so he did not record it as an archaeological site.

5.2 Expectations for Archaeological Deposits in the APE

Although intensive development and filling of the historical shoreline since the 1890s (see Section 4.3) could have destroyed or disturbed prehistoric, historical Native American, and Euro-American archaeological resources, it is possible that the APE could contain archaeological deposits. The APE location near the shallow tidelands near the shoreline of Fidalgo Bay suggests that prehistoric archaeological materials associated with occupation, shellfish gathering, fishing, and other activities could be present beneath historical fill. Artifacts could include remains that had been dumped onto the site as fill, such as lithic, bone, and shell artifacts, as well as the food and technological materials from plants and animals. Remains also could contain preserved wood and plant fiber artifacts. Human remains and burials, which were typically placed in upland areas, may be expected within the APE. Soil borings just west of the APE, conducted west of the Tommy Thompson Trail during monitoring in 2009, indicate the possibility of a shell midden nearby, but outside of the APE boundary (Chatters 2009).

Artifacts and features also could result from historical activities, which largely would consist of filling the APE as well as building and use of the saw, lumber, and pulp mill complexes, circa 1892-1990s (see Section 4.3). Artifacts or features related to railroad lines associated with the mill may also be encountered. The mill complex is well represented in documentary sources and the activities carried out there were common to the region. Unless remains related to Native American, Asian American, or female workers are located, the historic-period archaeological deposits are not anticipated to be historically significant.

6.0 Procedures for Archaeological Monitoring and the Treatment of Archaeological Resources

1. Archaeological monitoring will take place in the APE during ground disturbing activities.
2. Ecology will arrange for a professional Archaeologist who meets the Secretary of the Interior's qualifications (36 CFR Part 61; required by the State of Washington in RCW 27.53.030.8) to provide oversight for all cultural resources related activities on the site. If an archaeologist meeting the qualifications is not available but an experienced

archaeologist (e.g., one with 5 or more years of experience in a variety of archaeological field situations) is available to monitor construction activities, they will be allowed to do so given that a "Supervisory Plan for Archaeological Monitoring" has been filed with DAHP prior to their work at the site. The form is located in Appendix A. The Archaeologist may be on-site to observe soil disturbing activities, or shall be available on an on-call basis.

3. For those areas requiring monitoring and associated with contaminated soils, all field personnel including the Archaeologist shall be 40-hour Hazardous Work Operations and Emergency Responses (HAZWOPER) certified in accordance with Occupation Health and Safety Administration standards (OSHA 29 CFR, 1910.120).

4. Ecology's on-site representative will brief the Archaeologist on the Health and Safety Plan elements under which the Archaeologist will perform the monitoring, when present. The Archaeologist will provide the proper Personal Protective Equipment (e.g., hard hat, steel-toed shoes, safety glasses) as required by the Project Health and Safety Plan.

5. Ecology will arrange for the Archaeologist to train site personnel including Ecology's on-site representative and construction staff on the basics of artifact identification and the appropriate procedures to follow in the event of encountering archaeological deposits and human remains. Prior to conducting onsite training, the Archaeologist will contact the Tribes to ask if they have concerns or information they would like to have included in the training. The Archaeologist will arrange for Tribes to take part in the training upon their request. The training will be held before ground-disturbance activities in APE commences. In each week's Construction Safety Meeting during these ground-disturbance activities, Ecology's on-site representative and the Construction Supervisor will emphasize the need for vigilance regarding the unanticipated discovery of archaeological deposits and human remains, and the procedures for treating unanticipated discoveries.

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7.0 Procedures in the Event of Discovery of Archaeological Remains

If the Archaeologist or a member of the construction work force believes that they have encountered prehistoric or important historic-period archaeological materials (including, but not limited to, remains that had been dumped into the shallow intertidal waters of the bay, which may include lithic, bone, and shell artifacts, as well as the food and technological materials from plants and animals; the remains of stone or wood fish weir structures; or historic-period materials that appear to be associated with Chinese, Japanese, Philippine, Native American, and/or female workers), the Archaeologist or Ecology's on-site representative will direct the Construction Supervisor to stop excavation work in the immediate area. If the Archaeologist is not present at the time of discovery, Ecology's on-site representative will be responsible for stopping excavation work and immediately contacting the Archaeologist.

If the Archaeologist believes that the discovery is a significant archaeological resource (i.e., intact enough to warrant further investigation and potential testing for NRHP eligibility), Ecology's on-site representative will direct the contractor to take appropriate steps to protect the discovery site by installing a physical barrier (i.e., exclusionary fencing) and prohibiting machinery, other vehicles, and unauthorized individuals from crossing the barrier. If the discovery appears to be potentially eligible for listing in the NRHP, the Archaeologist will inform Ecology, who will then immediately contact the affected Tribes, DAHP, and other affected parties. Treatment measures may include mapping, photography, limited probing and sample collection, or other activities as determined by the Ecology in consultation with the affected Tribes, DAHP, and other affected parties. Ecology will then authorize excavation in the area of the discovery after it has been evaluated and treated.

If the monitoring of ground-disturbing activities results in the collection of any artifacts or samples, such as an isolated find not associated with a larger archaeological site, the Archaeologist will be responsible for temporary curation of the artifacts (including appropriate, secure storage). In the case of an isolated find, construction excavation will likely not halt for more than the several minutes that the Archaeologist will require for photography and recording details of the location (e.g., depth below the ground surface, sedimentary context) and other pertinent information about the object. Construction excavation may resume in the area when the Archaeologist has notified Ecology's on-site representative.

When monitoring work has been completed, the Archaeologist will prepare a report discussing the methods and results of the work. The report will be provided to Ecology for review. Ecology may provide review comments and HRA will complete a final version of the report responding to any comments. Ecology will file and distribute the report to the affected Tribes, DAHP, and other affected parties.

After monitoring has been completed, consultation among the interested and involved parties will determine the disposition of any artifacts or other cultural material collected. If monitoring reveals human remains, the procedures listed in Section 8 will be followed.

8.0 Procedures in the Event of Discovery of Human Remains

Any human remains that are discovered during construction will be treated with dignity and respect. The affected Native American Tribes are the Samish and Swinomish Tribes with regard to this issue.

If ground disturbing activities encounter human skeletal remains during the course of construction, then all activity that may cause further disturbance to those remains **must** cease, and the area of the find must be secured and protected from further disturbance. In addition, the finding of human skeletal remains **must** be reported to the county coroner **and** local law enforcement in the most expeditious manner possible. The remains should not be touched, moved, or further disturbed.

The county coroner will assume jurisdiction over the human skeletal remains and make a determination of whether those remains are forensic or non-forensic. If the county coroner determines the remains are non-forensic, they will report that finding to the DAHP, who will then take jurisdiction over those remains and report them to the appropriate cemeteries and affected tribes. The State Physical Anthropologist will make a determination of whether the remains are Indian or Non-Indian and report that finding to any appropriate cemeteries and the affected tribes. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

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Appendix A

Example Supervisory Plan for Archaeological Monitoring

Supervisory Plan for Archaeological Monitoring

Project: **Custom Plywood Interim Remedial Action, Phase II Intertidal and Subtidal Areas**

Location: **Anacortes, Skagit County, Washington**

Monitoring Plan: Attachment A (not included herein)

Name of Archaeological Monitor: Name

Monitor's Resume Attachment B (not included herein)

Summary of Monitor's Qualifications:

• At least 5 years of archaeological field experience:	☒ Yes	☐ No
• Experience in archaeological excavation:	☒ Yes	☐ No
• Experience with historical and prehistoric archaeological artifacts and deposits that could be found at the monitoring location:	☒ Yes	☐ No
• Experience in archaeological monitoring: (or an HRA onsite supervisor will be present during first monitoring project)	☒ Yes	☐ No

Professional Archaeologist(s) who will serve as Monitoring Supervisor(s):

Name, Degree	**Position**
Lynn Compas, M.A.	HRA Associate Archaeologist
Jennifer Gilpin, M.A.	HRA Project Archaeologist
Jenny Dellert, M.A.	HRA Research Archaeologist

Supervisory Requirements:

- Monitor will have a cell phone and a digital camera.
- Supervisor will visit the project site at the beginning of the work, if the monitor has not worked at the location previously. Supervisor will visit the project site periodically if the monitoring work continues longer than two full-time weeks. Supervisor will visit the project site if a find is made that needs immediate attention.
- Monitor will record daily notes on HRA's standard monitoring form (Attachment C). Monitor will take at least one photograph daily to record the work progress.
- Monitor will telephone Monitoring Supervisor daily to describe construction work, monitoring methods, and findings, and to discuss any questions.
- Monitor will send electronic photographs of any finds of artifacts or deposits to supervisor for discussion of treatment measures and decisions. The Supervisor will be available to visit site on short notice to view finds that are questionable and/or need immediate attention.
- Monitor will submit written notes weekly for Supervisor's review.
- Supervisor will review written notes at least weekly and during site visits, and will sign each monitoring record form.

Appendix B
List of Contacts

List of Contacts

Washington State Department of Ecology (Ecology)

Hun Seak Park, Project Manager
360-407-7189 office
360-584-5045 cell
hpar461@ecy.wa.gov

Sandra Caldwell, Bay-Wide Coordinator
360-401-7209 office
saca461@ecy.wa.gov

City of Anacortes Police Department (APD)

Bonnie Bowers, Chief of Police
360-293-4684

Skagit County Coroner

Daniel Dempsey
360-336-9431

Archaeological Consultant

Historical Research Associates, Inc. (HRA).
Gail Thompson
206-343-0226 (Ext. 15)
206-898-5692 cell

Samish Indian Nation

P.O. Box 217
2918 Commercial Avenue
Anacortes, WA 98221
Phone (360) 293-6404
samishtribe@samishtribe.nsn.us

Tom Wooten, Tribal Chairman
(360) 293-6404

Christine Woodward, Director, Samish Indian Nation Department of Natural Resources
(360) 293-6404, ext. 205

Swinomish Indian Tribal Community

PO Box 817
11404 Moorage Way
Laconner, WA 98257
(360) 466-3163

Brian Cladoosby, Tribal Senate Chairman
(360) 466-3163

Kevin Hall, Cultural Committee Chairman
(360) 540-3906

Charlie O'Hara, Director of Planning
(360) 466-7280

Washington State Department of Archaeology and Historic Preservation (DAHP)

State Archaeologist
Dr. Rob Whitlam
PO Box 48343
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State Physical Anthropologist
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Guy.tasa@dahp.wa.gov

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Appendix C
HRA Standard Monitoring Form

Recorder's Name and Signature of Primary Monitor	
Date and Hours on Site/ Travel Time	
Safety Meeting Yes / No – issues discussed	
Site Location/ Weather Conditions Area Description	
Site Description Describe environment, subdivision, road grade and also archaeological and/or historical context	
Nature of Construction Activity, Skidding, grubbing, scraping, excavating	
Remedial Activities Nature of removals and where taken to, if any	
Equipment working on Site Types and number of machines	
Workers Present Names and Companies	
Visitors On Site Names and Companies	
Arch Monitoring Activities Describe in full if equipment was stopped or asked to move	
Distance and Direction of nearby Recorded Archaeological Sites	
Archaeological Findings Include significant findings, soil descriptions, level of disturbance, description of debris not considered significant	
Notes on Discussions with others HRA, other contractors, Tribes	

APPENDIX C
30 PERCENT DESIGN DRAWINGS FOR PHASE II INTERIM INTERTIDAL AND SELECTED SUBTIDAL REMEDIAL ACTION

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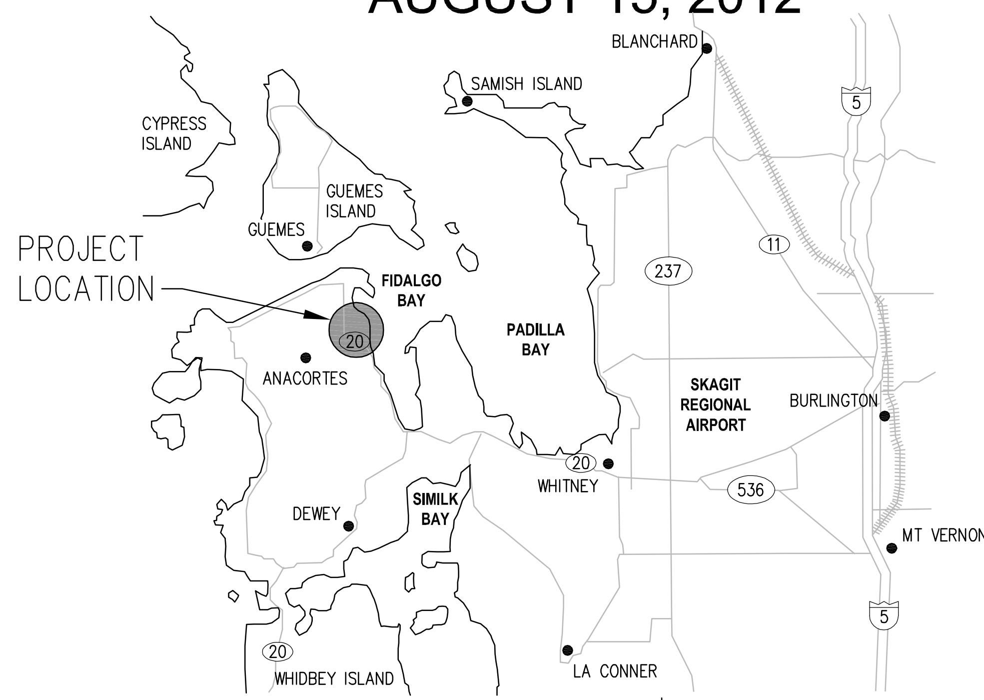
CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION

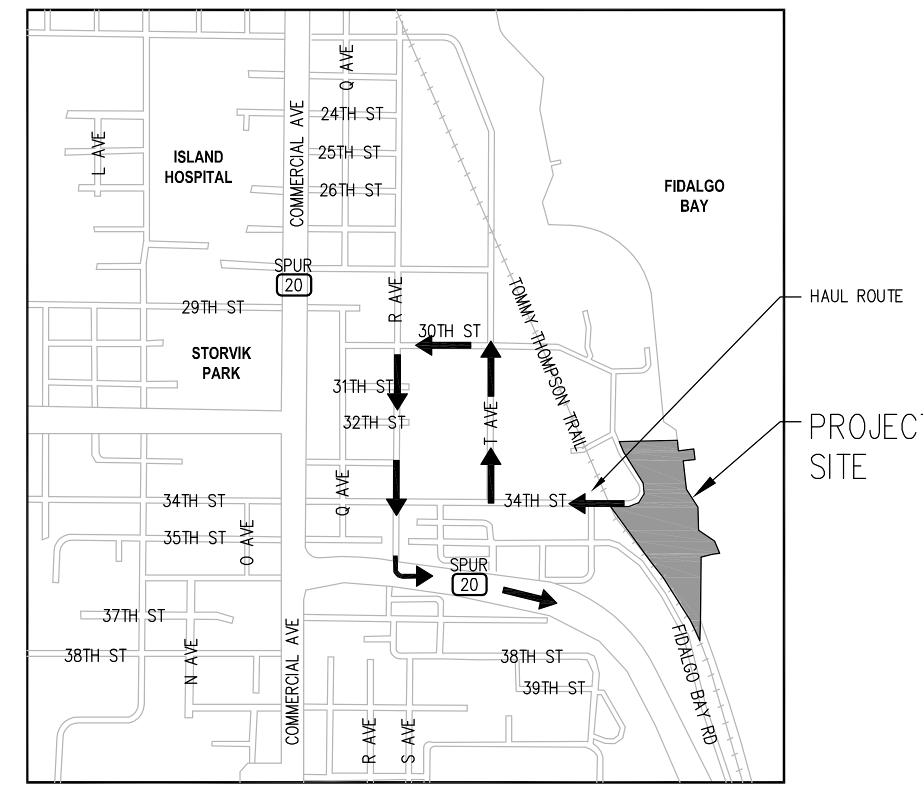
ANACORTES, WASHINGTON

30% CONCEPTUAL DESIGN

AUGUST 15, 2012



SITE MAP



VICINITY MAP

SHEET INDEX

G1.0	COVER SHEET AND INDEX
G1.1	SITE PLAN
G1.2	EXCAVATION AND DREDGING SITE PLAN
G1.3	EXISTING CONDITIONS PLAN
G1.4	SITE ACCESS PLAN
G1.5	PREVIOUS PHASE I UPLAND REMEDIAL EXCAVATION (AS-BUILT)
C1.0	TEMPORARY EROSION AND SEDIMENTATION CONTROL PLAN
C1.1	TEMPORARY EROSION AND SEDIMENTATION CONTROL DETAILS
C2.0	DEMOLITION KEY PLAN
C2.1	DEMOLITION PLAN
C2.2	DEMOLITION PLAN
C2.3	DEMOLITION PLAN
C2.4	DEMOLITION PLAN
C2.5	DEMOLITION PHOTOS
C3.0	EXCAVATION AND DREDGING KEY PLAN
C3.1	EXCAVATION AND DREDGING PLAN
C3.2	EXCAVATION AND DREDGING PLAN
C3.3	EXCAVATION AND DREDGING PLAN
C3.4	TYPICAL EXCAVATION AND DREDGING SECTIONS
C4.0	BERM BREACH AND SHORELINE GRADING PLAN AND SECTIONS
C5.0	SPIT CONSTRUCTION PLAN
C5.1	SPIT SECTION
C6.0	JETTY EXTENSION PLAN
C6.1	JETTY SECTIONS
C7.0	BULKHEAD HABITAT GRADING PLAN AND SECTION

SURVEY NOTES:

1. ELEVATIONS SHOWN IN THESE PLANS ARE PROVIDED IN NAVD88 UNLESS NOTED OTHERWISE. SEE NOTES BELOW FOR SOURCE OF SURVEY DATA SHOWN:

   UPLAND SURVEY SHOWN ON THESE DRAWINGS FROM PACIFIC SURVEY AND ENGINEERING, INC DATED 15 NOV 2011. THIS SURVEY WAS THE FINAL AS-BUILT SURVEY FROM THE PHASE I - UPLAND REMEDIATION CONSTRUCTION ACTIVITIES. THIS SURVEY GENERALLY INCLUDES UPLAND AREA ABOVE OHW.

   VERTICAL DATUM: NAVD88 FT
   HORIZONTAL DATUM: NAD83/91

   SURVEY SHOWN BETWEEN THE PHASE I UPLAND EXCAVATION AND THE MLLW LINE FROM SCHEMMER JOHNSTON ENGINEERING DATED APRIL 2009 PER AMEC GEOMATRIX REMEDIAL INVESTIGATION FIGURE 34 (PROVIDED BY DEPARTMENT OF ECOLOGY).

   VERTICAL DATUM: NAVD88 FT
   HORIZONTAL DATUM: NAD83

   BATHYMETRY SHOWN ON THESE DRAWINGS (BELOW MLLW) FROM CRA NORTHWEST DATED JANUARY 2006 PER AMEC GEOMATRIX REMEDIAL EXCAVATION FIGURE 11 (PROVIDED BY DEPARTMENT OF ECOLOGY).

   VERTICAL DATUM: MLLW FT (SEE NOTE 2)
   HORIZONTAL DATUM: NAD83/91 (ASSUMED)

2. NOTE THAT FIGURES IN ENVIRONMENTAL REPORTS (PROVIDED IN APPENDIX) ARE OFTEN SHOWN IN BOTH DATUMS. WHEN CONVERTING FROM NAVD88 TO MLLW DATUM, ADD 0.65 FEET. SEE TIDAL INFORMATION ON THIS DRAWING FOR SAMPLE CONVERSIONS.

TIDAL INFORMATION:

TIDAL DATUM PLANE-ANACORTES, GUEMES CHANNEL, SKAGIT COUNTY
(FROM WASHINGTON DEPARTMENT OF ECOLOGY)

	MLLW DATUM	NAVD88 DATUM (USED FOR THESE DRAWINGS)
HIGHEST RECORDED TIDE: ESTIMATED (EHW)	11.00 FT.	
MEAN HIGHER HIGH WATER: (MHHW)	8.20 FT.	MHHW = 7.55 FT.
MEAN HIGH WATER: (MHW)	7.40 FT.	
MEAN (HALF) TIDE LEVEL: (MTL)	5.00 FT.	
MEAN SEA LEVEL: (MSL)	4.42 FT.	
MEAN LOW WATER: (MLW)	2.60 FT.	
MEAN LOWER LOW WATER: (MLLW)	0.00 FT.	MLLW = -0.65 FT.
LOWEST RECORDED TIDE: (ELW)	-4.50 FT.	

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DEPARTMENT OF ECOLOGY
State of Washington

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

COVER SHEET AND INDEX

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	G1.0
SHEET NO.	X OF X

30% CONCEPTUAL DESIGN

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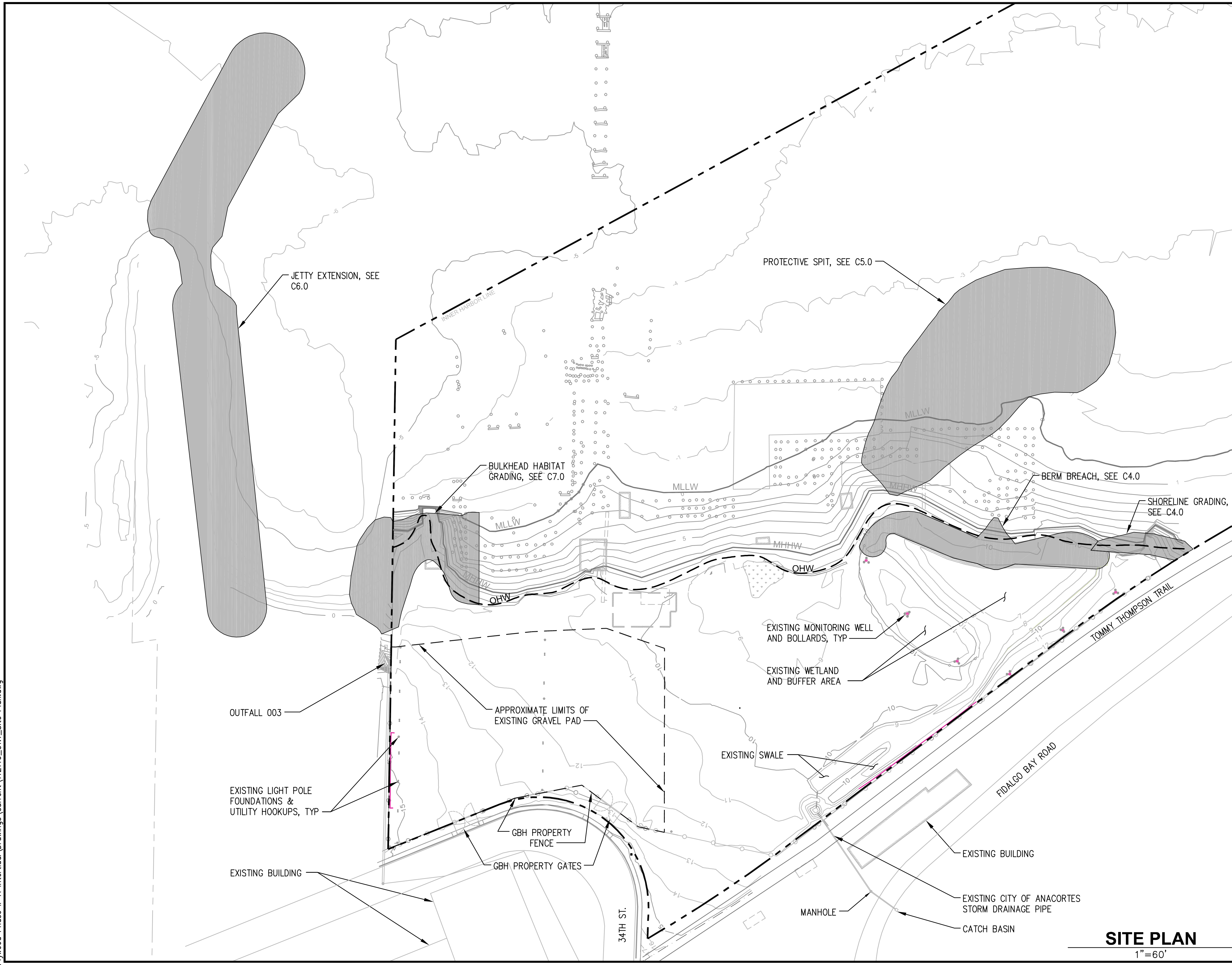

SITE PLAN
1"=60'

NOTES:

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

LEGEND:

- PROPERTY LINE
- OHW — ORDINARY HIGH WATER
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
- MLLW — MEAN LOWER LOW WATER (EL −0.65')
- FENCE
- STORM DRAIN LINE
- MONITORING WELL AND BOLLARDS

N

60' 0 60' 120'

SCALE: 1"=60'

Plotted: Aug 08, 2012 – 1:57pm cmathews Layout: G1.1
M:\2012\112110.1 Custom Plywood Phase II–A Intertidal\Drawings\Current\112110_G1.1_Site Plan.dwg

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CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

SITE PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	G1.1
SHEET NO.	X OF X

30% CONCEPTUAL DESIGN

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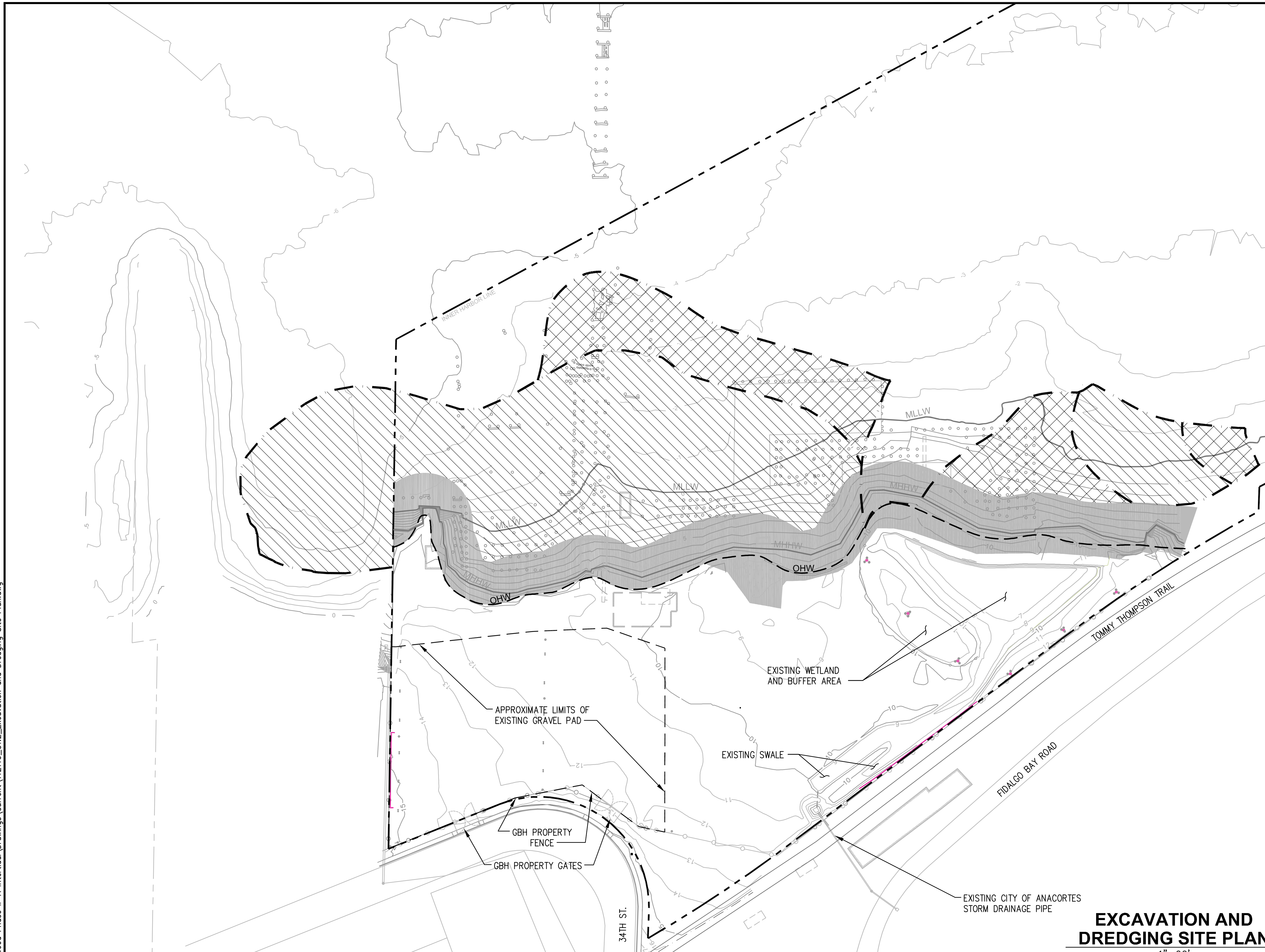

NOTES:

1. THIS PLAN IS INTENDED TO IDENTIFY THE GENERAL REMEDIAL EXCAVATION AND DREDGING LIMITS. SEE SHEET C3.0 FOR EXCAVATION AND DREDGING DETAILS.

LEGEND:

- DREDGING LIMITS
- PROPERTY LINE
- OHW — ORDINARY HIGH WATER
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
- MLLW — MEAN LOWER LOW WATER (EL −0.65')
- FENCE
- STORM DRAIN LINE
- MONITORING WELL AND BOLLARDS
- INTERTIDAL SHORELINE EXCAVATION AREA
- DREDGE TO 2 FEET BELOW EXISTING SURFACE WHERE WOOD WASTE > 1 FOOT THICK.
- DREDGE TO CONTACT WITH NATIVE SEDIMENT WHERE DIOXIN TEC > 25 ppt.

N

60' 0 60' 120'

SCALE: 1"=60'

EXCAVATION AND DREDGING SITE PLAN

1"=60'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 1:57pm cmathews Layout: G1.2
M:\2012\112110.1 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_G1.2_Excavation and Dredging Site Plan.dwg

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CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION

ANACORTES, WASHINGTON

EXCAVATION AND DREDGING SITE PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	G1.2
SHEET NO.	X OF X

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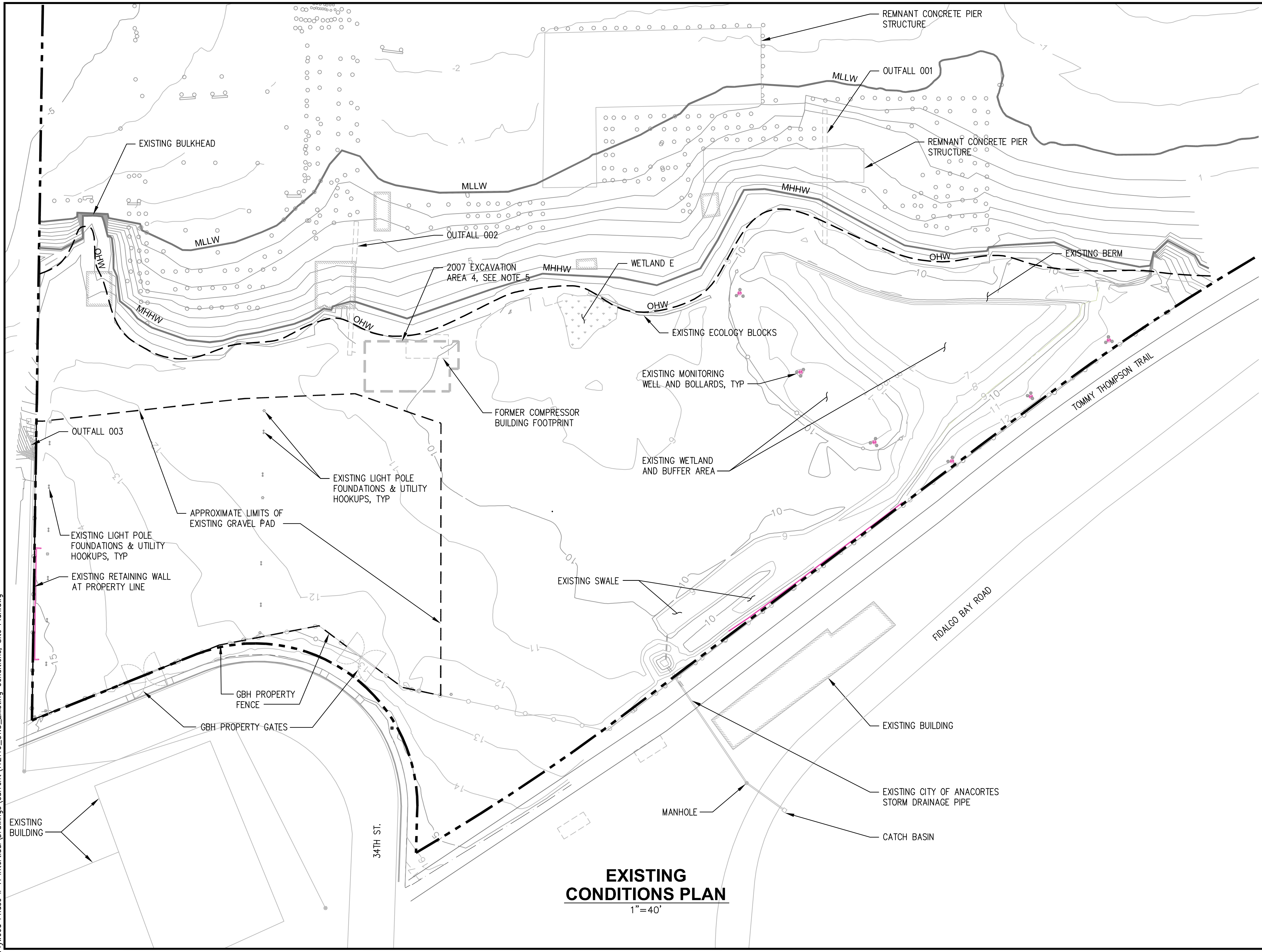

EXISTING CONDITIONS PLAN

1"=40'

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. WORK LIMITS FOR THIS PROJECT ARE AS SHOWN ON DRAWING G1.1. GENERALLY ALL INTERTIDAL SHORELINE EXCAVATION WILL OCCUR BELOW THE ORDINARY HIGH WATER (OHW) WITH ADDITIONAL DREDGING REQUIRED BEYOND IN AREAS..
3. OHW LINE AND MLLW LINE SHOWN ARE APPROXIMATE. SEE DRAWING C1.0 FOR 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.

LEGEND:

- PROPERTY LINE
- OHW — ORDINARY HIGH WATER (SEE NOTE 6)
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
- MLLW — MEAN LOWER LOW WATER (EL –0.65')
- 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

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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

EXISTING CONDITIONS PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	G1.3
SHEET NO.	X OF X

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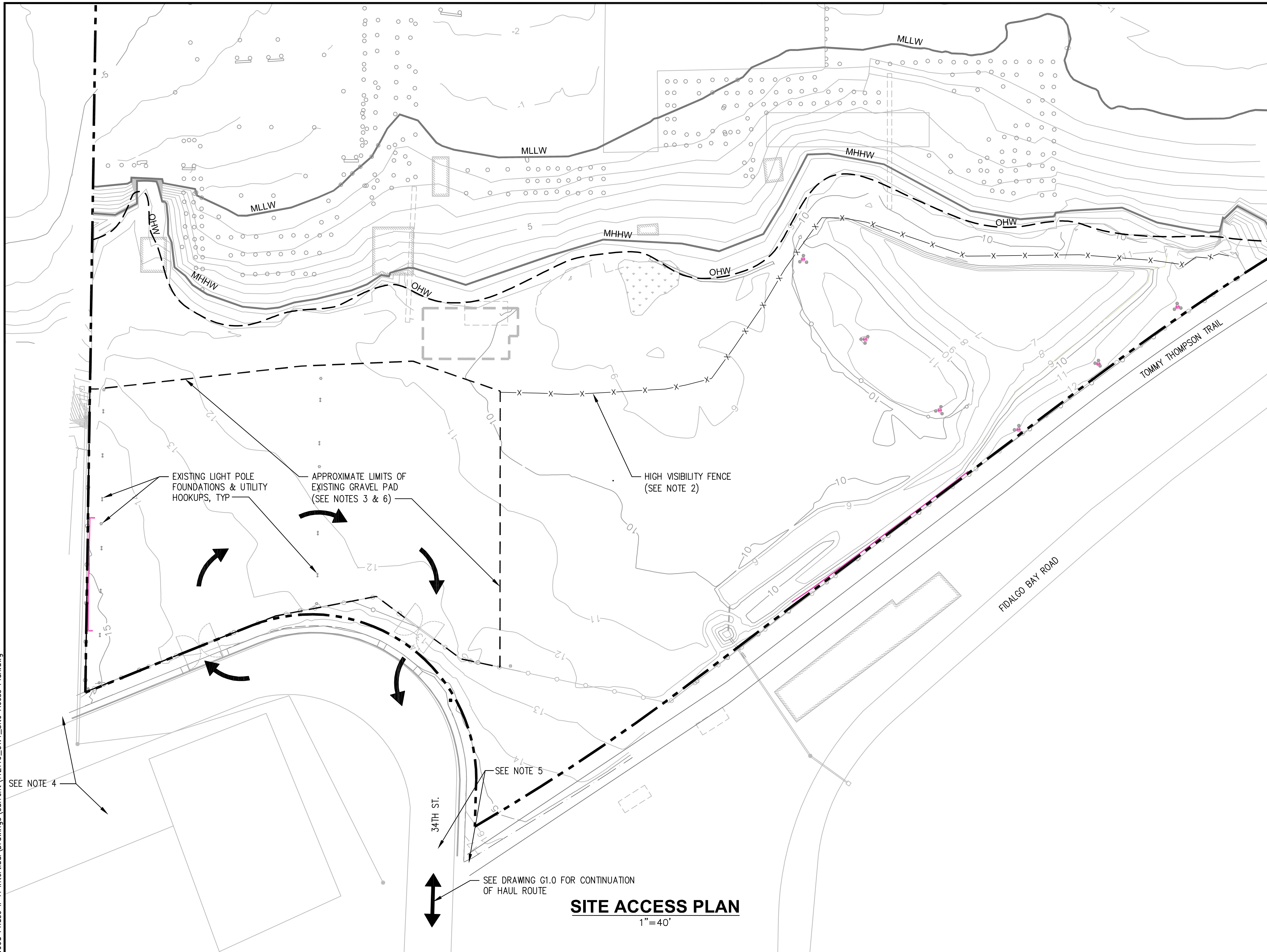

SITE ACCESS PLAN

1"=40'

NOTES:

1. THE ORDINARY HIGH WATER (OHW) LINE SHOWN IS APPROXIMATE.
2. THE CONTRACTOR SHALL INSTALL HIGH VISIBILITY FENCE AS SHOWN ON C1.0. THE CONTRACTOR SHALL HAVE ACCESS TO ALL AREAS WATERWARD OF THIS FENCE. NO WORK SHALL OCCUR LANDSIDE OF THIS FENCE UNLESS REQUIRED BY THESE DRAWINGS OR SPECIFICATIONS OR AS DIRECTED BY ECOLOGY OR ECOLOGY'S REPRESENTATIVE.
3. CONTRACTOR SHALL STOCKPILE AND STAGE ALL EQUIPMENT, SUPPLIES AND MATERIALS WITHIN THE WORK LIMITS SHOWN. CONTRACTOR SHALL COORDINATE TRUCK TRAFFIC ROUTING WITHIN THE SITE WITH STOCKPILE AND EXCAVATION LOCATIONS DURING ALL STAGES OF CONSTRUCTION.
4. SEE SPECIFICATIONS FOR TRAFFIC CONTROL REQUIREMENTS. THE CONTRACTOR SHALL MAINTAIN ACCESS AND NOT RESTRICT TRAFFIC/OPERATIONS OF ADJACENT BUSINESSES. SEE SPECIFICATIONS FOR STREET USE REQUIREMENTS.
5. TRUCK TRAFFIC TO AND FROM THE SITE WILL CROSS THE TOMMY THOMPSON TRAIL. CONTRACTOR SHALL TAKE PRECAUTIONS TO PREVENT IMPACTS TO PEDESTRIAN/BICYCLE TRAFFIC THROUGH AND ACROSS THE ADJACENT TOMMY THOMPSON TRAIL.
6. CONTRACTOR SHALL NOT TRACK SEDIMENT ONTO PUBLIC ROADS. SEE DRAWING C1.0 AND SPECIFICATIONS FOR CONSTRUCTION ENTRANCE, DECONTAMINATION FACILITY AND CONTAMINATION EXCLUSION ZONE REQUIREMENTS.
7. CONTRACTOR SHALL MAINTAIN A SECURE SITE PERIMETER FENCE AT ALL TIMES DURING CONSTRUCTION.
8. SEE SECTION 01 05 00 – TEMPORARY FACILITIES AND CONTROLS, AND OTHER SECTIONS OF THE SPECIFICATIONS FOR SPECIFIC APPLICABLE REQUIREMENTS.
9. SEE SPECIFICATIONS FOR ARCHEOLOGICAL MONITORING REQUIREMENTS DURING EXCAVATION.
10. EXISTING EEL GRASS BEDS MAY IMPACT ACCESS FOR REQUIRED DREDGING AND IN-WATER DEMOLITION.

LEGEND:

- PROPERTY LINE
- OHW — ORDINARY HIGH WATER (OHW)
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
- MLLW — MEAN LOWER LOW WATER (EL –0.65')
- FENCE
- STORM DRAIN LINE
- HISTORICAL FEATURE
- HISTORICAL CONCRETE FOUNDATION
- EXISTING WETLAND
- APPROX LIMITS OF 2007 EXCAVATIONS

N

40' 0 40' 80'

SCALE: 1"=40'

30% CONCEPTUAL DESIGN

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CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

SITE ACCESS PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	G1.4
SHEET NO.	X OF X

Plotted: Aug 08, 2012 – 1:56pm cmathews Layout: G1.4
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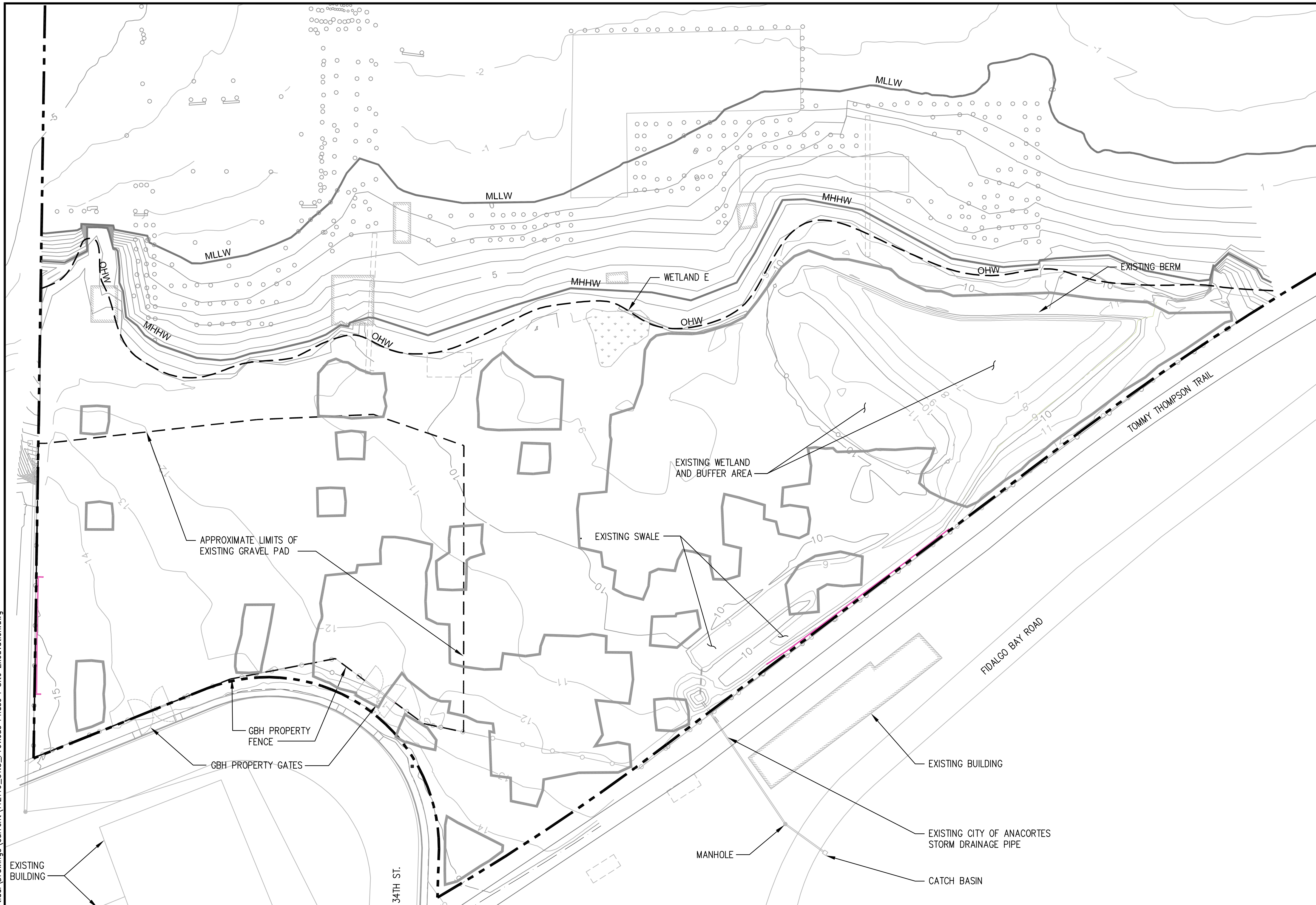

PREVIOUS PHASE I UPLAND REMEDIAL EXCAVATION (AS-BUILT) - [COMPLETED DECEMBER 2011]

1"=40'

NOTES:

1. THIS PLAN IS INTENDED TO ILLUSTRATE THE APPROXIMATE LIMITS OF PHASE 1 – UPLAND REMEDIATION EXCAVATION PERFORMED IN FALL 2011.

LEGEND:

- PHASE I EXCAVATION LIMITS
- PROPERTY LINE
- OHW — ORDINARY HIGH WATER
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
- MLLW — MEAN LOWER LOW WATER (EL –0.65')
- FENCE
- STORM DRAIN LINE
- EXISTING WETLAND

N

40' 0 40' 80'

SCALE: 1"=40'

30% CONCEPTUAL DESIGN

Plotted: Aug 15, 2012 – 8:33am gcarey Layout: G1.5
M:\2012\112110.1 Custom Plywood Phase II–A Intertidal\Drawings\Current\112110_G1.5_Previous Phase I Site Excavation.dwg

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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

PREVIOUS PHASE I UPLAND REMEDIAL EXCAVATION (AS-BUILT) - [COMPLETED DECEMBER 2011]

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	G1.5
SHEET NO.	X OF X

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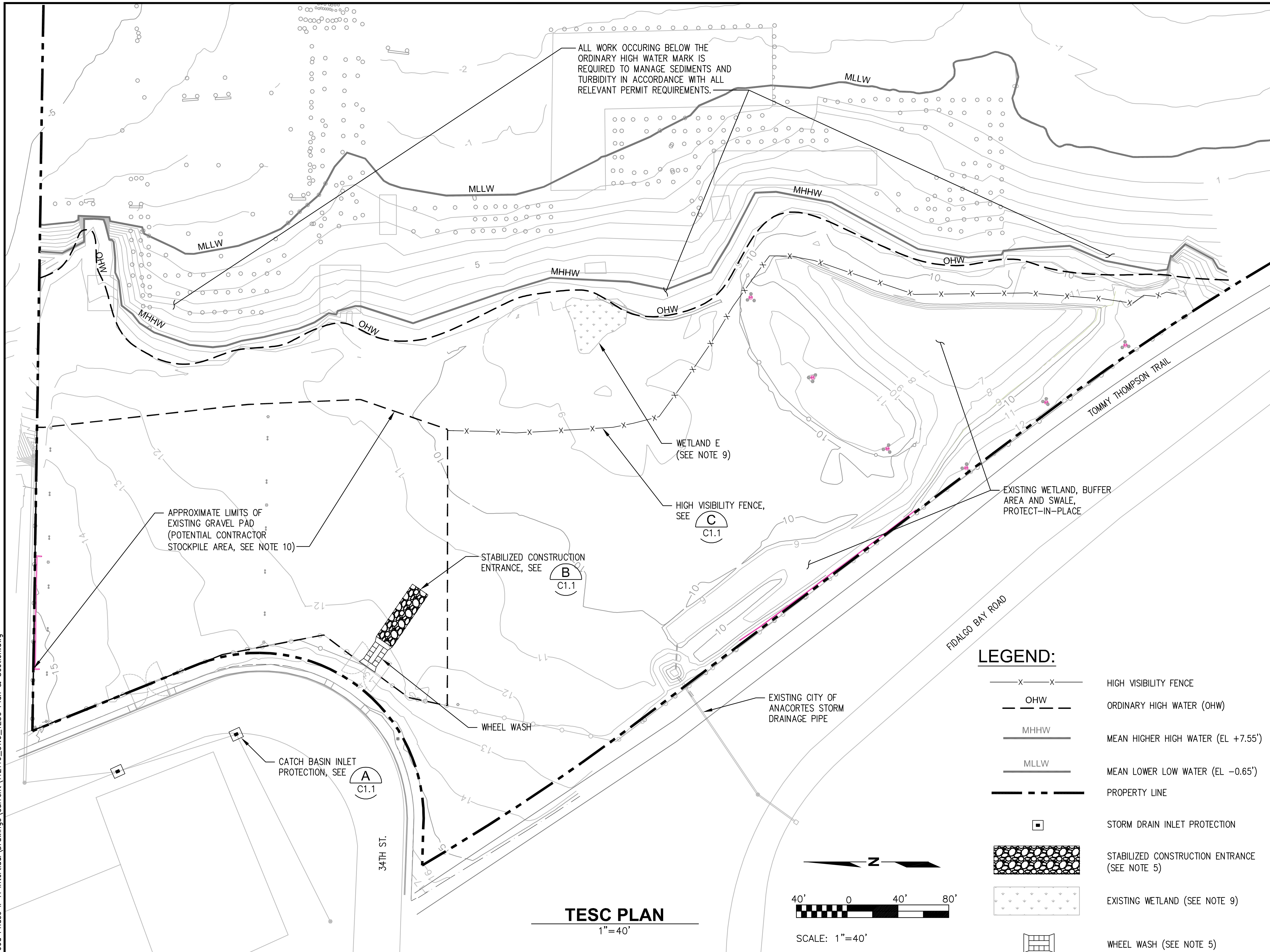

TESC PLAN

1"=40'

LEGEND:

—x—x—	HIGH VISIBILITY FENCE
OHW	ORDINARY HIGH WATER (OHW)
MHHW	MEAN HIGHER HIGH WATER (EL +7.55')
MLLW	MEAN LOWER LOW WATER (EL −0.65')
	PROPERTY LINE
	STORM DRAIN INLET PROTECTION
	STABILIZED CONSTRUCTION ENTRANCE (SEE NOTE 5)
	EXISTING WETLAND (SEE NOTE 9)
	WHEEL WASH (SEE NOTE 5)

NOTES:

1. THE CONTRACTOR SHALL DEVELOP, IMPLEMENT AND UPDATE A SWPPP IN ACCORDANCE WITH THE SUBSTANTIVE REQUIREMENTS OF THE CONSTRUCTION STORMWATER GENERAL PERMIT (CSGP). THE IMPLEMENTATION OF TESC MEASURES AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT AND MODIFYING OF THESE TESC FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED.
2. THAT PORTION OF PRECIPITATION OR STORMWATER THAT FALLS ON THE SITE THAT DOES NOT NATURALLY PERCOLATE INTO THE GROUNDWATER SHALL BE MANAGED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONSTRUCTION STORMWATER GENERAL PERMIT. SEE SPECIFICATIONS FOR FURTHER REQUIREMENTS.
3. CONTRACTOR SHALL ANTICIPATE ENCOUNTERING WATER IN REQUIRED EXCAVATIONS. CONSTRUCTION WATER THAT IS REMOVED FROM EXCAVATIONS OR RESULTS FROM THE DEWATERING OF EXCAVATED SOILS MAY BE MANAGED THROUGH INFILTRATION OR OTHER REQUIREMENTS OF THE CSGP, POTENTIALLY REQUIRING TREATMENT AND/OR DISPOSAL. CONSTRUCTION WATER ORIGINATING FROM CONTAMINATED EXCAVATIONS SHALL NOT BE INFILTRATED INTO AREAS WHERE REMEDIAL EXCAVATION HAS ALREADY BEEN COMPLETED. SEE SPECIFICATIONS FOR SITE CONSTRUCTION WATER HANDLING REQUIREMENTS.
4. CONTRACTOR SHALL INSTALL HIGH VISIBILITY FENCE ALONG THE DESIGNATED LINE AS SHOWN. NO EXCAVATION OR ANY OTHER WORK SHALL OCCUR LANDSIDE OF THIS FENCE UNLESS SPECIFICALLY REQUIRED IN THESE DRAWINGS OR SPECIFICATIONS OR AS DIRECTED BY ECOLOGY OR ECOLOGY'S REPRESENTATIVE.
5. STABILIZED CONSTRUCTION ENTRANCE SHALL BE PROVIDED AT ALL VEHICLE EXIT POINTS WHERE SEDIMENT MAY BE TRANSPORTED ONTO CITY OF ANACORTES ROADWAYS. A MECHANICAL WHEEL WASH SHALL BE PROVIDED AT EACH VEHICLE EXIT POINT. SEE SPECIFICATIONS FOR REQUIREMENTS FOR SITE DECONTAMINATION FACILITY AND CONTAMINATION EXCLUSION ZONE.
6. THE TESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED PRIOR TO AND IN CONJUNCTION WITH ALL CLEARING, GRADING, EXCAVATION, STAGING AND STOCKPILING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT AND CONSTRUCTION WATER DO NOT ENTER FIDALGO BAY OR VIOLATE CITY OF ANACORTES REGULATIONS. ALL TESC MEASURES SHALL BE REMOVED AT THE APPROPRIATE TIME DURING CONSTRUCTION SUCH THAT NONE REMAIN AT THE END OF CONSTRUCTION. SEQUENCE AS REQUIRED TO MATCH THE WORK.
7. THE TESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE FACILITIES SHALL BE MODIFIED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE.
8. THE TESC FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY OR AS DIRECTED BY THE CITY OF ANACORTES TO ENSURE THEIR CONTINUED FUNCTIONING.
9. WETLAND E WILL BE IMPACTED AND REMOVED BY REQUIRED REMEDIAL EXCAVATION.
10. ALL CONTRACTOR STOCKPILES AND LAYDOWN AREAS SHALL BE LOCATED WITHIN THE PROJECT LIMITS. CONTRACTOR SHALL COVER AND PROTECT STOCKPILES PER DETAIL D ON DRAWING C1.1. SEE SPECIFICATIONS FOR FURTHER REQUIREMENTS.

NOTE TO REVIEWER

CONTROL FOR HIGH VISIBILITY FENCE WILL BE PROVIDED IN FUTURE SUBMITTALS

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 2:06pm cmathews Layout: C1.0
M:\2012\112110.1 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_C1.0_TESC Plan & Section.dwg

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CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION

ANACORTES, WASHINGTON

TEMPORARY EROSION AND SEDIMENTATION CONTROL PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C1.0
SHEET NO.	X OF X

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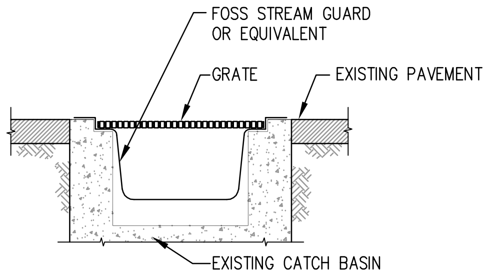
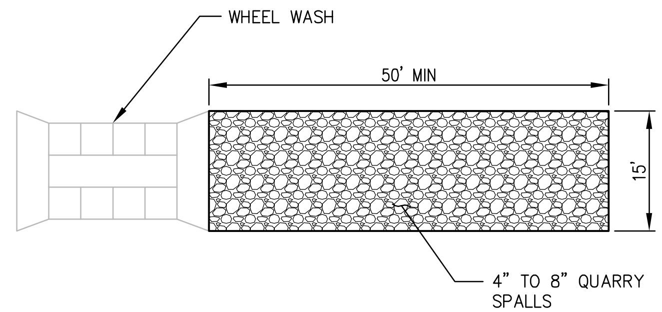


MAINTENANCE STANDARDS:

ANY ACCUMULATED SEDIMENT ON OR AROUND THE FILTER FABRIC SHALL BE REMOVED IMMEDIATELY. SEDIMENT SHALL NOT BE REMOVED BY FLUSHING W/WATER. ALL SEDIMENT MUST BE DISPOSED OF AND HAULED OFF-SITE.

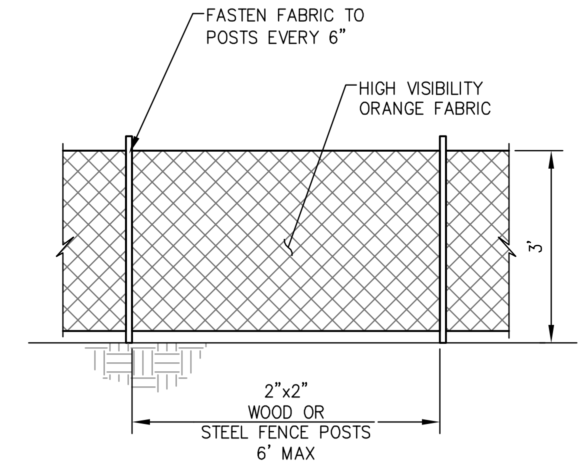
A C1.0 CATCH BASIN INLET PROTECTION
NTS



NOTES:

STABILIZED CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED AS SPECIFIED IN 2005 DOE SMMWW UNLESS NOTED OTHERWISE.

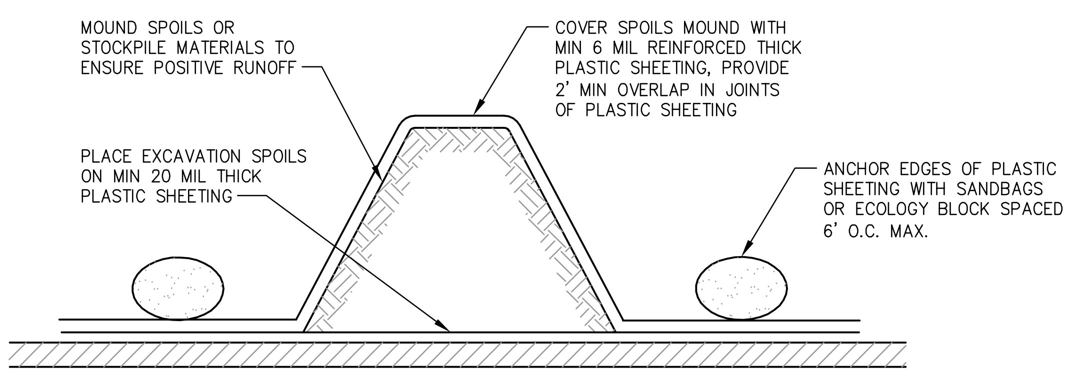
B C1.0 WHEEL WASH AND STABILIZED CONSTRUCTION ENTRANCE
NTS



NOTES:

SEE A C3.4 FOR SECTION.

C C1.0 HIGH VISIBILITY FENCE
NTS



D C1.0 STOCKPILE PROTECTION
NTS

Plotted: Aug 08, 2012 – 2:05pm cmathews Layout: C1.1
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State of Washington

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

TEMPORARY EROSION AND SEDIMENTATION CONTROL DETAILS

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C1.1
SHEET NO.	X OF X

30% CONCEPTUAL DESIGN

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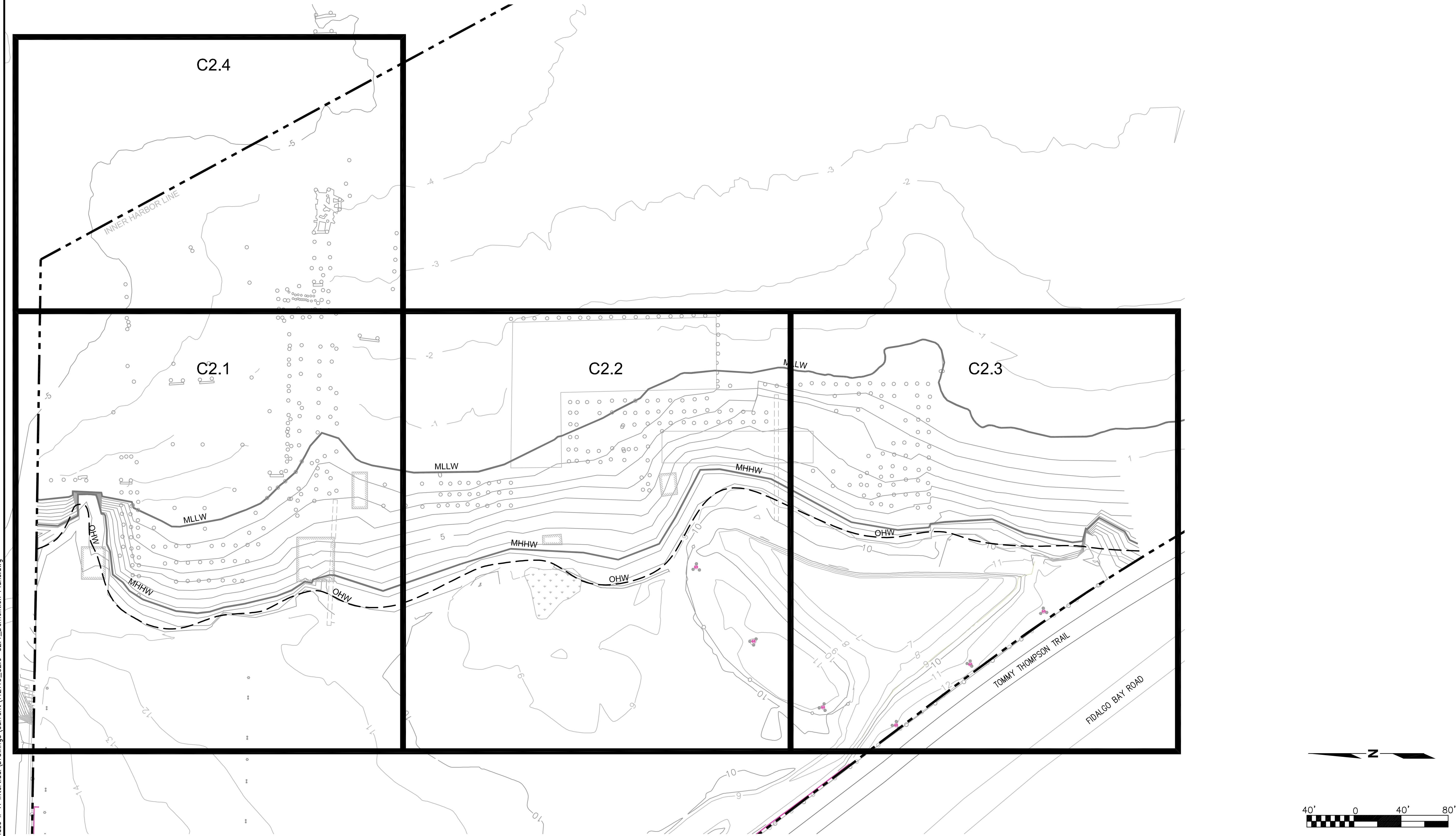

SCALE: 1"=40'

DEMOLITION KEY PLAN

1"=40'

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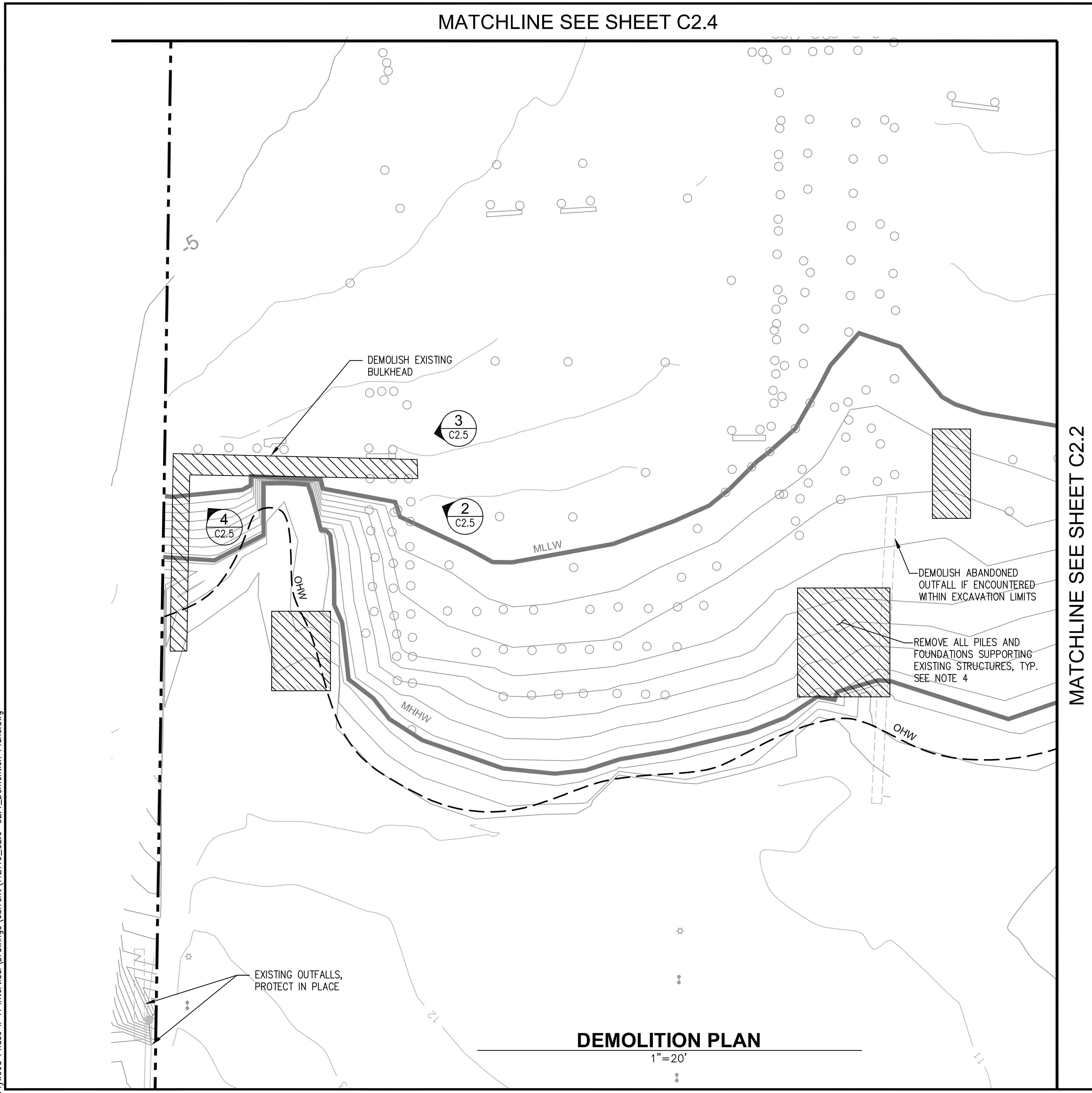
CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION

ANACORTES, WASHINGTON

DEMOLITION KEY PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C2.0
SHEET NO.	X OF X

30% CONCEPTUAL DESIGN



DEMOLITION PLAN
1"=20'

NOTES:

1. UNLESS NOTED OTHERWISE, ALL ITEMS MARKED OR NOTED FOR DEMOLITION AND/OR REMOVAL SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AND DISPOSED OF PER THE SPECIFICATIONS.
2. PREVIOUS SITE DEMOLITION DID NOT INCLUDE THE AREA WATERWARD OF THE PHASE I EXCAVATION LINE (APPROXIMATELY OHW). CONTRACTOR SHALL CLEAR AND GRUB THIS AREA REMOVING ALL MISCELLANEOUS DEBRIS, INCLUDING THE EXISTING WETLAND E. ALL LARGE WOODY DEBRIS IN THIS AREA SHALL BE RETAINED ON SITE AND RETURNED TO THE AREA WHERE IT WAS FOUND AT THE COMPLETION OF THE REMEDIAL EXCAVATION. SEE THE SPECIFICATIONS FOR FURTHER DETAILS.
3. PILES SHOWN WERE LOCATED FROM AN AERIAL PHOTOGRAPH. CONTRACTOR SHOULD EXPECT TO ENCOUNTER ADDITIONAL TREATED AND/OR UNTREATED TIMBER PILES THROUGHOUT THE SITE. SEE SPECIFICATIONS FOR PILE REMOVAL AND DISPOSAL REQUIREMENTS.
4. ALL PILES AND FOUNDATIONS BENEATH EXISTING STRUCTURES TO BE DEMOLISHED SHALL BE REMOVED PER THE SPECIFICATIONS.
5. UNLESS NOTED OTHERWISE, ALL EXISTING UTILITIES ONSITE ARE BELIEVED TO BE ABANDONED. DEMOLISH ANY UTILITIES WITHIN EXCAVATION LIMITS. CAP AT EXCAVATION LIMITS UNLESS NOTED OTHERWISE.

LEGEND:

Symbol	Description
OHW	ORDINARY HIGH WATER (OHW)
	PROPERTY LINE
MHHW	MEAN HIGHER HIGH WATER (EL +7.55')
MLLW	MEAN LOWER LOW WATER (EL −0.65')
	DEMOLISH CONCRETE STRUCTURE
	EXISTING WETLAND
	EXISTING PILE TO BE REMOVED, SEE NOTES 3 AND 4.
X CX.X	PHOTO ORIENTATION

N

20' 0 20' 40'
SCALE: 1"=20'

Plotted: Aug 08, 2012 – 2:04pm cmathews Layout: C2.1
M:\2012\112110.1 Custom Plywood Phase II–A Intertidal\Drawings\Current\112110_C2.0–C2.4_Demolition Plans.dwg

30% CONCEPTUAL DESIGN

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HARTCROWSER

NO.	DATE	BY	REVISION

DEPARTMENT OF ECOLOGY
State of Washington

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

DEMOLITION PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C2.1
SHEET NO.	X OF X

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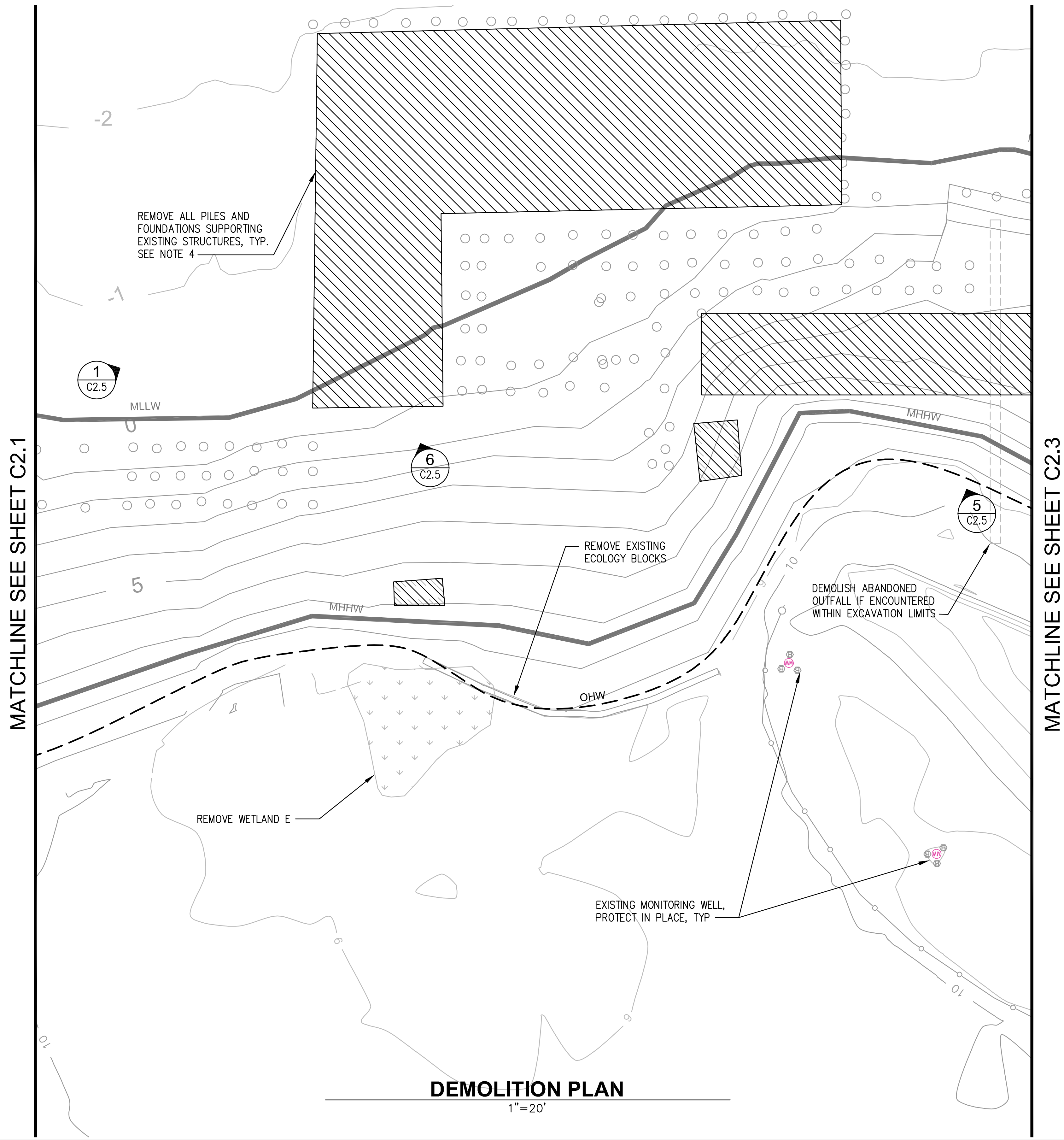

DEMOLITION PLAN

1"=20'

NOTES:

1. UNLESS NOTED OTHERWISE, ALL ITEMS MARKED OR NOTED FOR DEMOLITION AND/OR REMOVAL SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AND DISPOSED OF PER THE SPECIFICATIONS.
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LEGEND:

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	PROPERTY LINE
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	DEMOLISH CONCRETE STRUCTURE
	EXISTING WETLAND
	EXISTING PILE TO BE REMOVED, SEE NOTE 3.
X CX.X	PHOTO ORIENTATION

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 2:04pm cmathews Layout: C2.2
M:\2012\1121110.1 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_C2.0-C2.4_Demolition Plans.dwg

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DEPARTMENT OF ECOLOGY State of Washington

NO.	DATE	BY	REVISION

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

DEMOLITION PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C2.2
SHEET NO.	X OF X

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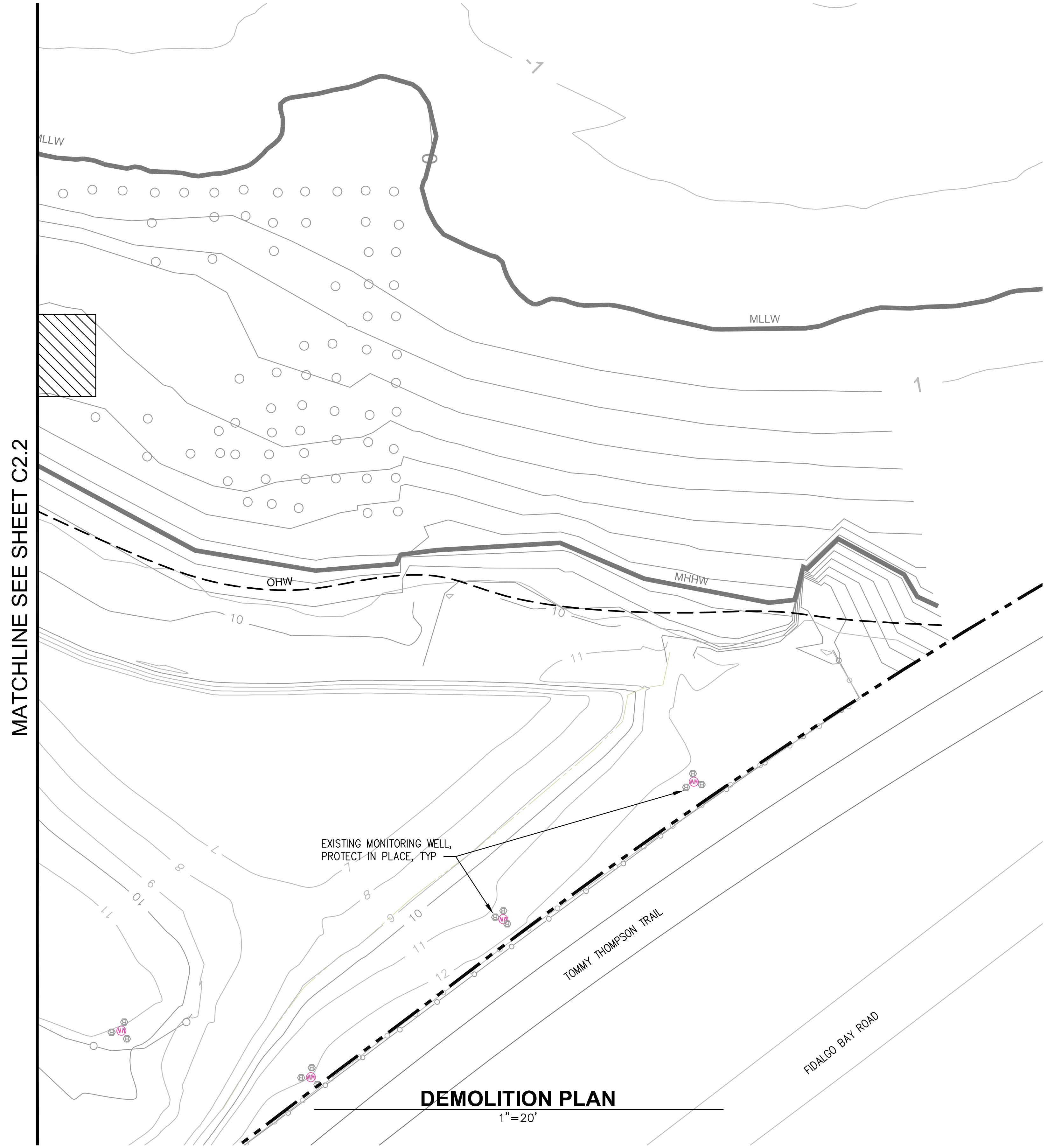

DEMOLITION PLAN

1"=20'

NOTES:

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LEGEND:

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	PROPERTY LINE
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MLLW	MEAN LOWER LOW WATER (EL −0.65')
	DEMOLISH CONCRETE STRUCTURE
	EXISTING WETLAND
	EXISTING PILE TO BE REMOVED, SEE NOTE 3.
X CX.X	PHOTO ORIENTATION

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

DEMOLITION PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C2.3
SHEET NO.	X OF X

Plotted: Aug 08, 2012 – 2:05pm cmathews Layout: C2.3
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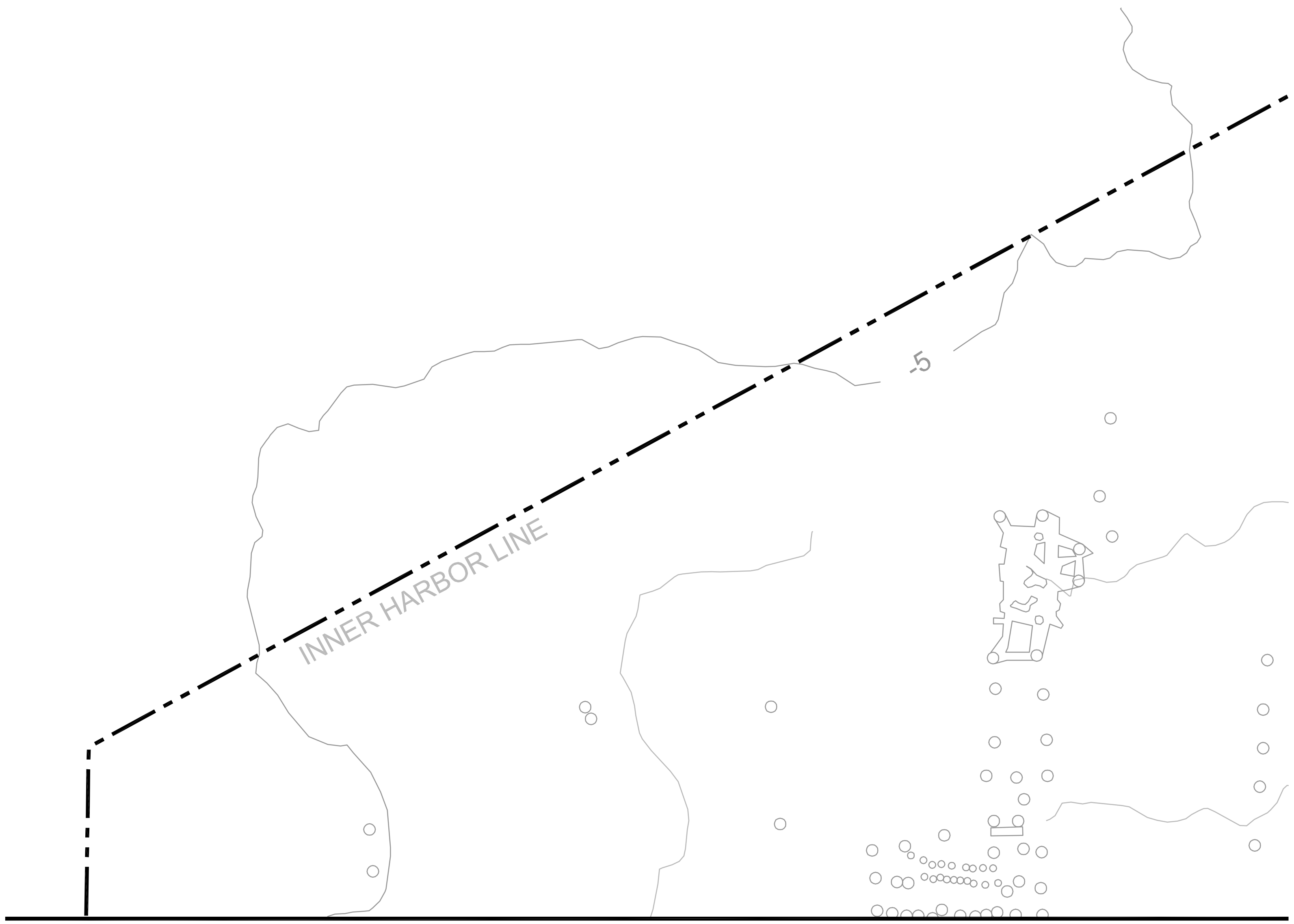

MATCHLINE SEE SHEET C2.1

DEMOLITION PLAN

1"=20'

NOTES:

1. UNLESS NOTED OTHERWISE, ALL ITEMS MARKED OR NOTED FOR DEMOLITION AND/OR REMOVAL SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AND DISPOSED OF PER THE SPECIFICATIONS.
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LEGEND:

OHW	ORDINARY HIGH WATER (OHW)
	PROPERTY LINE
MHHW	MEAN HIGHER HIGH WATER (EL +7.55')
MLLW	MEAN LOWER LOW WATER (EL −0.65')
	DEMOLISH CONCRETE STRUCTURE
	EXISTING WETLAND
	EXISTING PILE TO BE REMOVED, SEE NOTE 3.
X CX.X	PHOTO ORIENTATION

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 2:05pm cmathews Layout: C2.4
M:\2012\112110.1 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_C2.0-C2.4_Demolition Plans.dwg

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NO.	DATE	BY	REVISION

DEPARTMENT OF ECOLOGY
State of Washington

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

DEMOLITION PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C2.4
SHEET NO.	X OF X

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1 C2.2 **PHOTO** NTS

2 C2.1 **PHOTO** NTS

3 C2.1 **PHOTO** NTS

4 C2.1 **PHOTO** NTS

5 C2.2 **PHOTO** NTS

6 C2.2 **PHOTO** NTS

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NO.	DATE	BY	REVISION

DEPARTMENT OF ECOLOGY State of Washington

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON
DEMOLITION PHOTOS

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C2.5
SHEET NO.	X OF X

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 2:03pm cmathews Layout: C2.5
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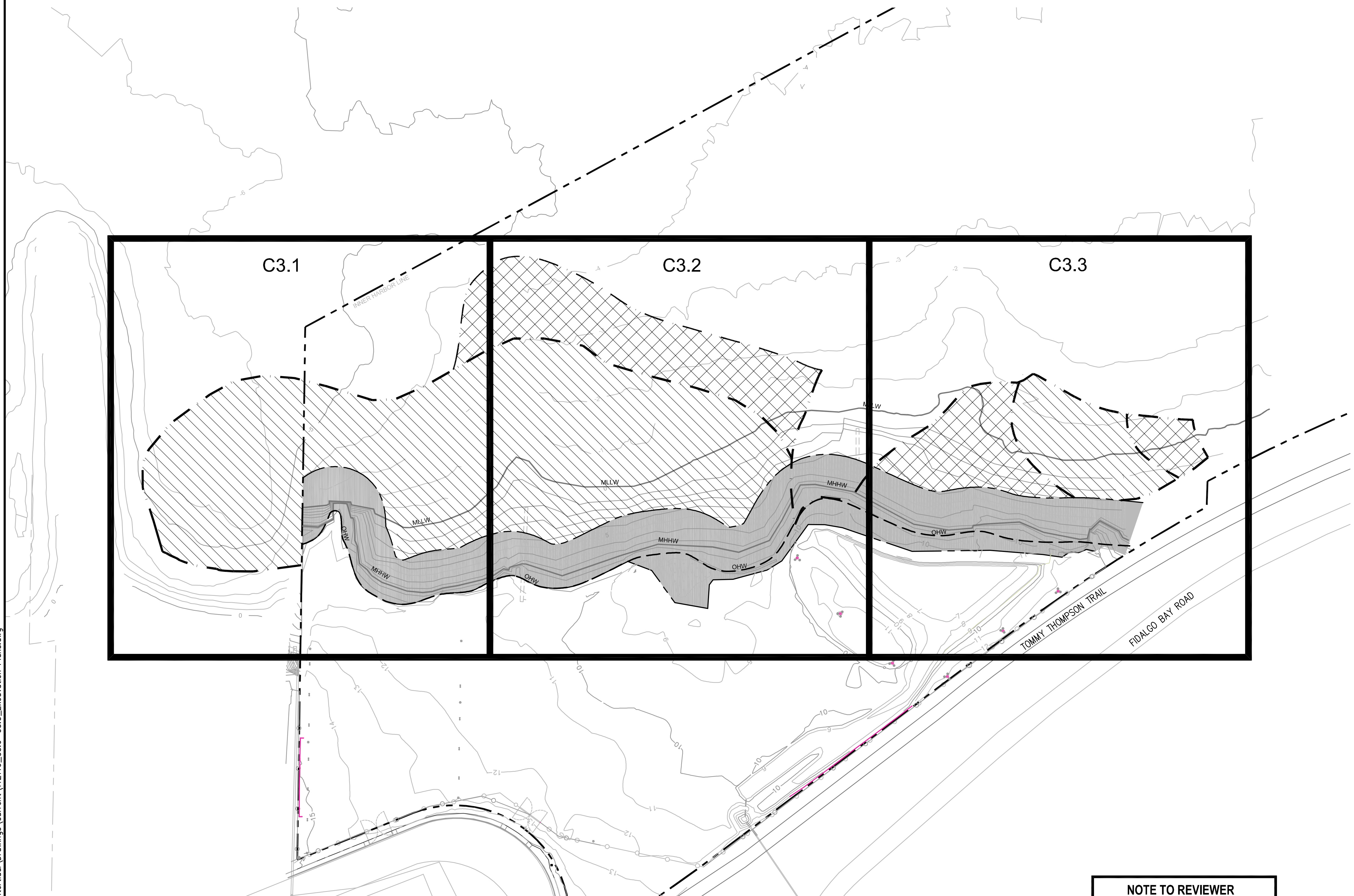

NOTE TO REVIEWER

CONTROL FOR EXCAVATION AND DREDGING LIMITS TO BE PROVIDED IN FUTURE SUBMITTALS.

EXCAVATION AND DREDGING KEY PLAN

1"=50'

NOTES:

1. SOIL AND MATERIAL REMOVED DURING EXCAVATION AND DREDGING, INCLUDING CONSTRUCTION WATER, SHALL BE HANDLED PER THE SPECIFICATIONS. CONTRACTOR SHALL CONTACT ECOLOGY OR ECOLOGY'S REPRESENTATIVE IMMEDIATELY UPON NOTICING EVIDENCE OF CONTAMINATION OR SUSPECTED CONTAMINATED MATERIAL BEYOND THAT NOTED HEREIN.
2. EXPLORATIONS IDENTIFIED SIGNIFICANT QUANTITIES OF SAW DUST, WOOD WASTE AND OTHER DEBRIS WITHIN THE FILL. CONTRACTOR SHALL ANTICIPATE ENCOUNTERING DEBRIS DURING EXCAVATION, DREDGING AND/OR SHORING INSTALLATION ALONG THE SHORELINE. SEE GEOTECHNICAL DATA FOR FURTHER INFORMATION.
3. CONTRACTOR SHALL ANTICIPATE WATER IN THE REQUIRED EXCAVATIONS. IT IS EXPECTED THAT REMOVING ALL THE WATER FROM INTERTIDAL SHORELINE EXCAVATIONS WILL BE IMPRACTICAL. CONTRACTOR SHALL ANTICIPATE EXCAVATION AND BACKFILL WILL OCCUR BELOW WATER WITHIN EXCAVATIONS.
4. SEE DRAWING G1.0 FOR SURVEY DATUM NOTES.
5. STRAIGHT GRADE SHALL BE MAINTAINED BETWEEN CONTOUR LINES AND SPOT ELEVATIONS UNLESS OTHERWISE NOTED.
6. SEE SPECIFICATIONS FOR ARCHEOLOGICAL MONITORING REQUIREMENTS DURING EXCAVATION.
7. EXCAVATION AREAS SHALL BE BACKFILLED TO EXISTING GRADE PER DRAWING C3.4 UNLESS NOTED OTHERWISE.
8. DREDGING AREAS SHALL BE BACKFILLED TO EXISTING GRADES PER SPECIFICATIONS.
9. PILES AND CONCRETE STRUCTURES ARE NOT SHOWN FOR CLARITY, AS IT IS ASSUMED THAT DEMOLITION ACTIVITIES WILL BE COMPLETED PRIOR TO EXCAVATION.

LEGEND:

Symbol	Description
	DREDGING LIMITS
	EXCAVATION LIMITS
OHW	ORDINARY HIGH WATER (OHW)
	PROPERTY LINE
MHHW	MEAN HIGHER HIGH WATER (EL +7.55')
MLLW	MEAN LOWER LOW WATER (EL −0.65')
	INTERTIDAL SHORELINE EXCAVATION AREA (SEE SECTION A ON DRAWING C3.4)
	EXISTING WETLAND
	DREDGE TO 2 FEET BELOW EXISTING SURFACE WHERE WOOD WASTE > 1 FOOT THICK. (SEE SECTION B ON DRAWING C3.4)
	DREDGE TO CONTACT WITH NATIVE SEDIMENT WHERE DIOXIN TEC > 25 ppt. (SEE SECTION C ON DRAWING C3.4)

N

40' 0 40' 80'

SCALE: 1"=40'

30% CONCEPTUAL DESIGN

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NO.	DATE	BY	REVISION

DEPARTMENT OF ECOLOGY State of Washington

CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION

ANACORTES, WASHINGTON

EXCAVATION AND DREDGING KEY PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C3.0
SHEET NO.	X OF X

Plotted: Aug 08, 2012 – 3:24pm tzehnder Layout: C3.0
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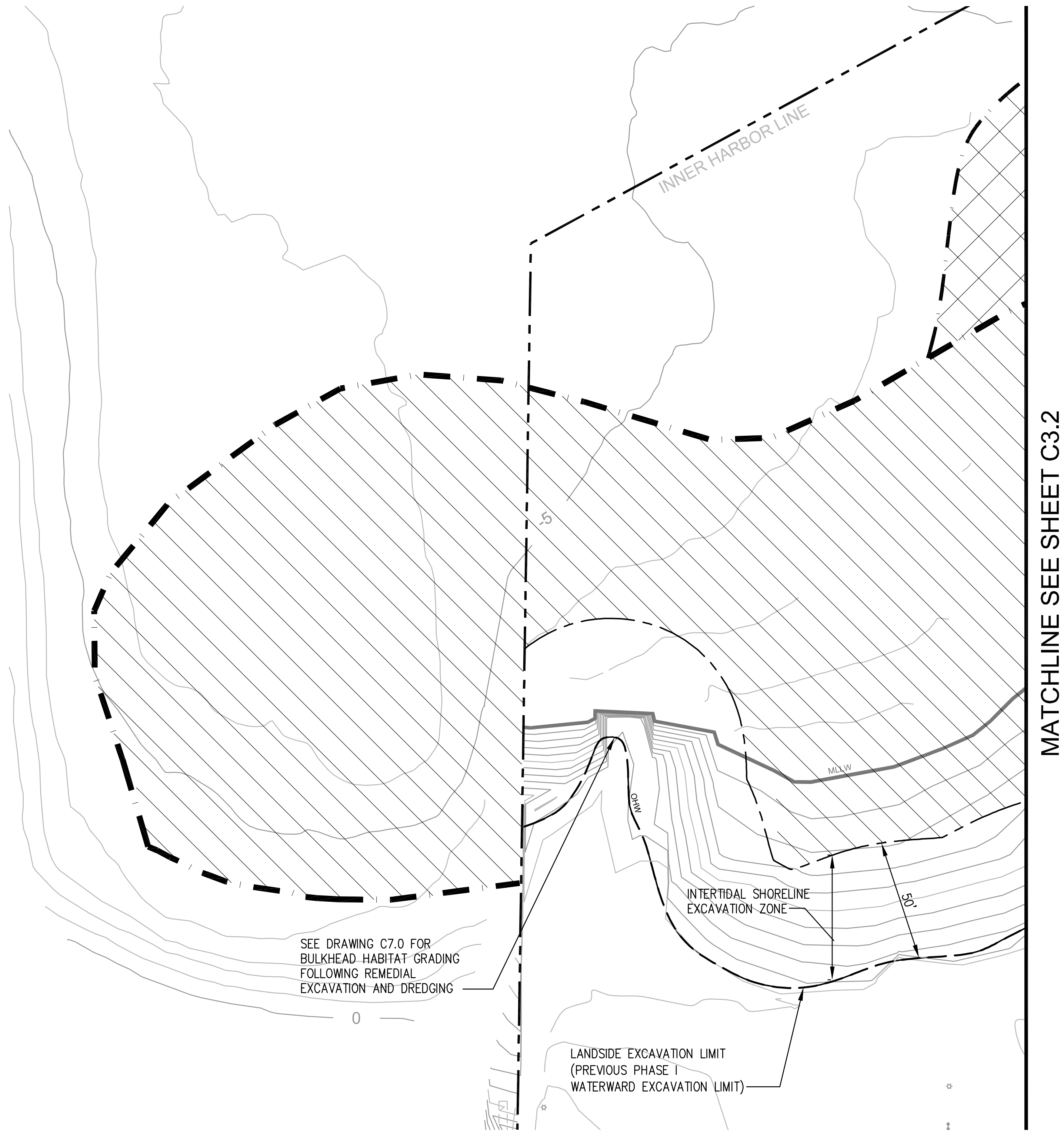

EXCAVATION AND DREDGING PLAN

1"=30'

NOTES:

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7. EXCAVATION AREAS SHALL BE BACKFILLED TO EXISTING GRADE PER DRAWING C3.4 UNLESS NOTED OTHERWISE.
8. DREDGED AREAS SHALL BE BACKFILLED TO EXISTING GRADES PER SPECIFICATIONS.
9. MEAN HIGHER HIGH WATER LINE NOT SHOWN FOR CLARITY.
10. PILES AND CONCRETE STRUCTURES ARE NOT SHOWN FOR CLARITY, AS IT IS ASSUMED THAT DEMOLITION ACTIVITIES WILL BE COMPLETED PRIOR TO EXCAVATION.

LEGEND:

- DREDGING LIMITS
- EXCAVATION LIMITS
- OHW — ORDINARY HIGH WATER (OHW)
- PROPERTY LINE
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
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- EXISTING WETLAND
- DREDGE TO 2 FEET BELOW EXISTING SURFACE WHERE WOOD WASTE > 1 FOOT THICK. (SEE SECTION B ON DRAWING C3.4)
- DREDGE TO CONTACT WITH NATIVE SEDIMENT WHERE DIOXIN TEC > 25 ppt. (SEE SECTION C ON DRAWING C3.4)

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 2:00pm cmathews Layout: C3.1
M:\2012\112110.1 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_C3.0-C3.3_Excavation Plans.dwg

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CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

EXCAVATION AND DREDGING PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C3.1
SHEET NO.	X OF X

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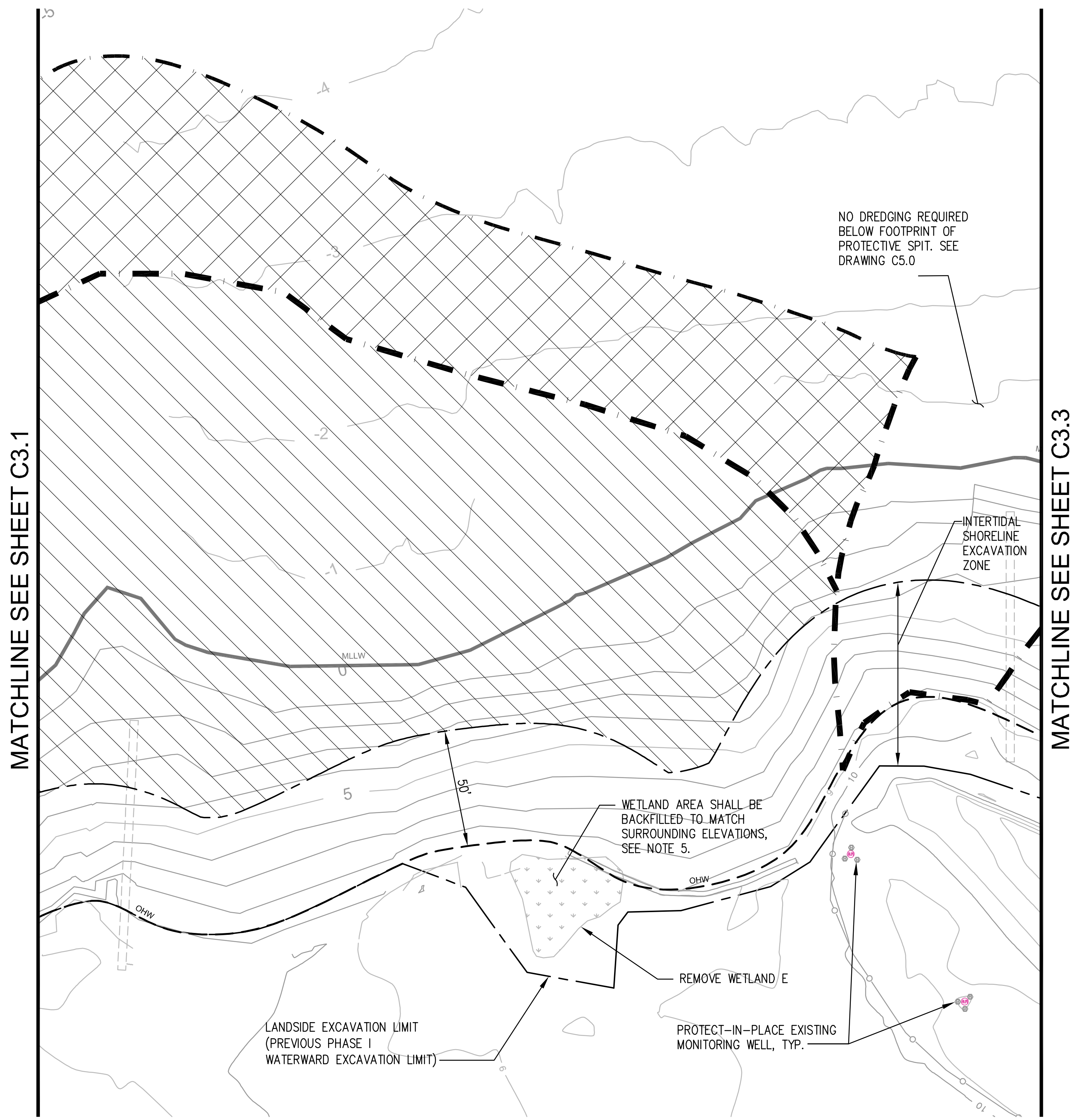

EXCAVATION AND DREDGING PLAN

1"=30'

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- DREDGE TO CONTACT WITH NATIVE SEDIMENT WHERE DIOXIN TEC > 25 ppt. (SEE SECTION C ON DRAWING C3.4)

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 3:06pm tzehnder Layout: C3.2
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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

EXCAVATION AND DREDGING PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C3.2
SHEET NO.	X OF X

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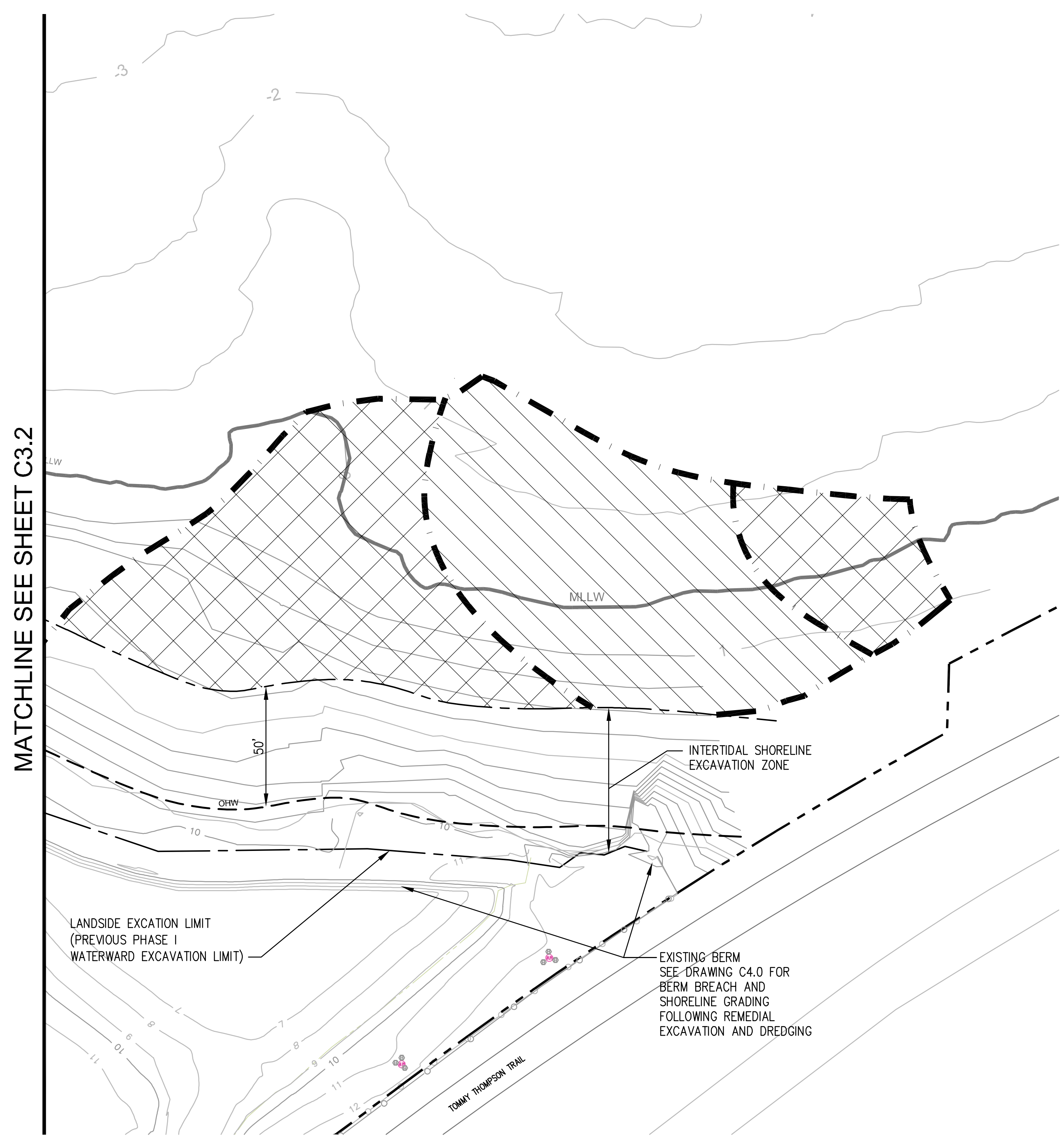

EXCAVATION AND DREDGING PLAN

1"=30'

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- EXCAVATION LIMITS
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- MLLW — MEAN LOWER LOW WATER (EL −0.65')
- EXISTING WETLAND
- DREDGE TO 2 FEET BELOW EXISTING SURFACE WHERE WOOD WASTE > 1 FOOT THICK. (SEE SECTION B ON DRAWING C3.4)
- DREDGE TO CONTACT WITH NATIVE SEDIMENT WHERE DIOXIN TEC > 25 ppt. (SEE SECTION C ON DRAWING C3.4)

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 2:02pm cmathews Layout: C3.3
M:\2012\112110.1 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_C3.0-C3.3_Excavation Plans.dwg

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DEPARTMENT OF ECOLOGY State of Washington

CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

EXCAVATION AND DREDGING PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C3.3
SHEET NO.	X OF X

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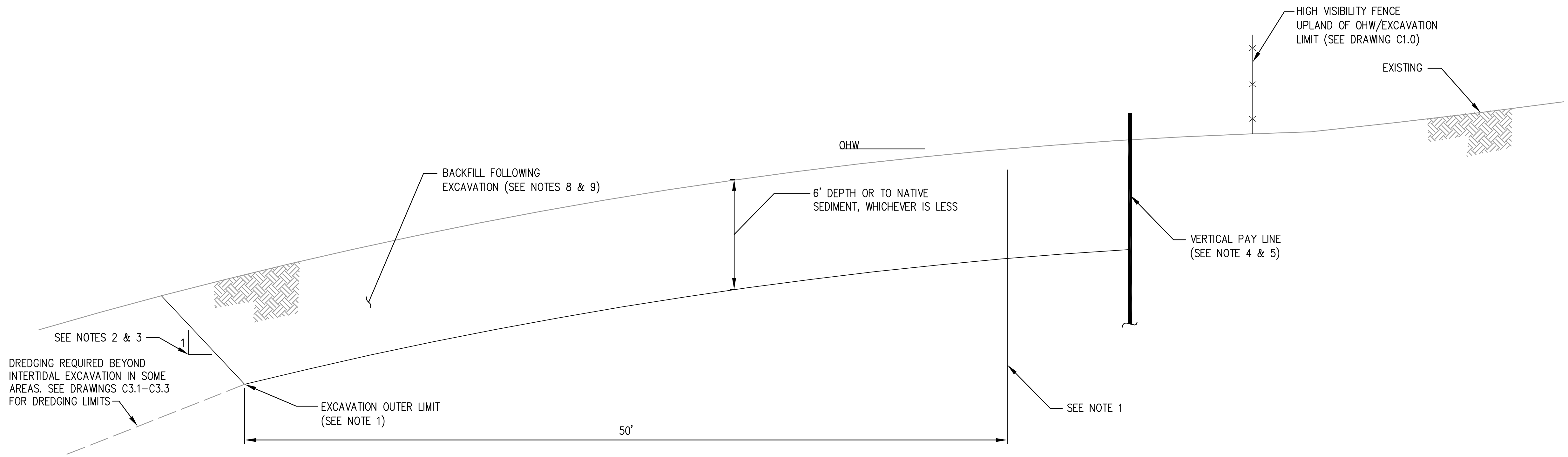
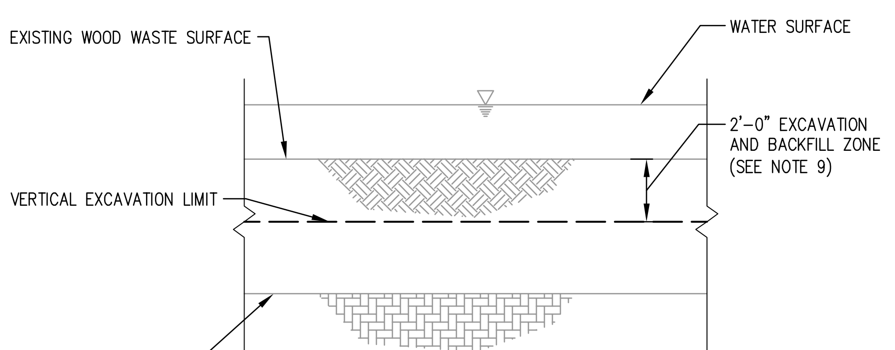


A — **TYPICAL INTERTIDAL SHORELINE EXCAVATION**
SCALE: 1/4"=1'-0"

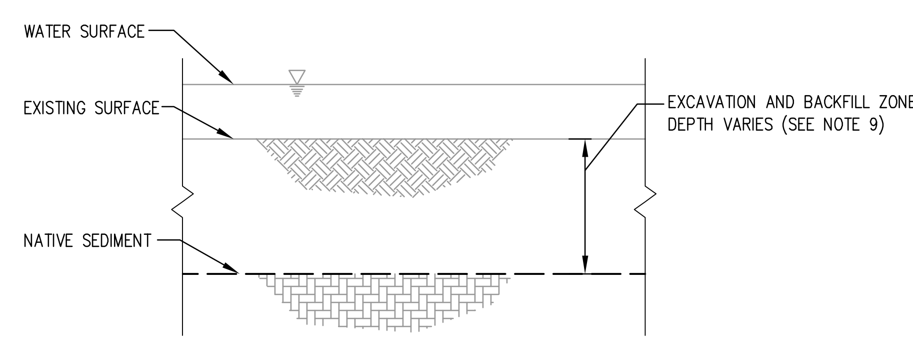
NOTES:

1. REMEDIAL EXCAVATION OUTER LIMIT IS SET AT A DISTANCE OF 50 FEET FROM THE OHW LINE.
2. MINIMUM SIDE SLOPES FOR TYPICAL EXCAVATIONS SHALL BE DETERMINED BY CONTRACTOR BASED ON FIELD CONDITIONS. SEE SPECIFICATIONS FOR FURTHER REQUIREMENTS.
3. INTERTIDAL SHORELINE EXCAVATION OUTER LIMIT MAY COINCIDE WITH DREDGING LIMIT. CONTRACTOR SHALL ENSURE EXCAVATIONS AND DREDGING REACH FULL DEPTH REQUIRED. SEE NOTE 2.
4. CONTRACTOR SHALL NOT OVEREXCAVATE BEYOND THE LIMITS SHOWN WITHOUT DIRECTION FROM ECOLOGY OR ECOLOGY'S REPRESENTATIVE.
5. EXCAVATION AND BACKFILL ALONG THE LANDWARD EXCAVATION LIMIT SHALL BE PAID ON A VERTICAL LINE AS SHOWN. SEE SPECIFICATIONS FOR FURTHER REQUIREMENTS.
6. CONTRACTOR SHALL USE SLIDE RAIL, SHEET PILE OR OTHER SHORING MEANS ALONG THE LANDWARD EXCAVATION LIMIT. SHORING DESIGN MUST BE IN ACCORDANCE WITH ALL APPLICABLE STANDARDS AND REQUIREMENTS. SEE SPECIFICATIONS FOR FURTHER DETAILS.
7. CONTRACTOR SHALL ANTICIPATE DEBRIS THAT MAY CROSS THE EXCAVATION VERTICAL PAY LINE. PRE-EXCAVATION MAY BE REQUIRED TO DRIVE SHEETS OR SET OTHER SHORING.
8. CONTRACTOR SHALL ANTICIPATE WATER WITHIN EXCAVATIONS. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
9. EXCAVATION AND DREDGING AREAS SHALL BE BACKFILLED TO EXISTING GRADE UNLESS NOTED OTHERWISE. SEE SPECIFICATIONS FOR FURTHER DETAILS, INCLUDING BACKFILL TIMING REQUIREMENTS.
10. SEE SPECIFICATIONS FOR IMPORT MATERIAL CLEANLINESS AND QUALITY REQUIREMENTS.



NOTE:
2-FOOT EXCAVATION DEPTH APPLIES ONLY TO THE AREAS INDICATED ON DRAWINGS C3.1-C3.3 AS HAVING GREATER THAN 1-FOOT THICK WOOD WASTE PRESENT.

B — **TYPICAL WOOD WASTE DREDGE PRISM SECTION**
SCALE: NTS



NOTE:
EXCAVATION TO NATIVE SEDIMENT ONLY APPLIES TO THE AREAS INDICATED ON DRWAINGS C3.1-C3.3 AS HAVING DIOXIN CONCENTRATIONS GREATER THAN 25 ppt TEC.

C — **TYPICAL DIOXIN DREDGE PRISM SECTION**
SCALE: NTS

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State of Washington

CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON
TYPICAL EXCAVATION AND DREDGING SECTIONS

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C3.4
SHEET NO.	X OF X

30% CONCEPTUAL DESIGN

Plotted: Aug 15, 2012 – 8:39am gcarey Layout: C3.4
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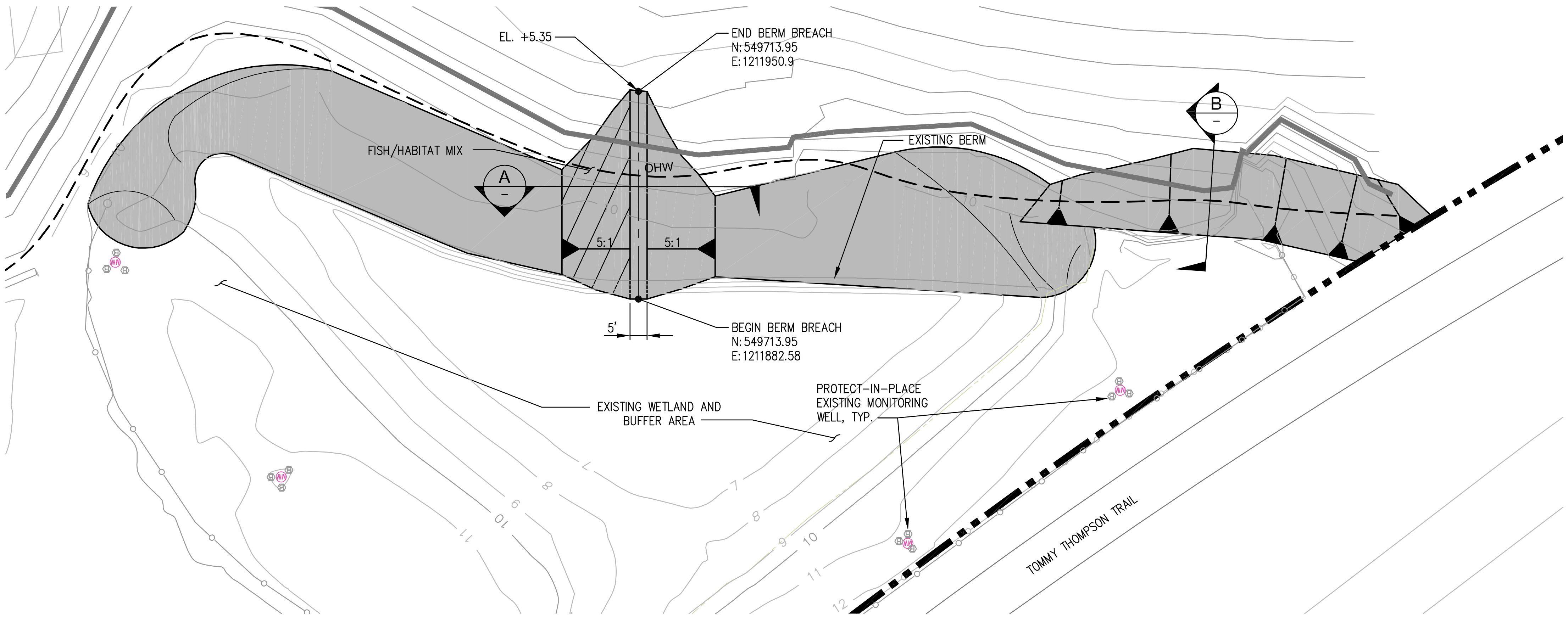
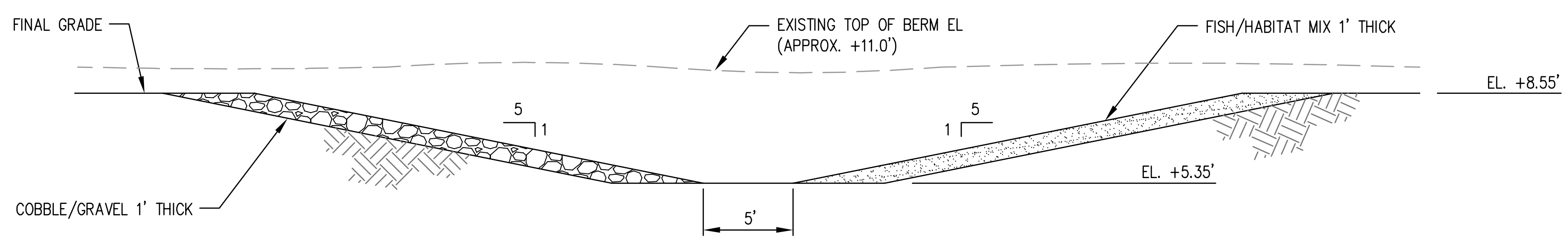


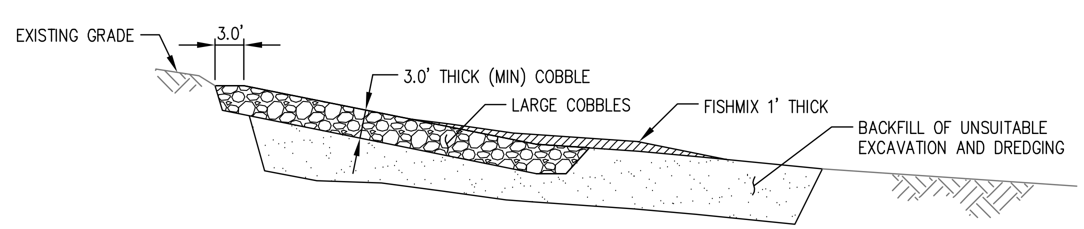
BERM BREACH AND SHORELINE GRADING PLAN

1"=20'



A SECTION

SCALE: 1"=5'



B SECTION

SCALE: 1"=10'

NOTES:

1. COBBLE/GRAVEL:
CLEAN NATURALLY OCCURRING, ROUNDED GRANULAR MATERIAL (RIVER RUN OR PROCESSED GLACIAL OUTWASH DEPOSITS) FREE FROM WOOD WASTE AND OTHER EXTRANEOUS OBJECTIONABLE MATERIALS AND SHALL HAVE SUCH CHARACTERISTICS OF SIZE AND SHAPE THAT IT WILL MEET THE FOLLOWING REQUIREMENTS FOR GRADATION:

SIEVE SIZE	PERCENT PASSING
8"	100%
6"	80–95%
4"	35–55%
2"	20–35%
1"	15–30%
0.375"	5–20%

ALL PERCENTAGES BY WEIGHT

2. FISH/HABITAT MIX:
CLEAN NATURALLY OCCURRING, ROUNDED GRANULAR MATERIAL (RIVER RUN OR PROCESSED GLACIAL OUTWASH DEPOSITS) FREE FROM WOOD WASTE AND OTHER EXTRANEOUS OBJECTIONABLE MATERIALS AND SHALL HAVE SUCH CHARACTERISTICS OF SIZE AND SHAPE THAT IT WILL MEET THE FOLLOWING REQUIREMENTS FOR GRADATION:

SIEVE SIZE	PERCENT PASSING
2" SQUARE	100%
1½" SQUARE	80–95%
¾" SQUARE	50–80%
US NO. 4	30–50%
US NO. 200	0–8%

ALL PERCENTAGES BY WEIGHT

3. HORIZONTAL CONTROL PROVIDED DEFINES THE CENTERLINE OF THE BERM BREACH.

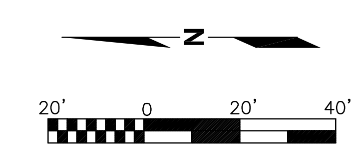
LEGEND:

OHW — ORDINARY HIGH WATER (OHW)

MHHW — MEAN HIGHER HIGH WATER (EL +7.55')

FISH/HABITAT MIX

COBBLE/GRAVEL MIX



SCALE: 1"=20'

30% CONCEPTUAL DESIGN

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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

BERM BREACH AND SHORELINE GRADING PLAN AND SECTIONS

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C4.0
SHEET NO.	X OF X

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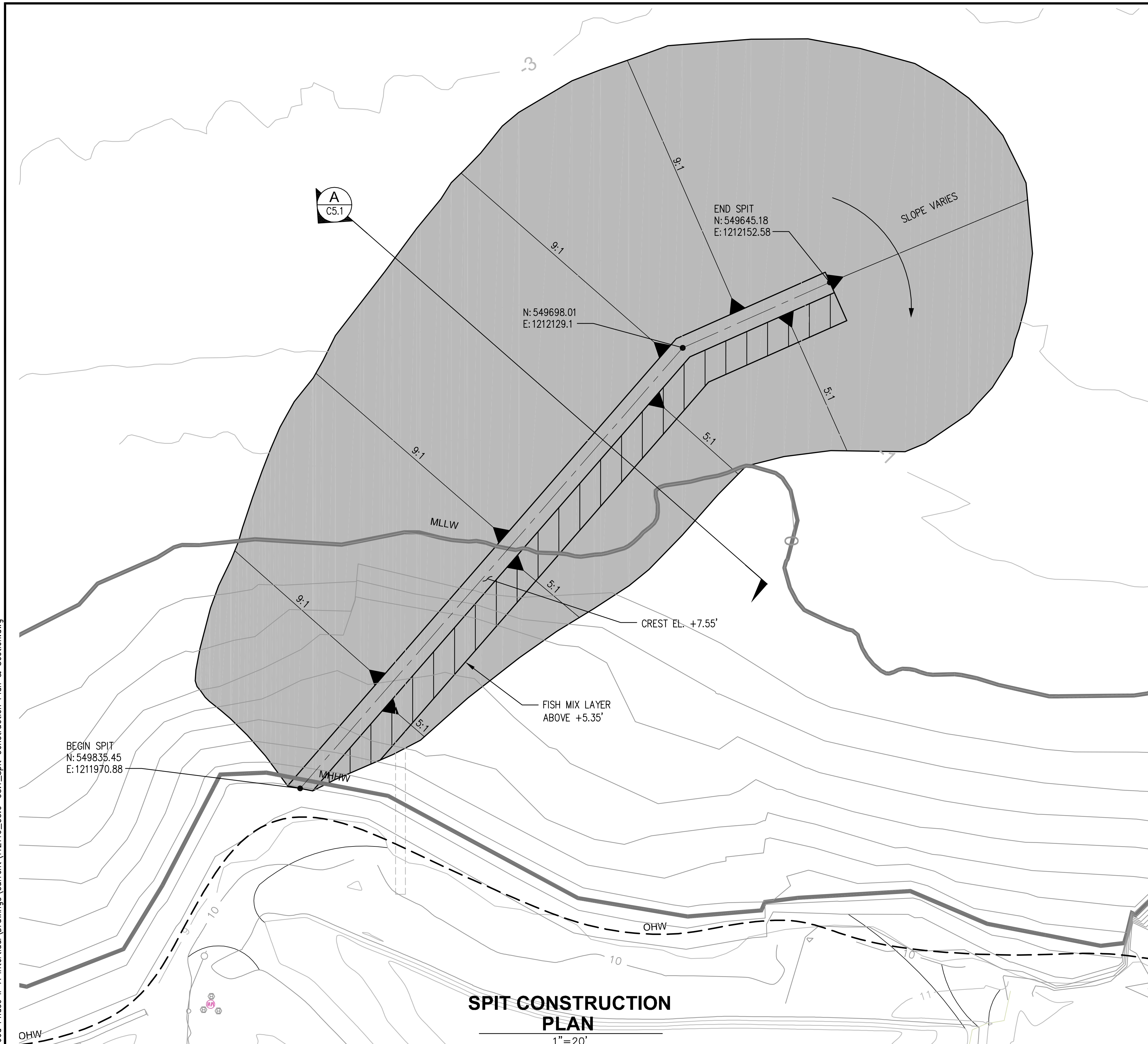

SPIT CONSTRUCTION PLAN
1"=20'

NOTES:

1. HORIZONTAL CONTROL PROVIDED DEFINES THE CENTERLINE OF THE CREST OF THE SPIT.
2. SPIT MATERIAL (COBBLE/GRAVEL MIX) SHALL CONSIST OF ROUNDED GRANULAR MATERIAL (RIVER RUN OR PROCESSED GLACIAL OUTWASH DEPOSITS) FREE FROM WOOD WASTE AND OTHER EXTRANEOUS OBJECTIONAL MATERIALS.

SLEVE SIZE	PERCENT PASSING
8"	100%
6"	80–95%
4"	35–55%
2"	20–35%
1"	15–30%
0.375"	5–20%

ALL PERCENTAGES BY WEIGHT

LEGEND:

- OHW — ORDINARY HIGH WATER (OHW)
- MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
- MLLW — MEAN LOWER LOW WATER (EL −0.65')
- FENCE
- FISH/HABITAT MIX
- COBBLE/GRAVEL MIX
- MONITORING WELL AND BOLLARDS

N

20' 0 20' 40'

SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 1:59pm cmathews Layout: C5.0
M:\2012\1121101 Custom Plywood Phase II-A Intertidal\Drawings\Current\112110_C5.0-C5.1_Spit Construction Plan & Section.dwg

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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

SPIT CONSTRUCTION PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C5.0
SHEET NO.	X OF X

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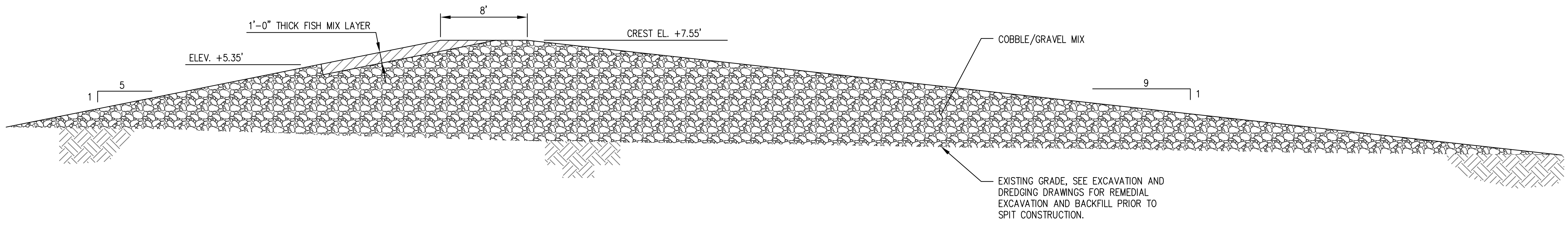

A / C5.0 **SECTION**
SCALE: 1"=5'

N

5' 0 5' 10'

SCALE: 1"=5'

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INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

SPIT SECTION

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	**C5.1**
SHEET NO.	**X** OF **X**

30% CONCEPTUAL DESIGN

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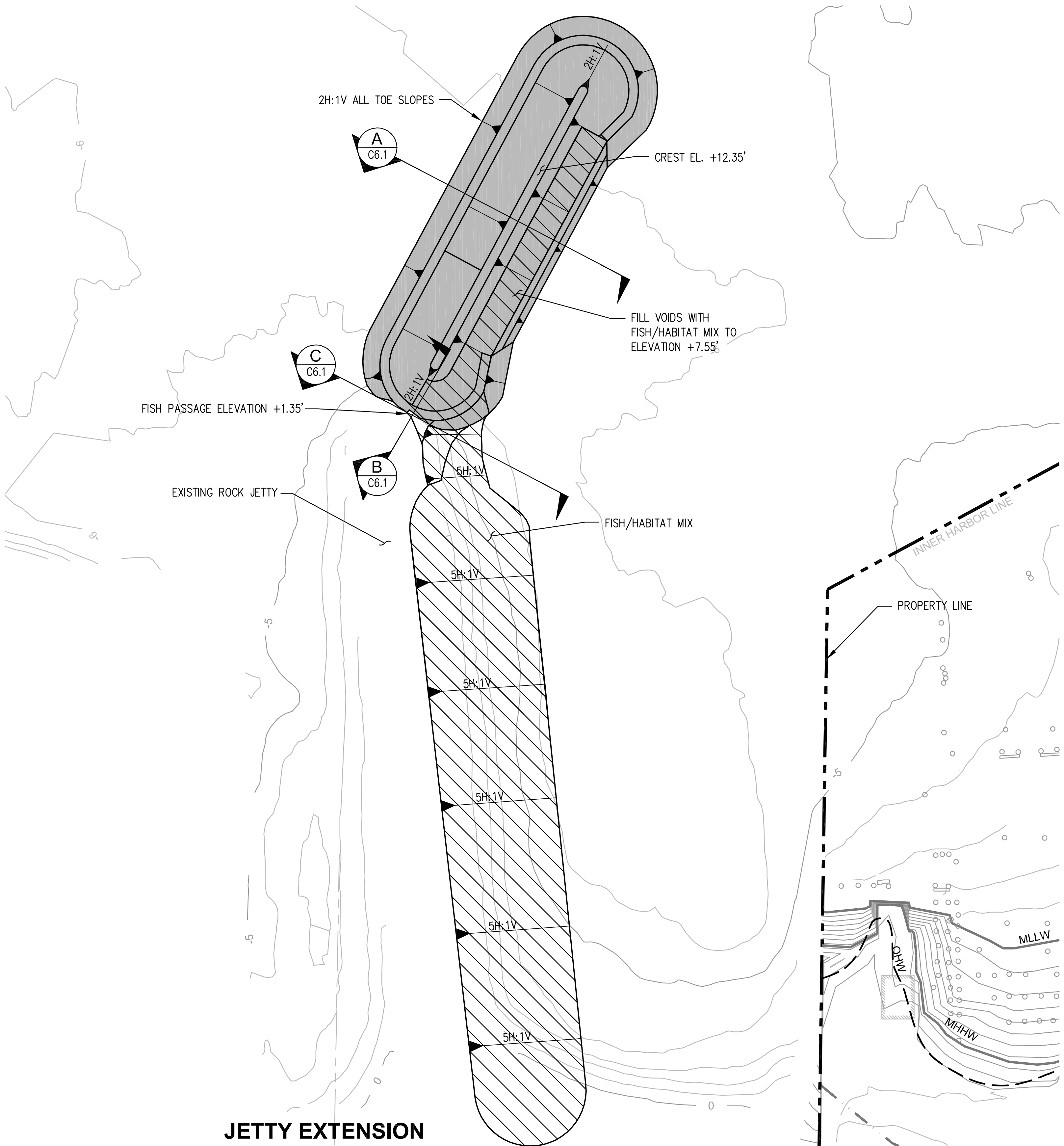

JETTY EXTENSION PLAN

1"=40'

NOTES:

1. SEE SECTION ON DRAWING C6.1 FOR JETTY EXTENSION MATERIALS.

LEGEND:

PROPERTY LINE

OHW — ORDINARY HIGH WATER (OHW)

MHHW — MEAN HIGHER HIGH WATER (EL +7.55')

MLLW — MEAN LOWER LOW WATER (EL −0.65')

N

40' 0 40' 80'

SCALE: 1"=40'

NOTE TO REVIEWER

CONTROL FOR JETTY EXTENSION WILL BE PROVIDED IN FUTURE SUBMITTALS

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 1:58pm cmathews Layout: C6.0
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CUSTOM PLYWOOD SITE PHASE II INTERIM REMEDIAL ACTION

ANACORTES, WASHINGTON

JETTY EXTENSION PLAN

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C6.0
SHEET NO.	X OF X

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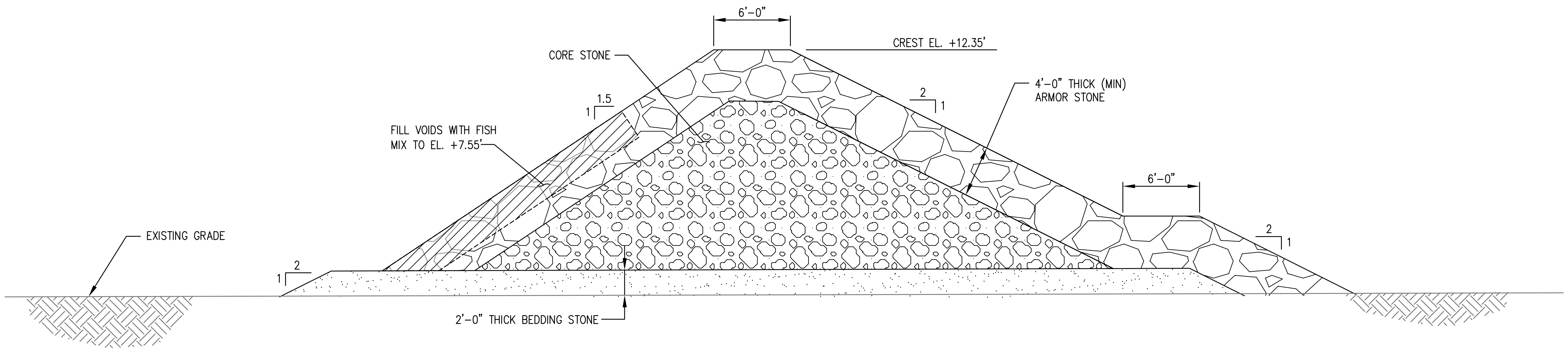
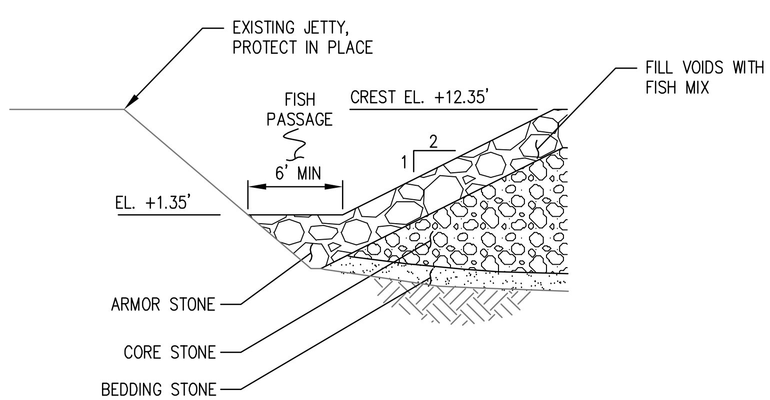
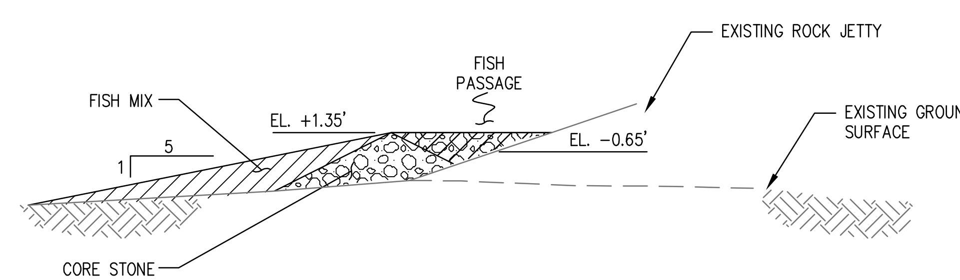


A C6.0 **SECTION**
SCALE: 1"=5'



B C6.0 **SECTION**
SCALE: 1"=10'



C C6.0 **SECTION**
SCALE: 1"=10'

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CUSTOM PLYWOOD SITE PHASE II
INTERIM REMEDIAL ACTION
ANACORTES, WASHINGTON

JETTY SECTIONS

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	**C6.1**
SHEET NO.	**X** OF **X**

30% CONCEPTUAL DESIGN

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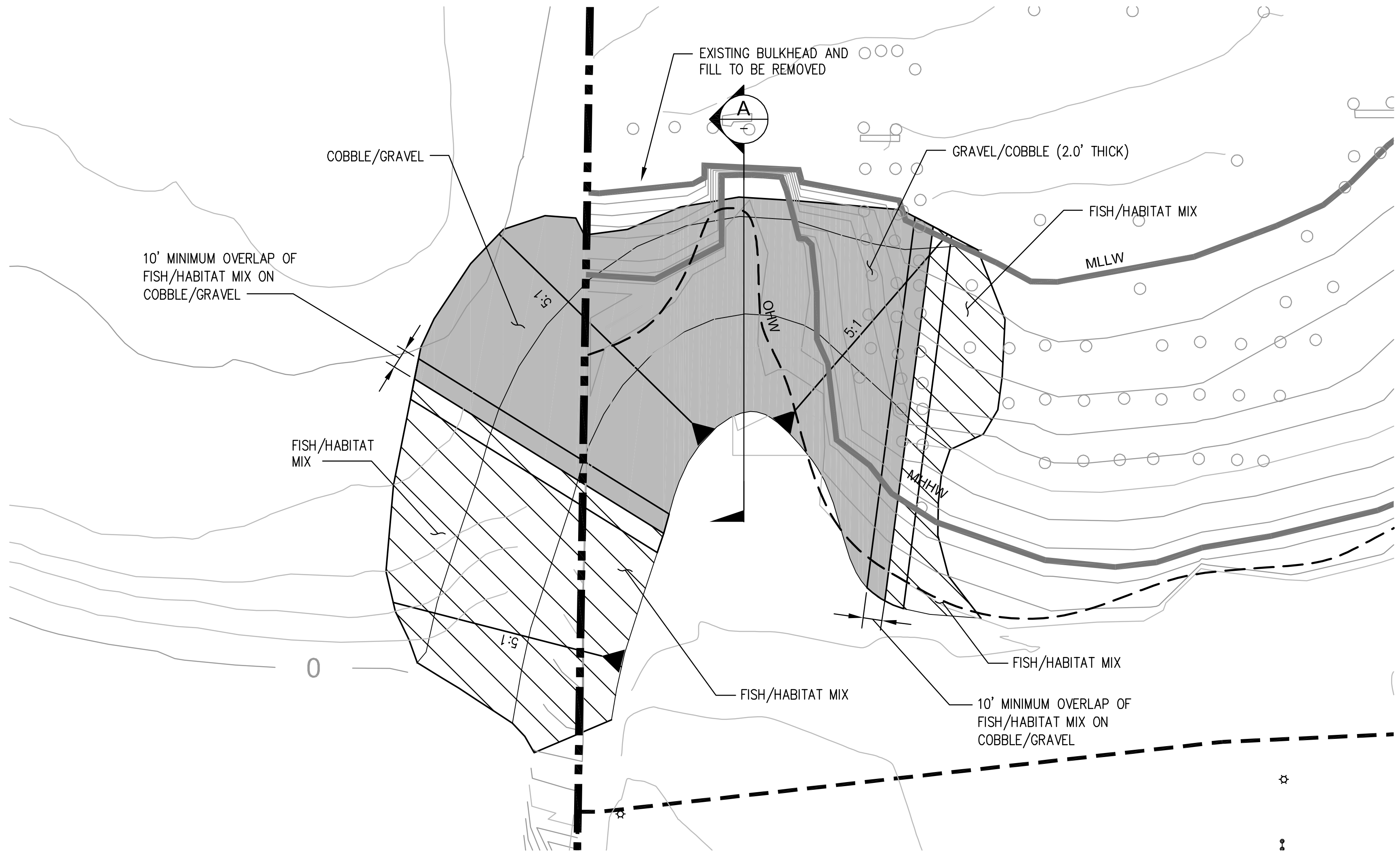
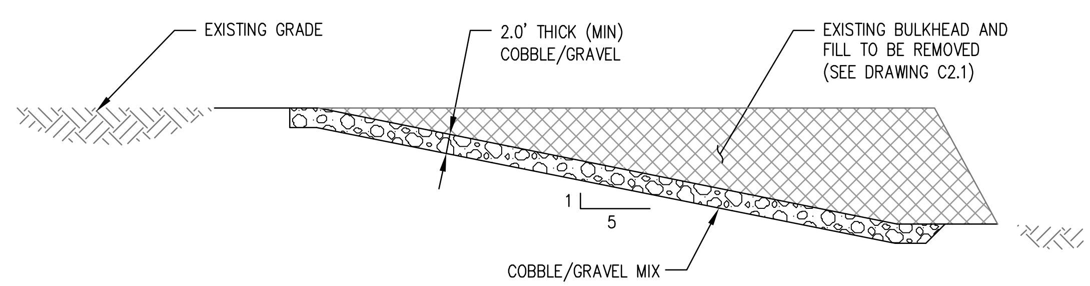


BULKHEAD HABITAT GRADING PLAN
1"=20'



A – **SECTION**
SCALE: 1"=10'

NOTES:

1. COBBLE/GRAVEL:
   CLEAN NATURALLY OCCURRING, ROUNDED GRANULAR MATERIAL (RIVER RUN OR PROCESSED GLACIAL OUTWASH DEPOSITS) FREE FROM WOOD WASTE AND OTHER EXTRANEOUS OBJECTIONABLE MATERIALS AND SHALL HAVE SUCH CHARACTERISTICS OF SIZE AND SHAPE THAT IT WILL MEET THE FOLLOWING REQUIREMENTS FOR GRADATION:

SIEVE SIZE	PERCENT PASSING
8"	100%
6"	80–95%
4"	35–55%
2"	20–35%
1"	15–30%
0.375"	5–20%

ALL PERCENTAGES BY WEIGHT

2. FISH/HABITAT MIX:
   CLEAN NATURALLY OCCURRING, ROUNDED GRANULAR MATERIAL (RIVER RUN OR PROCESSED GLACIAL OUTWASH DEPOSITS) FREE FROM WOOD WASTE AND OTHER EXTRANEOUS OBJECTIONABLE MATERIALS AND SHALL HAVE SUCH CHARACTERISTICS OF SIZE AND SHAPE THAT IT WILL MEET THE FOLLOWING REQUIREMENTS FOR GRADATION:

SIEVE SIZE	PERCENT PASSING
2" SQUARE	100%
1½" SQUARE	80–95%
¾" SQUARE	50–80%
US NO. 4	30–50%
US NO. 200	0–8%

ALL PERCENTAGES BY WEIGHT

LEGEND:

OHW — ORDINARY HIGH WATER (OHW)
MHHW — MEAN HIGHER HIGH WATER (EL +7.55')
PROPERTY LINE
FISH/HABITAT MIX
COBBLE/GRAVEL

N

20' 0 20' 40'
SCALE: 1"=20'

30% CONCEPTUAL DESIGN

Plotted: Aug 08, 2012 – 1:58pm cmathews Layout: C7.0
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ANACORTES, WASHINGTON
BULKHEAD HABITAT GRADING PLAN AND SECTION

DRAWN: KV	PROJECT NO.: 112110
DESIGN: TZ	SCALE: AS SHOWN
CHECKED: NW	DATE: AUG 15, 2012
DRAWING NO.	C7.0
SHEET NO.	X OF X

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APPENDIX D
HYDRODYNAMIC MODELING AND COASTAL ENGINEERING DESIGN REPORT

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COAST & HARBOR ENGINEERING

Technical Memorandum – DRAFT FINAL

Custom Plywood Mill Site Cleanup Project
Phase II In-Water Structures: Basis of Design

1. Introduction

This Technical Memorandum briefly summarizes the input data, coastal engineering analysis, design criteria, and basis for the preliminary design conducted by Coast & Harbor Engineering, Inc. (CHE) for the former Custom Plywood Mill Site Cleanup Project, Phase II. The information herein was developed at the request of Hart Crowser (HC) to support the preliminary Phase II design and permitting. The coastal engineering analysis and design was limited to the jetty extension, fish passage, habitat mix along the jetty, fish passage, beach restoration, channel (breach through existing temporary berm), and shore stabilization at the southern end of the project near the existing park/trail access. The recommendations presented herein are developed at a preliminary level and shall be revised and optimized as appropriate during final engineering design.

2. Data and Assumptions

2.1. Eelgrass

An existing eelgrass boundary was provided by HC and the design constrained to avoid impacts to existing eelgrass, where possible. One exception was a small patch of eelgrass near the proposed spit that was allowed to be impacted by the spit footprint per instructions from HC.

2.2. Bathymetry and Topography

Site bathymetry and topographic survey contours were provided by HC. Other supplemental bathymetric and topographic data that were applied included hydrographic survey by NOAA, the existing DEM for Fidalgo Bay, and aerial LiDAR data. All elevations herein reference MLLW.

2.3. Water Levels

According to HC, mean higher high water (MHHW) is equal to 8.2 ft above mean lower low water (MLLW) at the project site. Ordinary High Water (OHW) is 9.2 ft above MLLW. The analysis considered the range of normal tidal conditions.

2.4. Wind

Wind statistics are based upon previous statistical analysis of long-term winds measured at Bellingham Airport from the years 1973 to 2010. Comparative analysis of nearby short-term wind stations at Padilla Bay Farm and Weaverling Spit confirm and validate the use of the long term record at Bellingham Airport for developing wind speed return periods (CHE 2011). The predominant and strongest winds are from the south-southeast, with strong winds also from the northeast sector. Table 1 presents the return period wind speeds by wind sector. The 25- and 50-year speeds and directions were applied as input to the numerical wave model to develop design wave conditions.

Table 1. Design Wind Speed and Return Period by Sector

Return Period (Year)	Sector Wind Speed (mph)		
	NE	E	SE and S
25	43.0	31.7	46.3
50	45.5	38.4	48.9

3. Wave Analysis

3.1. Methodology

Wave conditions at the site were developed based upon numerical wave modeling of the design wind speeds from the northeast through the south sectors. A large-scale numerical wave model domain that was compiled in a previous analysis by CHE was incorporated into the Feasibility Study (HC 2011). The numerical model SWAN was applied to the large-scale domain to simulate wind-wave growth and propagation for the design wind from the directions 25° through 180° for water levels ranging from MLLW to MHHW.

The SWAN modeling results for the critical wind direction cases were extracted near the project site and applied as a boundary condition for a local scale HWAVE model of the immediate project vicinity. The HWAVE model was applied to simulate the local scale effects of diffraction, refraction, and reflection for the existing and proposed project features.

3.2. Results

As documented in the previous CHE analysis, the northeast fetch across Fidalgo and Padilla Bay is long and the bathymetry is relatively deep. Based upon the SWAN modeling results, the largest storm waves reaching the project site are generated by strong winds from this northeast sector. Figure 1 shows an example of the modeling results (wave heights and periods) over the modeling domain for 25-year storm wind speeds from the northeast direction for existing conditions at MHHW. The figure illustrates wave direction of propagation (arrows) and colors provide wave height in meters.

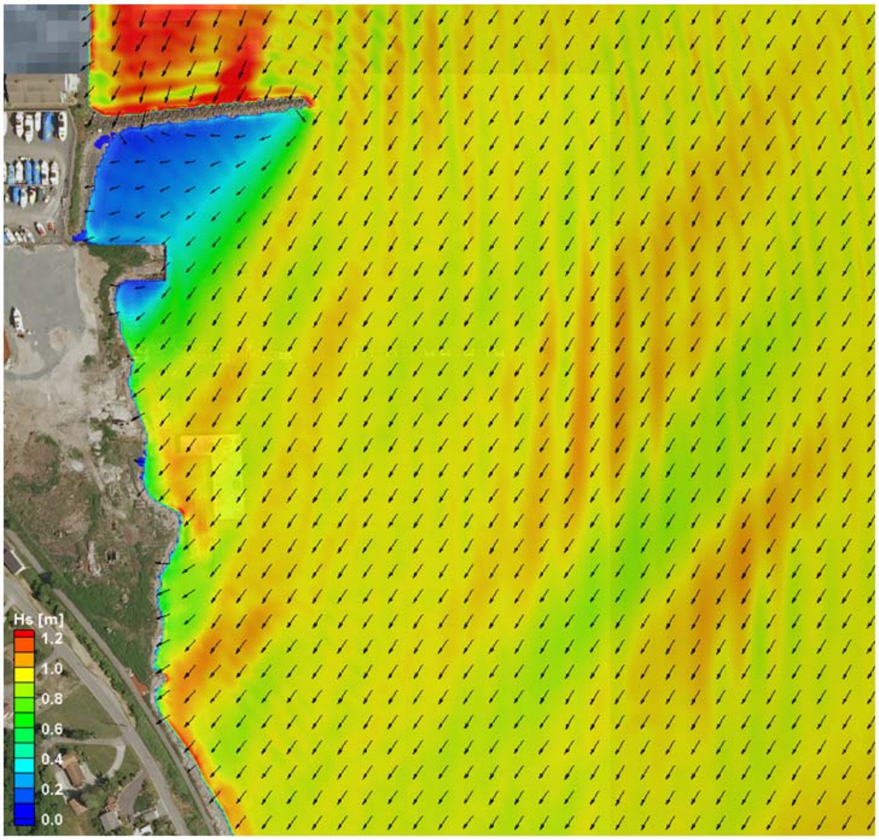

Figure 1. 25-year waves from NE for existing site conditions at MHHW

Due to limited fetch and water depth, wind from the south and southeast do not generate waves as large as those from the northeast. Still, the storm waves from the south were modeled and their effects considered in the preliminary project design.

It is noted that water levels at Fidalgo and Padilla Bay affect wave conditions at the project site. Larger waves are able to develop and propagate to the site as the tide level increases; this is particularly distinct for waves approaching from the south and southeast sector where the Bay is very shallow[1].

4. Preliminary Design

The following section summarizes the basis of preliminary design for the various in-water project features designed by CHE. It is emphasized that while the design elements are discussed separately for clarity, the analysis and design considered all the features acting together as a single design. Therefore, any modifications to the elements described herein

[1] Therefore, to satisfy stability of beach sediment and armor material wave numerical modeling was conducted at different water elevations and conservative results were applied as the design criteria.

must consider and evaluate the impacts on other design elements. The preliminary design drawings, as requested by HC, are provided as Appendix A.

4.1. General Criteria

The design criteria were developed and optimized based upon the previous hydrodynamic modeling and coastal engineering analysis documented in previous CHE technical memorandums (CHE 2010) as incorporated in the Feasibility Study by HC. It is understood that the project is intended to restore functional habitat while providing a cap of contaminated materials that may remain on site after the cleanup. The following general design criteria were applied herein:

- For dynamically-stable features (those features except for the rock jetty extension) the 25-year return period wave conditions at MHHW were considered for the design.
- For design of the extended jetty structure, 50-year return period wave conditions at MHHW were considered for design of the slopes and materials required for jetty static stability using standard coastal engineering methods from the Coastal Engineering Manual (USACE 2003).

To determine the size, type, and distribution of the dynamic habitat features, wave conditions along the project site were applied to compute bottom velocity distribution and bottom shear stresses. From this analysis, the preliminary gradations (particle sizes) for various project elements were designed, as described in subsequent sections of this report.

4.1.1. Jetty Extension and Fish Passage

The jetty extension and fish passage were designed to protect the restored project site against waves from the northeast and allow the passage of juvenile salmonids between the existing rock jetty and extended rock jetty. Therefore the design is prepared to balance the need to allow the passage of fish, while reducing the amount of wave penetration through the fish passage into other areas of the project.

4.1.2. Jetty Extension

The jetty length and alignment were established based upon numerical wave modeling results and to avoid filling atop existing eelgrass areas. The jetty crest elevation of 13.0 ft MLLW was selected to match the existing jetty and nominal crest width set, based upon the stable median rock size for the jetty. Armor rock for the jetty was sized using standard methods in the Coastal Engineering Manual (USACE 2003) for stability against the 50-year design wave from the northeast occurring at MHHW. Water levels one to two feet above MHHW were also checked for design sensitivity, but for the design conditions from the northeast these increases in water depth had little effect on the design rock size. Based upon the analysis and design experience at similar sites at Fidalgo Bay, a median rock weight of 800 pounds with corresponding median diameter (D_{50}) of approximately 2.0 ft was selected for preliminary design of the jetty.

To minimize the overall footprint, the north-facing jetty slope was set at 2:1(H:V), with a slightly steeper (1.5:1) slope on the south-facing side (more sheltered) of the breakwater. Other design details for the jetty are shown in the preliminary drawings in the Appendix. Incorporation of the fish passage into the jetty design is discussed below.

The estimated volume of fill for the preliminary jetty and fish passage (described below) is approximately 8,250 cubic yards (CY). Excavation is not anticipated and this volume does not include fish mix along the existing jetty.

4.1.3. Fish Passage (Juvenile Salmon Corridor)

Engineering design criteria for the fish passage provided by HC included a bottom elevation of 2.0 ft MLLW with no minimum width. Based upon the size of the preliminary armor rock and upon results of wave modeling, conducted to minimize the wave penetration through, the fish passage design was developed with a minimum width of 6 ft at elevation 2 ft MLLW. Due to the jetty side slopes, the effective width of the passage increases as the tide level rises above 2.0 ft MLLW. The length of the fish passage (measured in the assumed direction of fish travel) is approximately 40 ft.

4.1.4. Habitat Mix along the Jetty

To provide habitat enhancements along the south side of the existing and extended jetty, CHE evaluated the location, configuration, and gradation of appropriate habitat materials. For the jetty extension, establishment of beach slopes and grades suitable for habitat mix gradations (2-inch minus) is not recommended due to the geometric constraints (deep water and proximity to the fish passage), and the likely migration of placed materials into the fish passage by southerly wave action. If habitat materials are placed on the south side of the jetty extension, this should be only to fill voids in the jetty armor rock. It is noted that these materials will not be stable for the steeper slopes of the breakwater, and may be worked by waves deposited in the deeper water areas at flatter slopes over time.

Habitat mix placed within the fish passage itself would be relatively dynamic and unlikely to remain stable due to wave interaction with the jetties. However, to the west of the fish passage, it is feasible and recommended to place sloped habitat compatible materials along the south side of the existing jetty. Such habitat materials would be to fill voids in the existing jetty and should be placed at slopes capable of sustaining such materials. Placement at grades no steeper than 5:1 (H:V) is recommended. The habitat materials will then be naturally distributed and graded by the local wave and tide conditions.

The fish mix graduation would be clean, naturally occurring, rounded granular material (river run or processed glacial outwash deposits), free from wood waste and other extraneous objectionable materials, and shall have such characteristics of size and shape that it will meet the following requirements for gradation:

Table 2. Preliminary Fish Mix Gradation

Sieve Size	Percent Passing
2” square	100
1 1/2” square	80 to 95
3/4” square	50 to 80
U.S. NO. 4	30 to 50
U.S. NO. 200	0-5

Note: All percentages are by weight.

4.1.5. Pocket Beach

Placement of fish mix (see Table 2) would continue along the south side of the jetty, meeting the existing rock/rubble beach to the west where the jetty joins the existing uplands. In this sheltered pocket beach area, the same fish mix in Table 1 should be placed at a minimum thickness of 2 ft to cover the existing rubble materials. The pocket beach materials would transition to the more stable (more exposed) headland materials, as shown in the drawings in Appendix A, and described below.

4.1.6. Headland

The existing deteriorated concrete bulkhead is to be removed and replaced with a dynamically stable cobble headland joining the pocket beach to the northwest with restored beaches to the south. Engineering design criteria for the headland required that no modifications be made to upland areas already remediated in Phase I, per HC instructions. The existing bulkhead area would be re-contoured with a combination of excavation, fill, and site grading to achieve an intertidal cobble beach headland, as shown in the drawings in Appendix A. The design grades will smoothly transition from the pocket beach to the northwest and the restored beach to the south to allow the natural redistribution of placed beach materials after construction. The fish mix on either side of the headland should overlap on top of the cobble/gravel materials to form a smooth transition.

Because the headland will be subject directly to waves from the northeast moving through the proposed fish passage, a cobble/gravel mixture gradation 5:1(H:V) is recommended. The cobble/gravel gradation shall be clean, naturally-occurring, rounded granular material (river run or processed glacial outwash deposits) free from wood waste and other extraneous objectionable materials, and shall have such characteristics of size and shape that it will meet the following requirements for gradation:

Table 3. Preliminary Cobble/Gravel Gradation

Sieve Size	Percent Passing
8”	100
6”	80 to 95
4”	35 to 55
2”	20 to 35

Sieve Size	Percent Passing
1”	15 to 30
0.375”	5-20

Note: All percentages are by weight.

The volume of cobble gravel material for formation of the head land is estimated at approximately 725 CY. The volume of fish mix material for formation of the headland at the pocket beach is estimated at approximately 425 CY.

4.1.7. Restored Beach

The restored beach consists of two segments: 1) between the headland and spit; and 2) south of the new spit to the shoreline stabilization area. According to the design by HC, due to the presence of contaminants the existing beach within approximately 50 ft seaward of OHW (9.2 ft MLLW) will be removed to a depth of 6 ft below existing grades. After removal, clean beach-compatible materials would then be placed and graded to restore the existing beach grades.

CHE design of the beach material gradation and locations of placement was based on analysis of locale geomorphic conditions and computed (modeling) wave shear stresses during design storm events, both from north and south directions. The dynamically stable beach particle size was determined to correspond to a fish mix type of material. For consistency with other elements of the project, the gradation of the restored beach material is the same as that recommended and described above in section “Habitat Mix Along the Jetty” and shown in Table 2 above.

4.1.8. Spit

The spit is designed to shelter the future restored shoreline from wave action that will increase at the shoreline, relative to existing conditions, when in-water pile structures are removed as part of the project cleanup action. Based upon direction from HC, the spit crest elevation was constrained to be no higher than MHHW. The spit geometry with relatively flat slopes is designed to be dynamically stable and is expected to adjust slightly to local wind and wave conditions, up to the design storm conditions, without substantial loss of spit materials. The spit extends out to approximately the inshore limit of existing eelgrass, and only a small patch of eelgrass near the proposed spit may be impacted by the spit footprint.

In consideration of the exposure of the spit to large waves from the northeast and smaller waves from the southeast, the spit gradation was designed to incorporate a range of materials sizes from cobble to fine gravel. Such materials will minimize negative impacts of sediment transport onto nearby eelgrass beds located offshore of the proposed spit toe.

The recommended gradation is the cobble/gravel gradation provided above in Table 3 for the headland. On the south side of the spit, fish mix gradation (Table 2) is incorporated as a habitat enhancement along the upper slope, from elevation 6.0 ft MLLW to the crest at 8.2 ft MLLW. Such fish mix material is expected to be dynamic on the spit and will be shaped and distributed along the spit by wave action at high tide.

The estimated volume of fill is 6,250 CY. Note that to complete the spit construction using land-based equipment, the contractor may need to temporarily construct and maintain the spit crest elevation above MHHW to avoid operating construction equipment in the water. CHE expects that the temporary construction footprint would be contained within the design spit footprint. See Appendix A for the geometry of the spit.

4.1.9. Channel

The channel will be excavated through the existing temporary beach berm and restored beach to provide tidal exchange between Fidalgo Bay and the new pocket estuary created in Phase I construction. Based upon the Phase I as-built drawings, the tidal prism of the estuary is estimated to be approximately 7,400 cubic feet with an inundated area of slightly less than 0.2 acres at MHHW. Some slight additional inundated area and tidal prism is provided within the constructed storm water channel upstream. Based on the relatively small tidal prism and observation of similar-sized estuary features at Fidalgo Bay, the constructed channel bottom width of 5 ft is recommended at an elevation of 6 ft above MLLW. To minimize infilling of the channel from the south waves, the cobble/gravel gradation (Table 3) is recommended on the south channel side slope, and on the north channel side slope the fish mix gradation (Table 2) may be placed. See Appendix A for the geometry of the channel.

4.1.10. Shore Stabilization at South End

The shoreline at the southern end of the project is actively eroding due to the combined action of waves and tides. Figure 2 indicates the active erosion taking place, illustrated by the vertical scarp (2 to 4 ft high) present in the photograph. The materials being eroded from the uplands appear to be from historic fills, not natural beach materials. Note that a significant amount of concrete rubble, scattered large rock, and driftwood are present along this eroding area, apparently providing little protection to the upland areas. Therefore, without action it is expected that these areas would continue to erode landward.

Based upon analysis of wave conditions and observations of existing trends, a shoreline erosion protection measure is recommended by providing a cobble stabilized shoreline fill with a small berm, extending from +11.0 ft MLLW elevation at 5:1 (H:V) and embedded down into the seaward beach below the existing grades. The relatively flat design slope will allow for the imported, clean placed fish mix materials to be placed seaward and mix with the stabilized slope by natural wave action and sediment transport. This will provide a smooth transition to the beach, while maintaining protection of the shoreline up to the 25-year design storm event.

Figure 2. Erosion evident along shoreline at south end of project

Given the exposure of the eroding area and desire to reduce shoreline erosion, a stable coarse cobble gradation is recommended along the eroding area, approximately 100 to 125 ft in total length. Similar material was used for construction of the temporary berm along the wetland area. The preliminary coarse cobble gradation shall be clean, naturally-occurring, rounded granular material (river run or processed glacial outwash deposits) free from wood waste and other extraneous objectionable materials, and shall have such characteristics of size and shape that it will meet the following requirements for gradation:

Table 4. Preliminary Large Cobble Gradation

Sieve Size	Percent Passing
18"	100
12"	60 to 95
8"	35 to 65
4"	20 to 40
1"	0 to 20

Note: All percentages are by weight.

It is possible that the material obtained upon lowering the elevation of the temporary berm (to OHW) would be reused for construction of coarse cobble shoreline protection at the south end of the project. The estimated volume of fill of the large cobble gradation is approximately 300 CY.

5. References

CHE. May 12, 2011. Former Custom Plywood Mill Site Cleanup Project Verification of Wind-Wave Design Criteria. Technical Memorandum.

Hart Crowser. September 2011. Final Feasibility Study Report for Interim Action Work Plan Custom Plywood Site Anacortes, Washington. Report prepared for WA State Department of Ecology.

USACE. 2003. Coastal Engineering Manual. U.S. Army Corps of Engineering, Washington, D.C.

Appendix A

Preliminary Design Drawings

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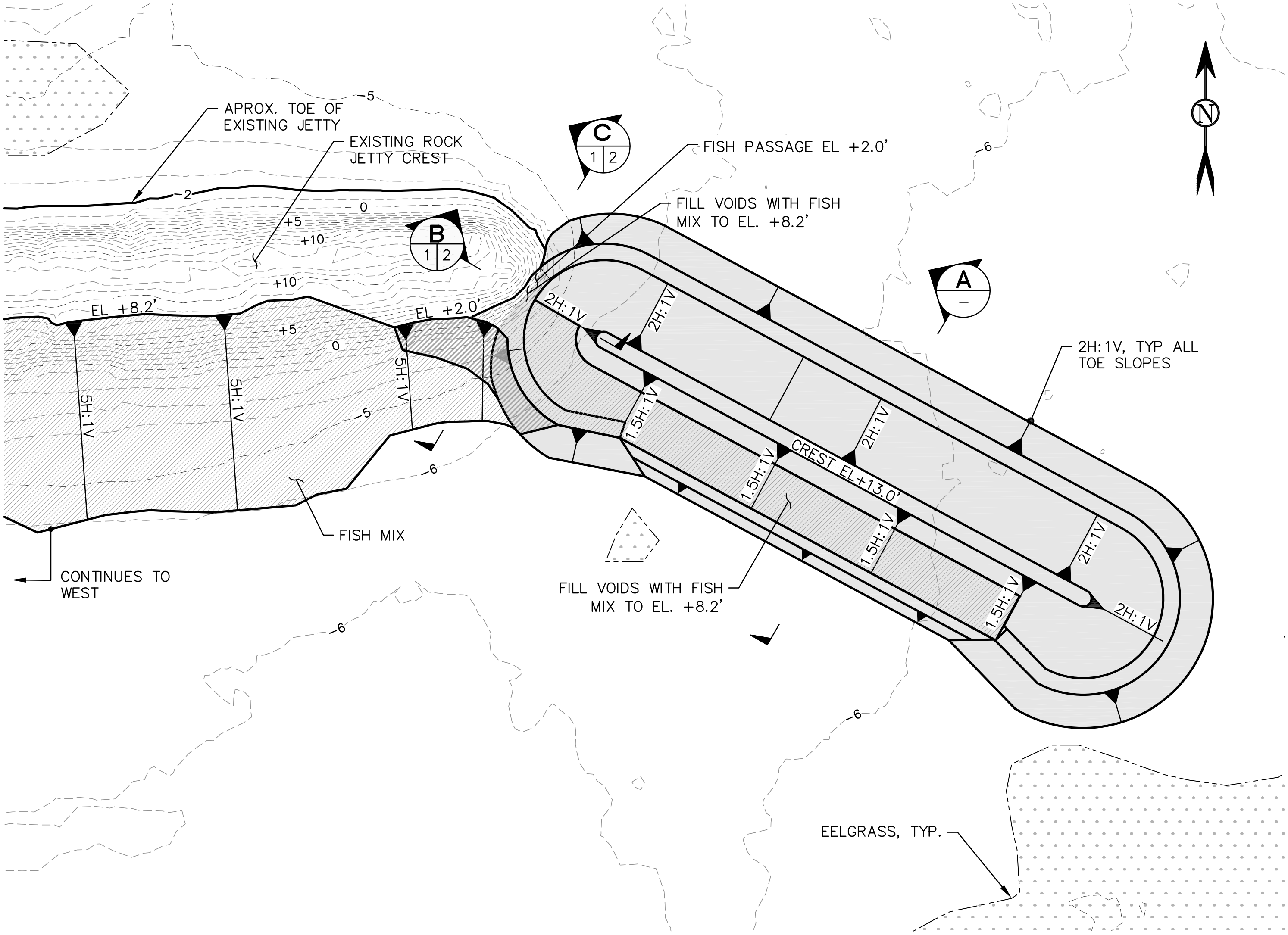

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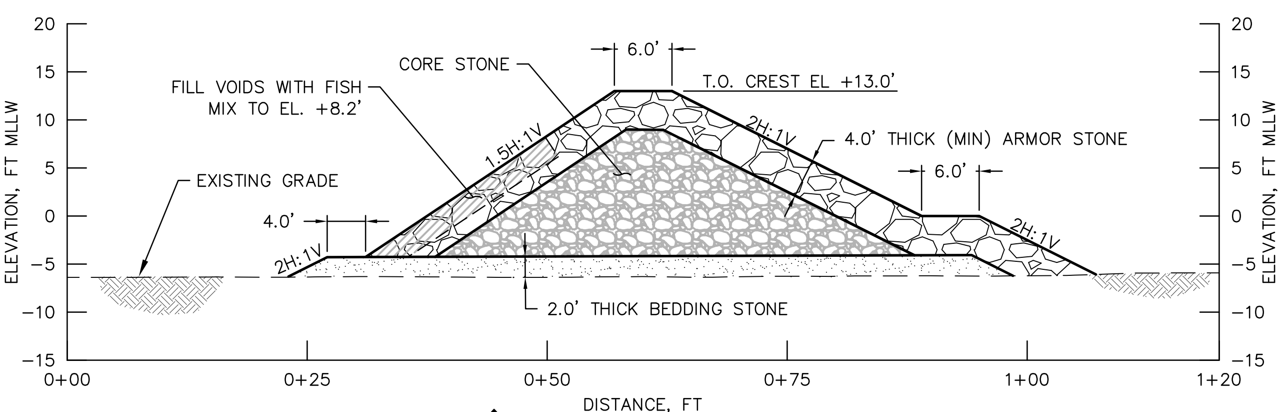

A – SECTION

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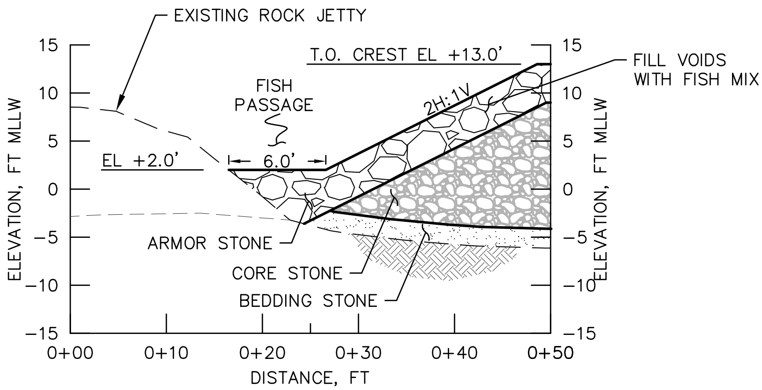
JETTY PLAN AND SECTION



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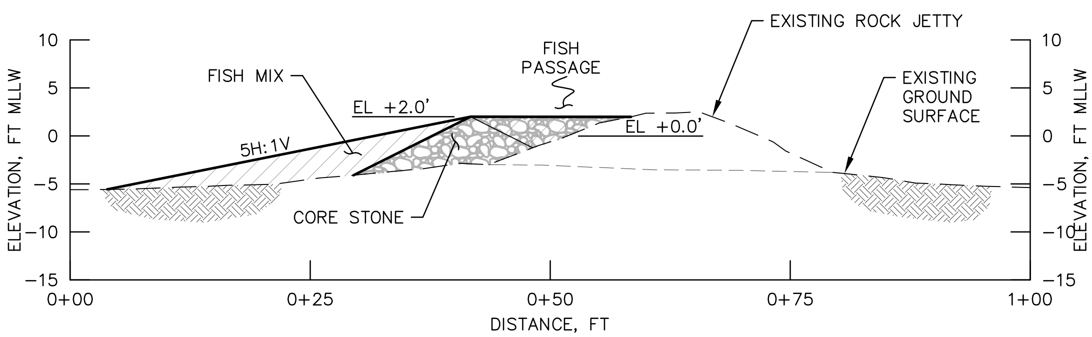

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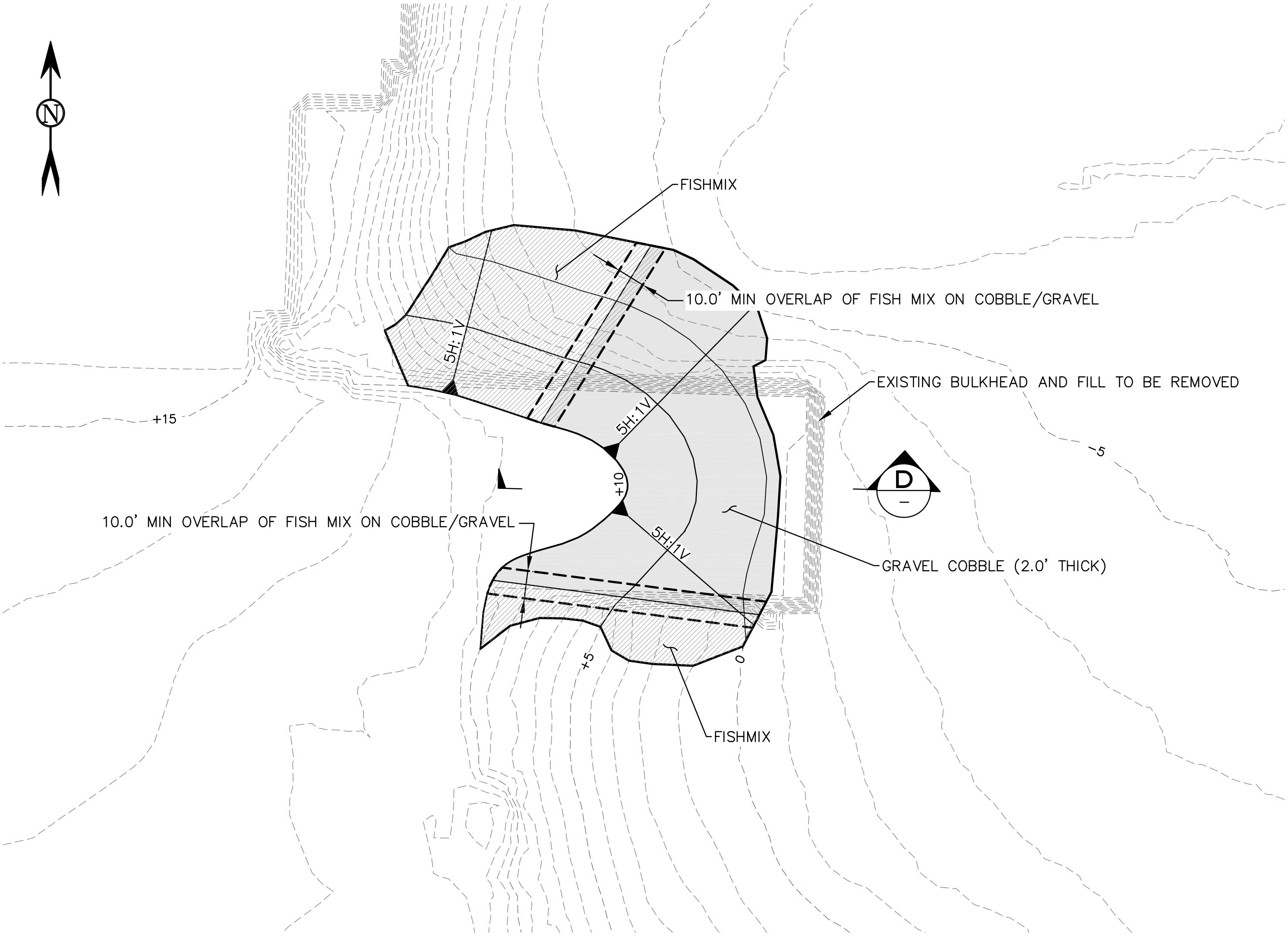

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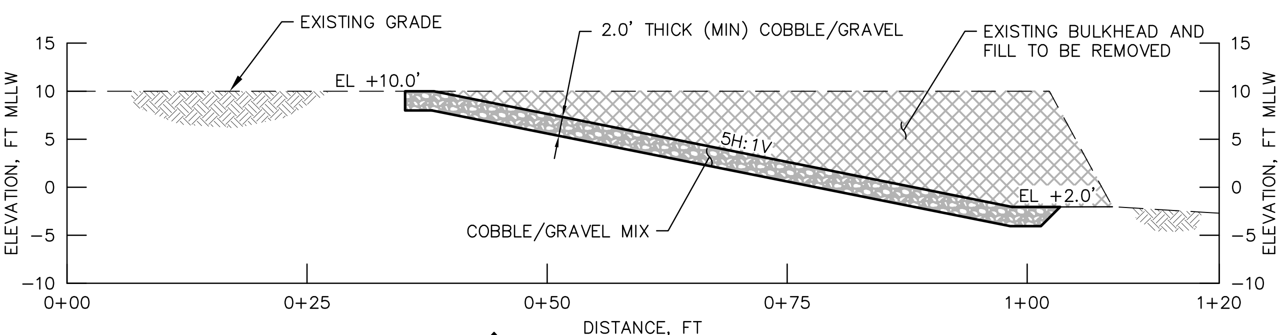

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HEADLAND

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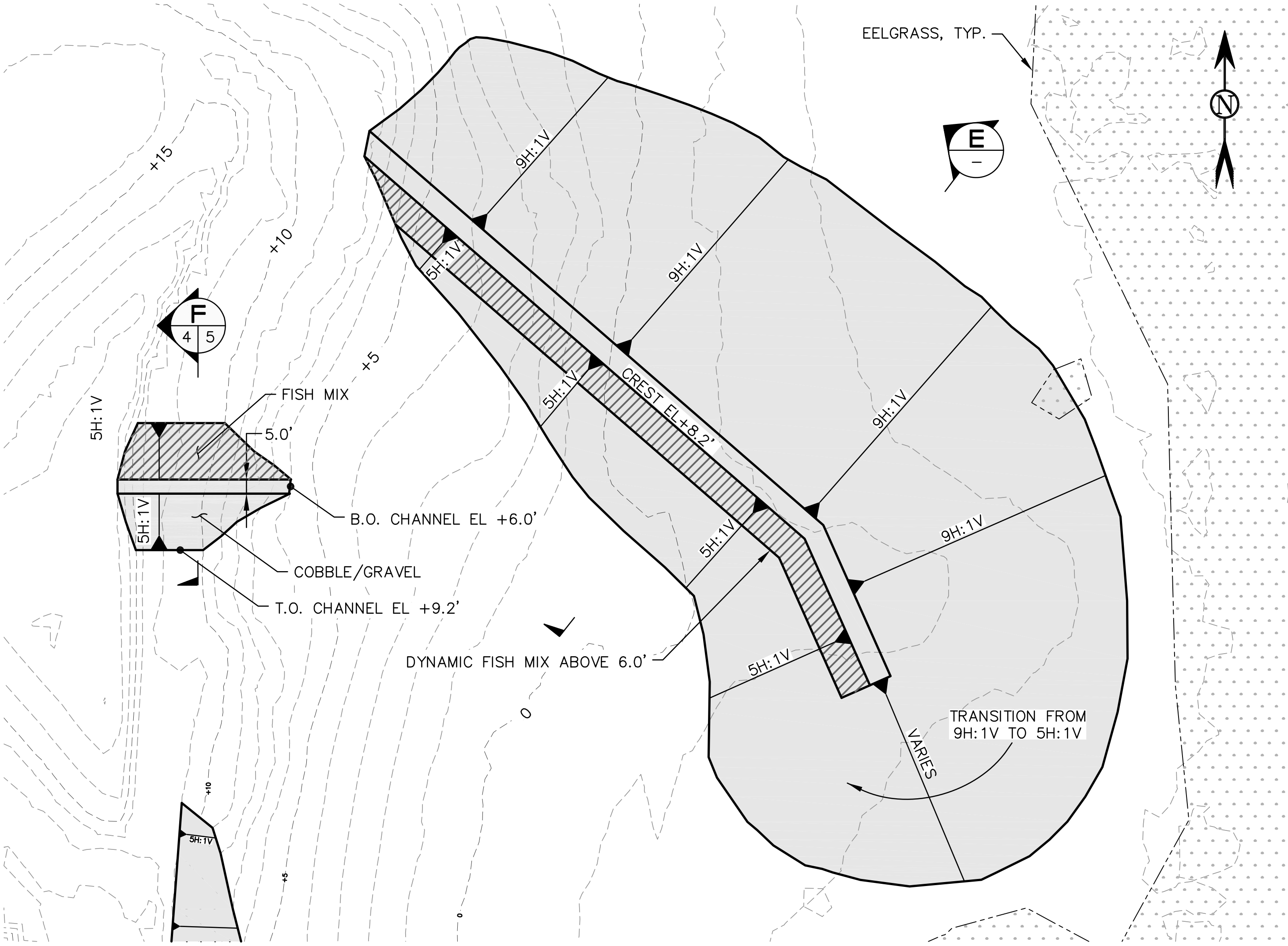
HEADLAND PLAN & SECTION



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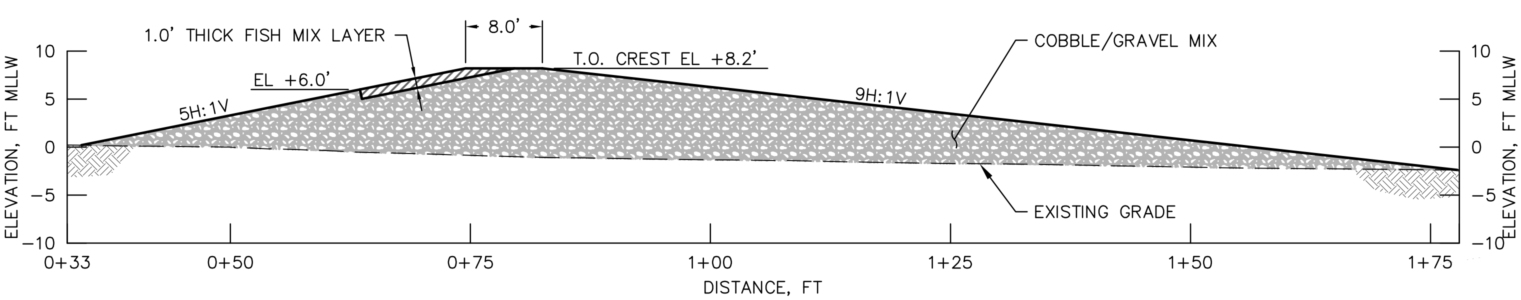

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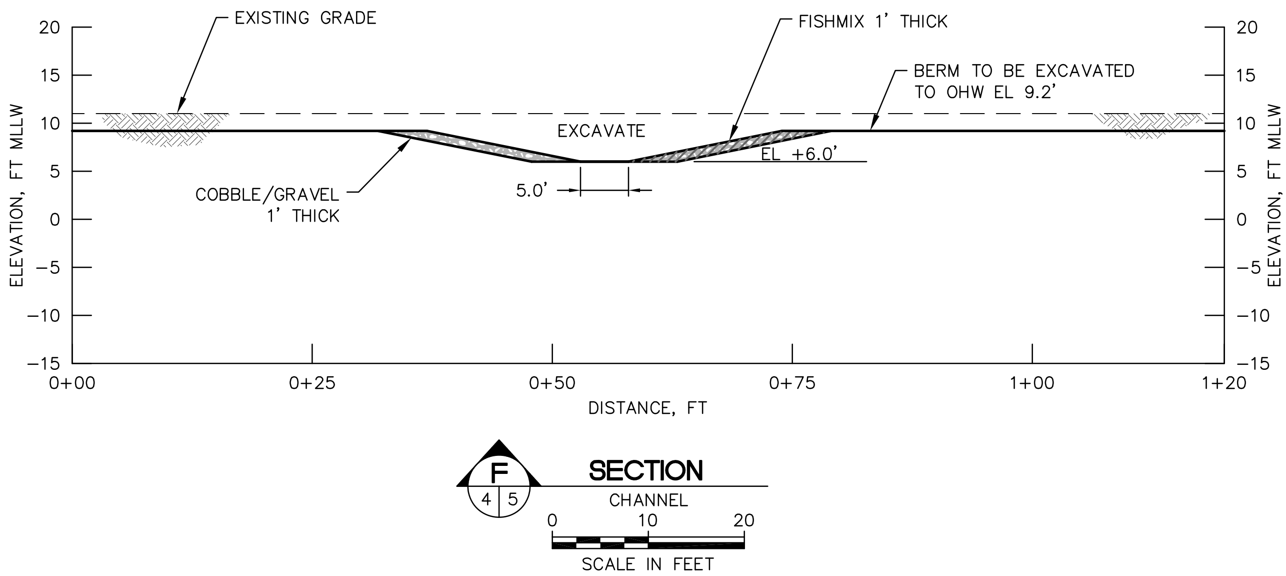
SPIT PLAN AND SECTION



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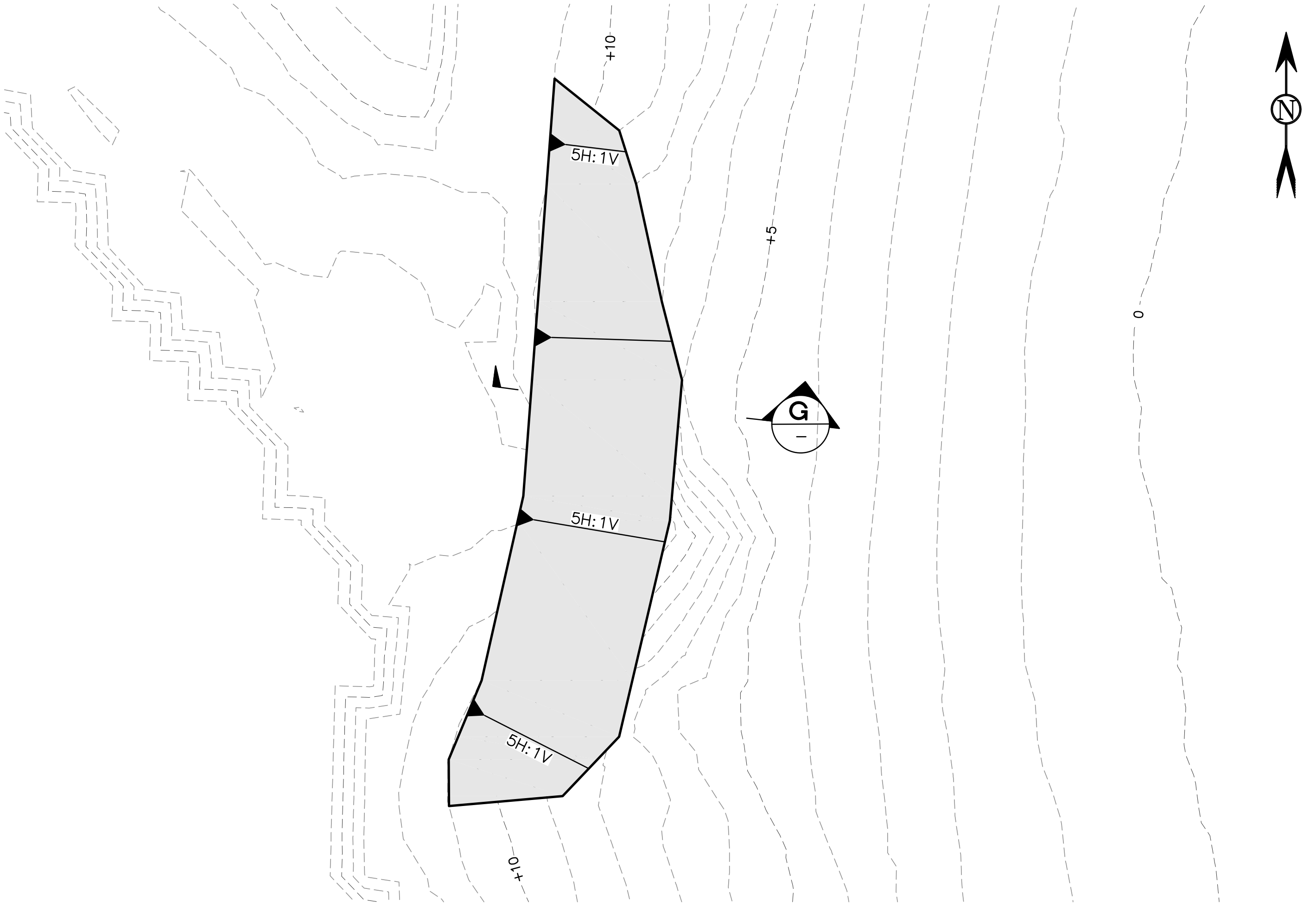
CHANNEL SECTION



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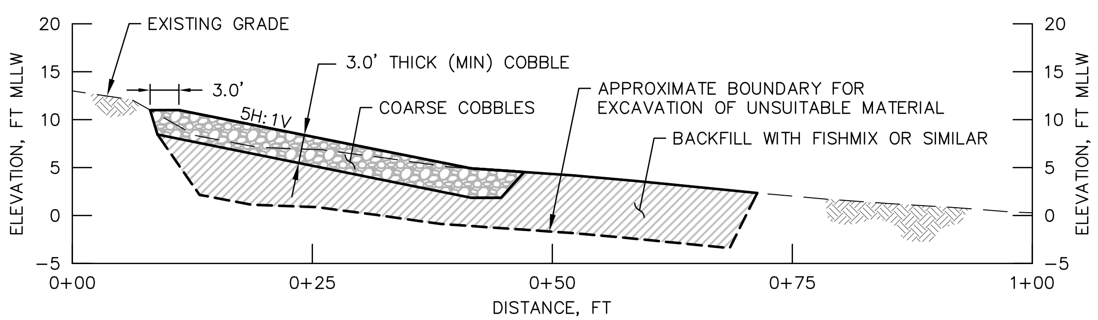

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