

**APPENDIX G**  
**Shoreline Habitat Survey**

DRAFT

# PORT OF EVERETT: WEYERHAEUSER MILL A CLEANUP PROJECT

## BASELINE EELGRASS AND SHORELINE HABITAT SURVEY

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FEBRUARY 3, 2023



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# 1 INTRODUCTION

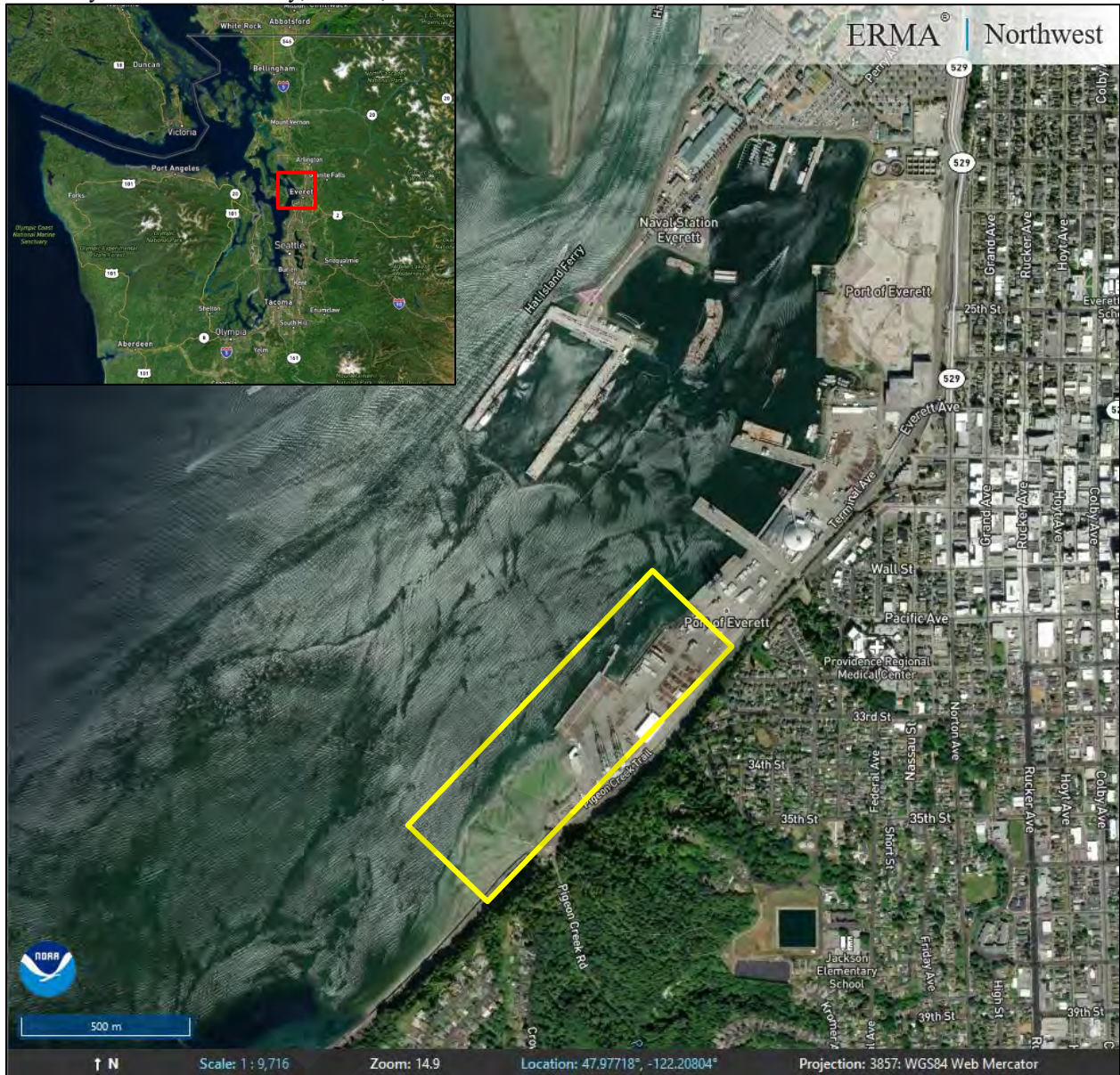
The Port of Everett Weyerhaeuser Mill A Cleanup Site (Site) is located along the waterfront of the East Waterway of Port Gardner Bay, at 3500 Terminal Avenue in Everett, Snohomish County, Washington 98201 (Figure 1). The Site is adjacent to the South Terminal in the Port of Everett (Port) and is currently a developed industrial property, providing a docking station and wharf/berth for large ships to load/unload materials. The Site encompasses approximately 13 acres of uplands with multiple buildings, container cranes, paved concrete deck, transit shed, and paved yard space for heavy equipment to traverse and temporarily store/transport container cargo from ships. Historically this property was used as a sawmill and pulp mill starting in the 1890s, but has also been used for: ship building, saw milling, shingle milling, pulp manufacturing, and log handling (Ecology 2012). The adjacent Site is currently contaminated, partially due to the waste materials when this property was a sulfite pulp mill (Ecology 2012). In 1980, all pulp manufacturing operations came to a close and the Port purchased the property in 1983 and converted it into a break bulk container cargo handling facility still being used today.

The Site is currently under an Agreed Order (AO) by the Washington State Department of Ecology (Ecology) to provide for remedial action. The AO requires the Port, Weyerhaeuser, and the Department of Natural Resources (DNR), who are currently the collectively identified Potentially Liable Persons (PLPs) to conduct a Remedial Investigation and Feasibility Study (RI/FS) addressing both potential upland and in-water contamination for the Site.

As part of the technical support of the Weyerhaeuser Mill A Cleanup Project (Project), Grette Associates (Grette) completed a detailed baseline assessment of the habitat conditions at the Site. The baseline assessment consisted of a shoreline habitat survey and a diver-based survey.

This report describes the results of a shoreline habitat survey and a diver-based survey which were conducted in September 2022. The purpose of the shoreline survey was to document the existing habitat conditions (primarily vegetation, slopes, and substrates) between the aquatic and upland portions of the Site. Diver-based SCUBA surveys were completed in addition to the shoreline assessment to inspect the Site for eelgrass (*Zostera marina*) and determine its distribution and density if present, and to identify the types of macroalgae, substrates, and debris present in the underwater portions of the Site. The details in this report will serve as the baseline biological conditions for the Site, to assist with the design and permitting of the Cleanup Action Plan for the Project. Copies of the shoreline survey data sheet, eelgrass survey data sheets, eelgrass transect coordinates, substrate and macroalgae survey data sheets, and additional Site photographs are in Appendices A – E respectively.

**Figure 1. Location of the Port of Everett Weyerhaeuser Mill A Cleanup Site**, with the red box indicating the general Site location in the NW portion of Washington, and the yellow box indicating the Site location within the East Waterway of Port Gardner Bay, Everett, WA.



## 2 SHORELINE HABITAT SURVEY

### 2.1 BACKGROUND

On September 7, 2022, Grette biologists completed a shoreline habitat survey to assess the existing shoreline habitat conditions of the Site in Everett, WA. The shoreline survey was primarily focused on recording the vegetation, substrate types and extents, slopes, and structural characteristics of the Site that were visible above or just below the water level at the time of the site visit.

### 2.2 METHODS

The entire shoreline was traversed during low tide, with data collected from the boundary of the property line south of Pigeon Creek, to the Pacific Terminal wharf north of the Site (Figure 2). The survey was conducted around low tide, which reached a low of -1.42 ft at 8:57 am on the day of the Site visit. The shoreline was categorized into three primary zones based on uniformities in habitat conditions (Figure 2). Since each zone was relatively uniform in composition, the zones were surveyed individually on foot. Qualitative data were collected within each zone, including: the slope, substrate characteristics (type, shape, and size), habitat structures, debris present, and vegetation present (species and their percent coverage). Additional observations on macrofauna and debris were also recorded.

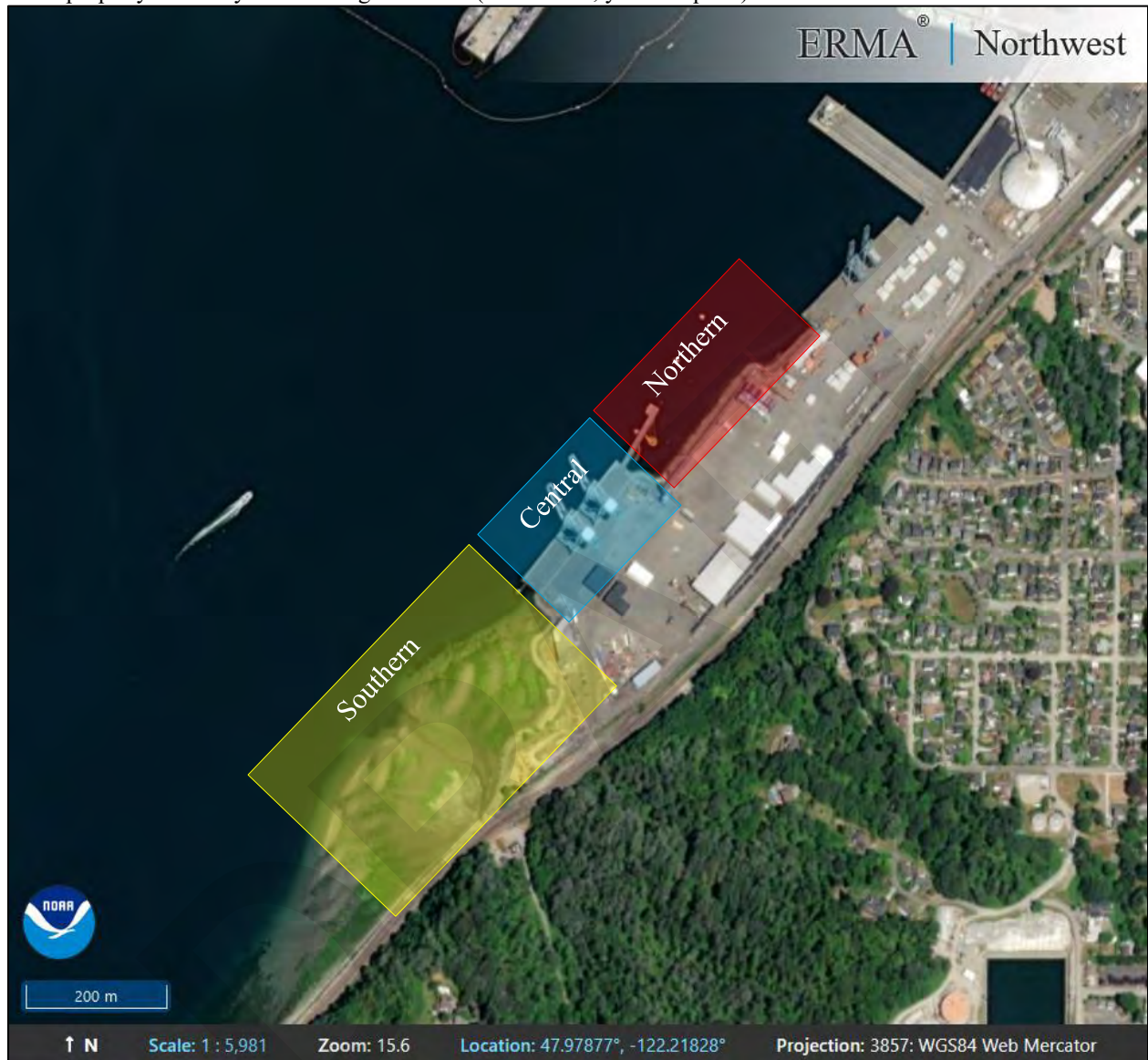
In addition to shoreline characteristics, the Site was traversed to determine if seagrasses were present (specifically eelgrass [*Zostera marina*], and dwarf eelgrass [*Zostera japonica*]) and, to the extent possible, to delineate the boundaries of any eelgrass beds observed. Eelgrass observed on shore was delineated using a Trimble Geo7x differential GPS datalogger. The shoreward most portion of beds that were accessible by foot were also delineated. All GPS coordinates were transferred into AutoCAD LT to determine and map the distribution of eelgrass on Site, then added to base drawings of the Site. Additional eelgrass delineations were completed by Grette biologists via SCUBA on September 26-28, 2022 to determine the full extent of eelgrass beds and underwater conditions within the Project Area (see Section 3).

### 2.3 RESULTS

Three primary shoreline zones were noted on Site based on similarity of conditions (see Figure 2): 1.) the shoreline from the South Terminal wharf to the Pacific Terminal wharf further north, 2.) the shoreline beneath the South Terminal wharf, and 3.) the large sandy mudflat between the South Terminal wharf and property boundary South of Pigeon Creek. These areas will be discussed and referenced to as the “Northern”, “Central”, and “Southern” portions of the Site, respectively. The following results describe the entirety of the shoreline generally above 0 feet Mean Lower Low Water (MLLW). The shoreline survey datasheet is in Appendix A, with additional Site photographs in Appendix E; all shoreline survey photographs were taken on September 7, 2022, during the site visit.



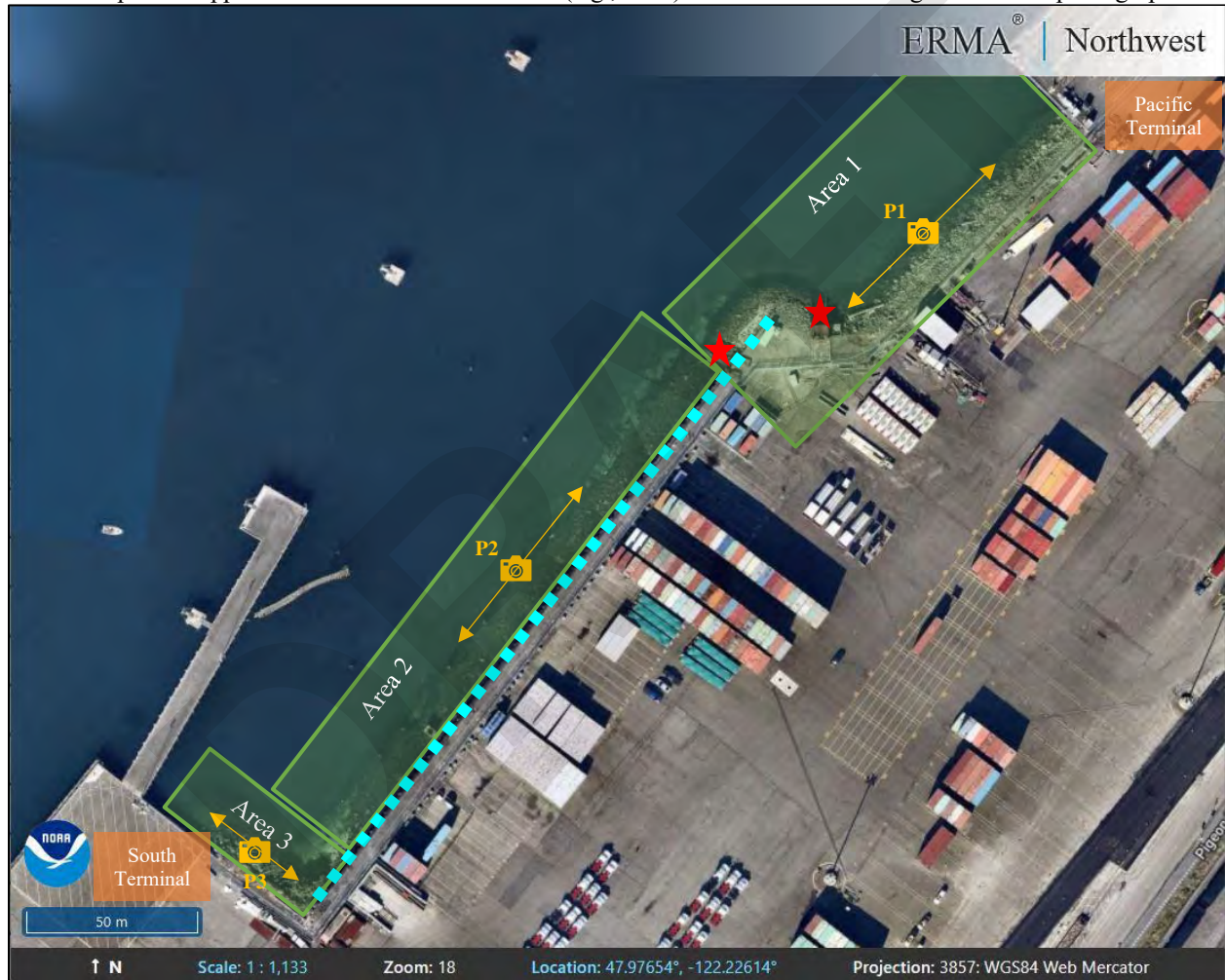
**Figure 2. Location of the Shoreline Habitat Survey, and the zones of the Site.** The three zones include: 1.) the armored shoreline north of the South Terminal (“Northern”, red square), the armored shoreline covered by the wharf of the South Terminal (“Central”, blue square), and 3.) the armored shoreline and mudflats south of the South Terminal to the property boundary south of Pigeon Creek (“Southern”, yellow square).



### 2.3.1 Northern Shoreline Conditions

The following data for the Northern shoreline will be discussed as a whole, and in terms of three (3) areas (Areas 1-3; see Figure 3). Though similar conditions were observed throughout the entire shoreline, the slope angle differs between each area, as discussed below. The total linear distance of this shoreline is approximately 1,200 feet, ranging in width (top of bank to 0 ft MLLW) from 37 to 60 feet, with the exposed shoreline spanning a total of approximately 0.9 acres.

**Figure 3. Northern shoreline conditions** between the South and Pacific Terminals in the Port of Everett. The shoreline is separated into three areas (1, 2, and 3) represented by green boxes, the red stars are the locations of two sets of derelict rails leading down to the waterline, the blue dotted line represents the timber bulkhead, and the yellow cameras represent approximate Photo Point locations (e.g., “P1”) with arrows indicating direction of photographs.



#### 2.3.1.1 Slope and Substrate

The entirety of the Northern shoreline consists of an armored riprap slope, with a mix of smaller materials and substrates. The riprap is composed of large angular rock, typically ranging in size from 2 feet to 5 feet in diameter. Smaller materials intermixed with the large riprap include: small angular rock, quarry spalls, and cobble. A vertical timber bulkhead is present along the upper intertidal shoreline in Areas 2 and 3. At approximately 0 ft MLLW, a distinct break in slope and

substrate is present, where slopes decrease and transition to smaller materials including: gravel, shell hash, and sand.

In Area 1 (Figure 3; The slopes within Area 2 (Figure 3; Photographs 3 and 4) were less steep than in Areas 1 and 3, ranging from 5% to 25%, likely due to the presence of the vertical bulkhead in these areas. The substrate within Area 2 is also generally smaller material than observed in 1 and 3, consisting of an assorted mix of angular rock and quarry spalls. Dominant and subdominant materials range in size from 1 to 48 inches in diameter. A break in slopes and substrates are also present in Area 2 near 0 ft MLLW, where slopes become more gradual and consist of sand mixed with shell hash. Watermarks on the timber bulkhead (visible in Photographs 3 and 4) also indicate that during high tides, this portion of the shoreline is completely inundated.

In Area 3 (Photographs 5 and 6), slopes range from 30% to 50%. The substrate primarily consists of large riprap (ranging from 1 to 6 feet diameter), with subdominant materials including cobble and small angular rock (6 to 24 inches in diameter), and gravel. The break in slope is less evident in Area 3 versus Areas 1 and 2; the rocky slope appears to continue below 0 ft MLLW, and no toe of slope was visible at the time of the Site visit.

Photographs 1 and 2), the majority of the riprap slopes were 45%, with a break in slopes observed near 0 ft MLLW. At this break, slopes became more gradual and materials typically transitioned to smaller sediments like sand and shell hash. Subdominant materials within the large riprap included small angular rock (diameter 2-12 in).

The slopes within Area 2 (Figure 3; Photographs 3 and 4) were less steep than in Areas 1 and 3, ranging from 5% to 25%, likely due to the presence of the vertical bulkhead in these areas. The substrate within Area 2 is also generally smaller material than observed in 1 and 3, consisting of an assorted mix of angular rock and quarry spalls. Dominant and subdominant materials range in size from 1 to 48 inches in diameter. A break in slopes and substrates are also present in Area 2 near 0 ft MLLW, where slopes become more gradual and consist of sand mixed with shell hash. Watermarks on the timber bulkhead (visible in Photographs 3 and 4) also indicate that during high tides, this portion of the shoreline is completely inundated.

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**Photographs 1 & 2. Photo Point 1 in Area 1 of the Northern shoreline** facing northeast (above) towards the Pacific Terminal, and southwest (below) towards the South Terminal; typical conditions. (See Figure 3 for approximate location.)



**Photographs 3 & 4. Photo Point 2 in Area 2 of the Northern shoreline** facing northeast (above) towards the Pacific Terminal, and southwest (below) towards the South Terminal. (See Figure 3 for approximate location.)



**Photographs 5 & 6. Photo Point 3 in Area 3 of the Northern shoreline** facing southeast (above) northwest (below) adjacent to the South Terminal. (See Figure 3 for approximate location.)



### 2.3.1.2 Vegetation

The Site is adjacent to industrial use properties that are highly developed and paved. Overall, the top of the bank of the Northern shoreline is flat and sparsely vegetated with assorted grasses and weeds growing up through cracks in pavement, timber bulkhead, and the uppermost riprap (Photograph 16 and Photograph 17; Appendix E). Some species observed include: English ivy (*Hedera helix*), Himalayan blackberry (*Rubus armeniacus*), and prickly lettuce (*Lactuca serriola*). English ivy and Himalayan blackberry are invasive species and classified as noxious weeds within Washington State.

Within the upper intertidal zone, macroalgae is attached to most of the riprap. Where macroalgae coverage is low, this is typically due to high coverage of barnacles or mussels (Photograph 19; Appendix E). Turkish washcloth (*Mastocarpus papillatus*) is the dominant species in the upper intertidal zone through all three Areas. Generally, this species is most dominant higher in the intertidal, though it continues down into the lower intertidal zone as well. *Ulva* spp. (Photograph 20; Appendix E) becomes more dominant starting at approximately +3 ft to +1 ft MLLW and continuing downslope. Of all Areas, *Ulva* is most prevalent in Area 2, attached to shoreline armoring with coverage in some areas up to 50% (example in Photograph 18; Appendix E). *Ulva* is also present in Area 1; however, Turkish washcloth was more prevalent with a coverage of nearly 20%. Starting at approximately +6 to +7 ft MLLW and above, Turkish washcloth is the most dominant species in Area 2 (percent cover approximately 20%), and is significantly limited by barnacle coverage. Area 3 (Photographs 5 and 6) has the least amount of *Ulva* (percent cover approximately 1%) and Turkish washcloth (percent cover approximately 10%), as it is dominated by barnacles (percent cover approximately 80%).

Eelgrass (*Zostera marina*) beds were observed running parallel to most of the Northern shoreline, starting at approximately -3 ft MLLW. Additional information on eelgrass bed extent is in Section 3.2.

### 2.3.1.3 Additional Observations

Within Areas 1 and 2 small portions of the shoreline display beach-like characteristics. The small beaches typically occur at the base of the riprap slopes near 0 ft MLLW in Area 1 (Photographs 12 and 13; Appendix E), consisting of sand and shell hash. Area 2 has the lowest overall slopes with multiple small beaches (Photograph 23 and Photograph 24; Appendix E), and a large beach adjacent to Area 3 (Photograph 256 and Photograph 26; Appendix E). This large beach within Area 2 consists primarily of sand and shell hash, and extends up to the timber bulkhead.

Various types of debris are present along the Northern shoreline, including: derelict creosote timber piles, rusted metal rails, LWD, and assorted trash. The derelict piles are standing upright in Areas 1 and 2 (Photograph 27 and Photograph 28; Appendix E). LWD is commonly scattered on the upper slopes within Areas 1 and 3 (Photograph 29 and Photograph 30; Appendix E); the gradual slopes of Area 2 are void of LWD. Two sets of metal rails are also present within Area 1 (see locations in Figure 3, and one set of metal rails in Photograph 27; Appendix E).



### 2.3.2 Central Shoreline Conditions

The Central shoreline is completely covered by the pile supported wharf of the South Terminal. When surveying this portion of the shoreline, all observations were restricted to the outer edges of the terminal due to inaccessible conditions including: frequent traffic from large vessels, a small enclosed overhead environment, and steep riprap slopes.

The total linear distance of the Central shoreline is approximately 708 feet. This portion of the armored shoreline consists entirely of a steep riprap slope of large angular rock (ranging from 4 feet to 4 inches in diameter; Photographs 7 and 8). The riprap is almost completely covered in barnacles and mussels, in addition to a large portion of the piles. The steep riprap slope (approximately 50%) continues below 0 feet MLLW. From what is visible, this portion of the shoreline is completely void of eelgrass, macroalgae, and upland vegetation due to decreased light availability from the wharf and frequent traffic from large vessels.

**Photographs 7 & 8. Photo Point 5 in the Southern Shoreline. Central shoreline beneath the South Terminal wharf.** Photographs of the riprap slope beneath the southern edge of the wharf facing North (above), and riprap slope beneath the northern edge of the wharf facing South (below).



### **2.3.3 Southern Shoreline Conditions**

The following data for the Southern shoreline will be discussed as a whole, and in terms of two areas: Area A (northern half of the Southern shoreline, north of Pigeon Creek) and Area B (southern half of the Southern shoreline, including the mouth of Pigeon Creek and continuing

south) (Figure 4). The total linear distance of this shoreline is approximately 1,800 feet, ranging in width (top of bank to 0 ft MLLW) from 70 to 620 feet, with the exposed shoreline spanning a total of approximately 16 acres.

Most of the Southern shoreline is a mudflat, consisting of a mix of soft silt and sand. This mudflat is partially formed as the delta from the input of Pigeon Creek, which enters Puget Sound in this area. Upper intertidal areas include areas of gravel and shell hash. Armored slopes support the majority of this shoreline which is adjacent to developed industrial properties in the Port of Everett, and a railroad track. Photo Points displaying the Site as a whole are presented in Photograph 9 through Photograph 12.

**Figure 4. Southern shoreline conditions** from the South terminal to the property boundary line south of Pigeon Creek (creek entrance onto shoreline noted by the red star). The shoreline is separated into two areas (A and B) represented by green boxes, and the legend describes the primary types of substrates present along the armored boundaries of the shoreline. Approximate Photo Point locations (e.g. “P4”) are indicated by the cameras, with arrows noting direction of photograph taken. Note that these locations are generalized, and roughly estimate what is present on Site.



**Photograph 9. Photo Point 4 in the Southern Shoreline.** Photograph taken facing southwest.



**Photographs 10 & 11. Photo Point 5 in the Southern Shoreline.** Photographs taken facing northeast (above) and southwest (below).



**Photograph 12 . Photo Point 5 in the Southern Shoreline.** Photograph taken facing northwest.



### **2.3.3.1 Slopes and Substrates**

In general, the size of materials decreases along with decreases in slope. A distinct break in slope occurs between approximately +3 and +6 ft MLLW within Area A, and +9 to +10 ft MLLW in Area B, where substrates typically transition to mud. Near the South Terminal in Area A, the slopes consist primarily of large angular rock riprap ranging 2 to 3 ft in diameter (Photograph 31; Appendix E), with approximate slopes ranging from 10 to 40%. The steepest slopes of the shoreline exist adjacent to the Southern terminal, and slowly decrease when approaching Pigeon Creek. The mudflat region is sloped as flat as approximately 2% in some areas. See Figure 4 for a map of substrate types.

Continuing south down the shoreline, the armoring transitions into large concrete blocks (approximately 4x4x4 ft) (Photograph 32; Appendix E), with a mix of cobble and small angular rock/gravel further down the slope. Armoring within Area A is covered in *Ulva* spp. typically from +2 to +3 ft MLLW. Barnacles and mussels also cover slopes from +2 to +6 ft MLLW, at coverages of 85% and 10% respectively.

Occasional pools of shallow, standing water are present on Site in addition to many holes from burrowing invertebrates (Photograph 33; Appendix E). Nearly 50% of all substrates in the mudflat are covered in *Ulva* spp (Photograph 34; Appendix E). Empty valves of hardshell clams (e.g., varnish clams) are also common.

Sediments within the mudflat change surrounding the Pigeon Creek mouth. Mixed with the soft sand and silt substrates is rounded gravel, and smaller pea gravel, likely deposited from Pigeon

Creek (Photograph 35; Appendix E). The shoreline is still armored within Area B; however, it primarily consists of a vertical rock wall that supports the railroad which runs directly adjacent to the shore (Photograph 36; Appendix E).

### **2.3.3.2 Vegetation**

Similar to the Northern shoreline, vegetation is sparse and primarily present above the shoreline armoring, consisting of: Himalayan blackberry, occasional trees, and assorted grasses and weeds. The armoring supporting the railroad limits vegetation on this shoreline slope.

Site observations indicate there is no aquatic vegetation within the mudflat of the southern shoreline. Macroalgae (*Ulva* sp.) is abundant (Photograph 34; Appendix E) throughout the entire southern shoreline, covering approximately 50% of the mudflat. As mentioned above, *Ulva* also covers lower portions of the armored shoreline. Additional information on macroalgae present at lower elevations is in Section 3.

Eelgrass (*Zostera marina*) and dwarf eelgrass (*Zostera japonica*) is visible on Site during low tide. Dwarf eelgrass primarily exists above -2 ft MLLW and as high as +1 ft MLLW, adjacent to the southern edge of the South terminal, covering approximately 0.14 acre (6,153 sq ft) (Figure 5 and Figure 6 in Section 3.2 display the location of delineated dwarf eelgrass beds). Occasional eelgrass shoots are present within the dwarf eelgrass bed; however, the large majority of eelgrass exists below -3 ft MLLW. Site observations indicate no eelgrass is present south of Pigeon Creek. See Section 3 for the eelgrass and macroalgae survey results.

### **2.3.3.3 Additional Observations**

Along the Southern shoreline primarily in Area B are four solitary timber pile located at approximately 0 to +1 ft MLLW, spaced approximately 200 ft from each other. LWD is common within the entirety of the Southern shoreline, existing at higher elevations along the armored slopes. In addition to the large concrete blocks armoring the shoreline (Photograph 32; Appendix E), debris within the Southern shoreline includes: concrete chunks, a cement slab, a large tire, and assorted trash.

### **2.3.4 Macrofauna**

Macrofauna observed during the shoreline survey are listed in Table 1. According to WDFW's online forage fish spawning mapper, no forage fish presence has been documented on Site (WDFW 2022); however, one individual Pacific sand lance was observed stranded on the Southern shoreline. The nearest documented presence of forage fish off Site is the shoreline approximately 0.7 miles (straight line distance) south of the South Terminal wharf.

**Table 1. Macrofauna observed during the shoreline habitat survey (See Figure 2 for Zone locations).**

Species	Common Name	Zones observed
<i>Haliaeetus leucocephalus</i>	Bald eagle	S
<i>Ardea herodias</i>	Great blue heron	S
<i>Corvus</i> sp.	Crow	S
<i>Larus glaucescens</i>	Glaucous-winged gull	N, S
<i>Branta canadensis</i>	Canada goose	S
<i>Phalacrocorax</i> sp.	Cormorant	N
<i>Phoca vitulina</i>	Harbor seal	S
<i>Pisaster ochraceus</i>	Ochre sea star	N
<i>Cancer magister</i>	Dungeness crab	S
<i>Neotrypaea californiensis</i>	Ghost shrimp	S
<i>Ammodytes hexapterus</i>	Pacific sand lance	S
<i>Platichthys stellatus</i>	Starry flounder	S
-	Mussels	N, C, S
-	Barnacles	N, C, S
-	Assorted gastropods	N, S



## 3 EELGRASS AND MACROALGAE SURVEY

### 3.1 BACKGROUND

The eelgrass and macroalgae/substrate survey was conducted to identify and map all eelgrass on Site, to assess the areal coverage and density of all eelgrass, to estimate the total number of turions present on the Site, and collect information on macroalgae, debris, and substrates. Eelgrass and macroalgae/substrate surveys were completed separately, and will be discussed as such.

### 3.2 EELGRASS SURVEY

#### 3.2.1 Methods

##### 3.2.1.1 *Eelgrass Reconnaissance*

An initial eelgrass reconnaissance of the Site was conducted on September 7, 2022 from shore at a low tide, as discussed in Section 2 above. This initial reconnaissance was able to locate most of the eelgrass on Site, map the landward edge of the largest beds, and identify the waterward edge of those beds. However, this initial reconnaissance was unable to visually assess all portions of potential eelgrass habitat onsite to verify that all eelgrass was identified, particularly in the area south of Pigeon Creek.

To complete the eelgrass reconnaissance, two divers swam a reconnaissance transect parallel to shore along the elevation contour at which eelgrass has established on Site—between approximately -5 ft and -10 ft MLLW. This transect extended from the southern property boundary north to the eelgrass bed previously identified on Site. Divers maintained proper depth using their depth gauges, combined with a knowledge of the tide level at the time of the dive. Divers carried buoys anchored to weights, which were dropped upon encountering eelgrass for later survey. This transect encompassed approximately 900 linear ft.

##### 3.2.1.2 *Delineation*

Grette biologists SCUBA divers conducted an eelgrass delineation and survey on September 26 and September 27, 2022. As mentioned above, the landward edge of the majority of the eelgrass was delineated on foot at low tide during the September 7, 2022 Site survey. The waterward edges of the respective beds were delineated by two biologists: a diver, swimming the perimeter of the bed while towing an inflatable raft, and a second biologist in the raft collecting GPS data with a Trimble Geo7x differential GPS datalogger when cued by the diver.

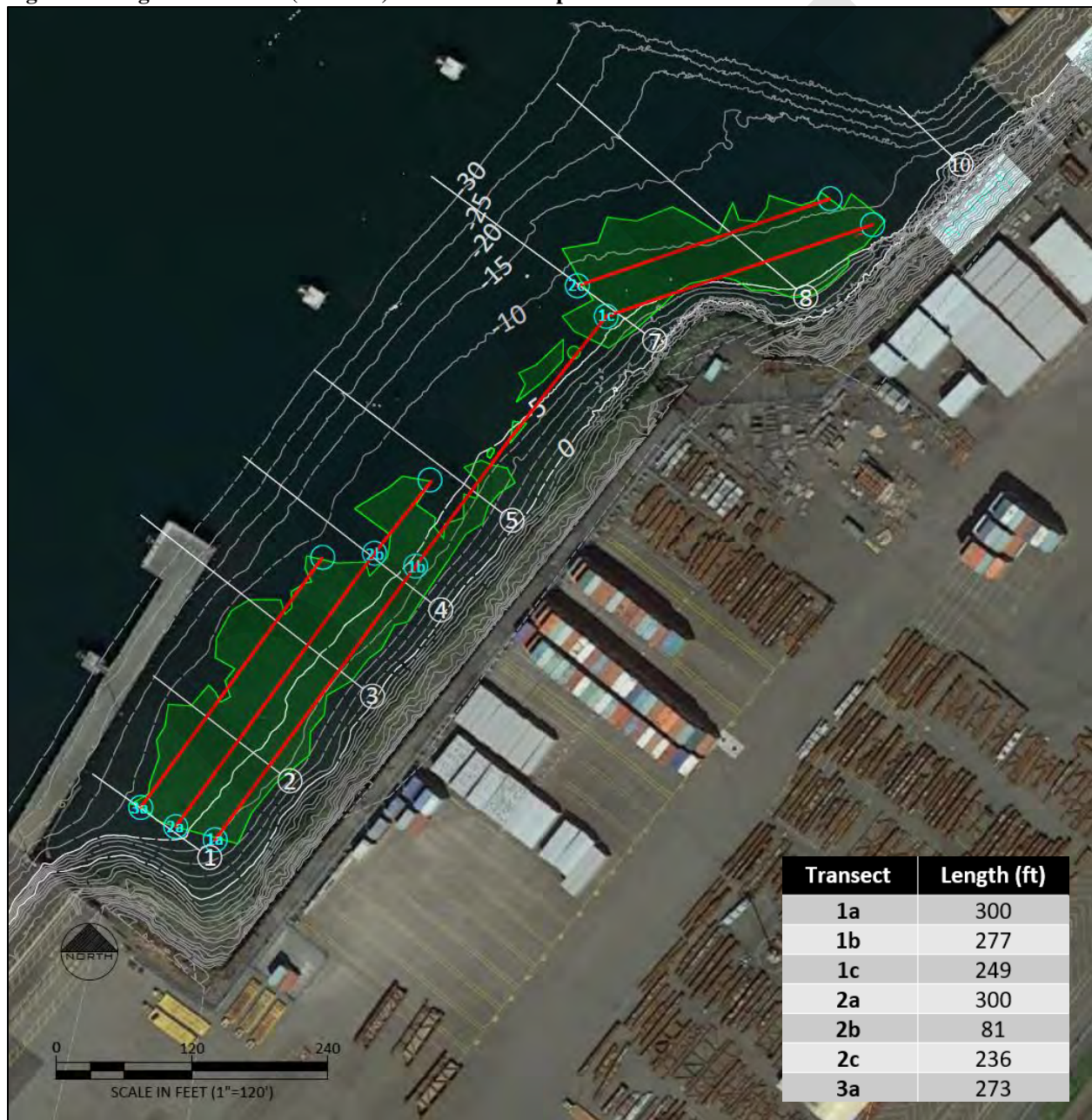
##### 3.2.1.3 *Eelgrass Density*

Eelgrass density was surveyed by two divers working in tandem. Eelgrass density transects were established and field marked using GPS and weighted buoys at start/end points, with a fiberglass transect tape run between the two buoy anchors. Eelgrass density was recorded every 20 feet along the tape. At each observation point, divers conducted triplicate turion (shoot) counts using 0.25 m<sup>2</sup> quadrats, placed at the 2 o'clock, 6 o'clock, and 10 o'clock positions relative to the transect tape. Within each quadrat, the number of shoots, percent coverage of macroalgae, sediment type, and other biota or objects present were recorded. Divers also recorded "start" and "stop" points

along each transect where eelgrass boundaries intersected the transect tape, to document and map the extent of eelgrass beds along each transect.

A total of 8 transects were surveyed in two areas of the Site: the area north of the South Terminal cargo vessel wharf (Transects 1a – 1c, 2a – 2c, and 3a; Figure 5) and the area south of the wharf (one singular long transect, Transect S) (Figure 6). All transects were roughly parallel to the shoreline, with lengths varying from 81 to 380 feet (see tables in Figure 5 and Figure 6 and spacing of approximately 30 – 40 ft between transects). Copies of the eelgrass data sheets are in Appendix B, and the eelgrass transect coordinates and transect lengths are in Appendix C.

**Figure 5. Eelgrass transects (red lines) in the Northern portion of the Site.**



**Figure 6. Eelgrass transect (red) in the Southern portion of the Site.**



### 3.2.2 Results

Weather conditions during the survey ranged from overcast and windy, to sunny and calm. For the divers, visibility underwater ranged from 5 – 30 feet on Site, with a maximum tidal fluctuation from +4 ft MLLW to +8.5 ft MLLW during dive operations.

### 3.2.2.1 Eelgrass Density

The overall eelgrass (*Zostera marina*) density on Site is approximately 33.3 shoots/m<sup>2</sup> (Table 2). The greatest density of eelgrass is present in the Southern Zone of the Site (Transect S) with an average density of 54.5 shoots/m<sup>2</sup> (Table 2). The Northern Zone (Transects 1a – 3a) has an average eelgrass density of approximately 28.5 shoots/m<sup>2</sup>. The total estimated number of eelgrass turions within delineated beds are listed in Table 3. Digitized eelgrass data sheets are available in Appendix B.

**Table 2. Average density of eelgrass on Site.** Table includes the average density of eelgrass turions per square meter per transect (“Transect Avg. Density/m<sup>2</sup>”), the total average density of the average density of eelgrass turions per square meter of each Zone (“Zone Avg. Density/m<sup>2</sup>”), and the entire Site average density of eelgrass turions per square meter (“Site Avg. Density/m<sup>2</sup>”).

Zone	Transect	Transect Avg. Density/m <sup>2</sup> *	Zone Avg. Density/m <sup>2</sup> **	Site Avg. Density/m <sup>2</sup> ***
North	1a	36.0	28.5	33.3
	1b	20.9		
	1c	25.0		
	2a	31.2		
	2b	7.2		
	2c	39.6		
	3a	26.5		
South	S	54.5	54.5	

\* Denotes the mean density of all eelgrass plots in each respective transect.

\*\* Denotes the mean density of all eelgrass plots in each respective zone, not the mean of the average density per transect.

\*\*\* Denotes the mean density of all eelgrass plots in both zones, not the mean of the average density per zone.

**Table 3. Eelgrass bed acreages and total turion counts on Site.** Table includes eelgrass (*Zostera marina*) extent (acreage) by zone, and the total number of eelgrass turions estimated in each Zone and the total for delineated eelgrass beds on Site.

Species	Zone	Eelgrass Bed Extent (acres)	Total est. Turions (per Zone)	Total est. Turions in Eelgrass Beds
Eelgrass ( <i>Zostera marina</i> )	North	1.27	146,695	214,362
	South	0.31	67,667	

### 3.2.2.2 Eelgrass Distribution

Figures 5 through 8 show the delineated eelgrass beds and sampling transects. Eelgrass beds cover a total of 1.27 acres in the Northern Zone and 0.31 acre in the Southern Zone, for an overall Site total of 1.58 acres. In general, eelgrass beds range from approximately -3 ft to -10 ft MLLW, extending as deep as -13 ft MLLW. Eelgrass coverage decreases to become patchy in the waterward extent of its range at the Site.

The northern eelgrass bed is divided by a gap in eelgrass coverage, with two dense sub-beds separated by approximately 200 ft of sparse, patchy eelgrass (Figure 5). This may be a result of substrate limitations, as substrate in this area is larger with a higher component of cobble than areas of higher eelgrass density (see Appendix B, Transect 1c).

Dwarf eelgrass (*Z. japonica*) was not observed during SCUBA surveys; however, as identified during the Shoreline habitat survey, it is present at higher elevations in a single, 0.14-acre bed immediately south of the southern wharf (Figure 6, see Section 2).

Overall, the eelgrass beds on Site appear healthy, with blades approximately 6 feet long, occasionally covered in epiphytes (Photographs 34 and 35). The eelgrass beds within the Northern and Southern Zones of the Site contain a dense, continuous community of eelgrass existing within elevations from approximately -3 to -13 ft MLLW. As mentioned previously, the eelgrass beds within the Southern Zone are smaller but more dense than beds observed in the Northern Zone (Tables 2 and 3). Due to inaccessible conditions, the Central Zone was not surveyed for eelgrass. However, eelgrass presence within this portion of the Site is extremely unlikely. The wharf of the South Terminal has created low light conditions likely not suitable for eelgrass proliferation. Bathymetry data also indicate that riprap beneath the wharf ends at approximately -35 ft MLLW, which is deeper than where eelgrass is observed in the Northern and Southern Zones of the Site. Large vessels mooring at the wharf also provide continual disturbance which could affect eelgrass presence.

**Photographs 13 & 14. Eelgrass observed on Site (typical conditions)** with an example of a dense patch of eelgrass (above), and eelgrass blades with epiphytes (below).



### 3.2.2.3 Macroalgae Presence in Eelgrass Beds

A total of 4 macroalgal species were observed along the eelgrass transects. Excluding areas with 0% macroalgae, the average total percent coverage of macroalgae for each observation point where macroalgae was observed is 59%. The most common species are Sugar kelp (*Saccharina latissima*) and Sea lettuce (*Ulva lactuca*), followed by less common species including Gut weed (*Ulva intestinalis*) and *Gracilaria* spp. (Table 4).

**Table 4. Macroalgae present within surveyed eelgrass transects on Site.**

Species	Common Name
<i>Ulva intestinalis</i>	Gut weed
<i>Gracilaria</i> spp.	–
<i>Saccharina latissima</i>	Sugar kelp
<i>Ulva lactuca</i>	Sea lettuce

Macrofauna present during the eelgrass surveys included: assorted small fish (schools of juvenile salmonids and bay pipefish [*Syngnathus leptorhynchus*]), Dungeness crab (*Metacarcinus magister*), hermit crabs, nudibranchs, and orange sea pens (*Ptilosarcus gurneyi*). Additional animals on Site during the Shoreline survey are mentioned in Section 2 (

Table 1). Near the south eelgrass beds, a large number of dead Dungeness crabs were also observed.

### **3.3 MACROALGAE AND SUBSTRATES SURVEY**

#### **3.3.1 Methods**

Grette biologist SCUBA divers conducted a macroalgae and substrates survey on September 28, 2022. Surveys were conducted by running transect tape perpendicular to shore from the shallowest access point attainable by divers (approximately MLLW) to a defined distance (based on pre-assessed bathymetry and/or intersection with the wharf) or to 40 feet of depth on the divers' gauges, whichever was encountered first. Eight transects (Transects 1-5, 7, 8, 10) were laid out and surveyed in the Northern Zone of the Site, with approximately 100 feet of spacing between each transect, or wider if results indicated largely similar conditions (Figure 7). Within the Southern Zone of the Site, a total of 3 transects (Transects 12-14) were surveyed each spaced approximately 200 ft apart (Figure 8). Total transect length ranged from 127 feet to 290 feet (see tables in Figure 7 and Figure 8). Divers swam the length of the transect (to a maximum water depth of 40 ft) documenting presence/absence and percent cover of macroalgae (identified to species, when possible), substrate characteristics, and substrate depth. Depth was measured with a 2-foot piece of rebar inserted into the substrate until refusal, recording the depth of refusal on datasheets. Data were collected any time a change in substrate was observed. Presence of debris was also noted. Copies of the macroalgae and substrates survey data sheets are in Appendix D.



Figure 7. Perpendicular macroalgae and substrate survey transects (yellow) in the Northern portion of the Site.

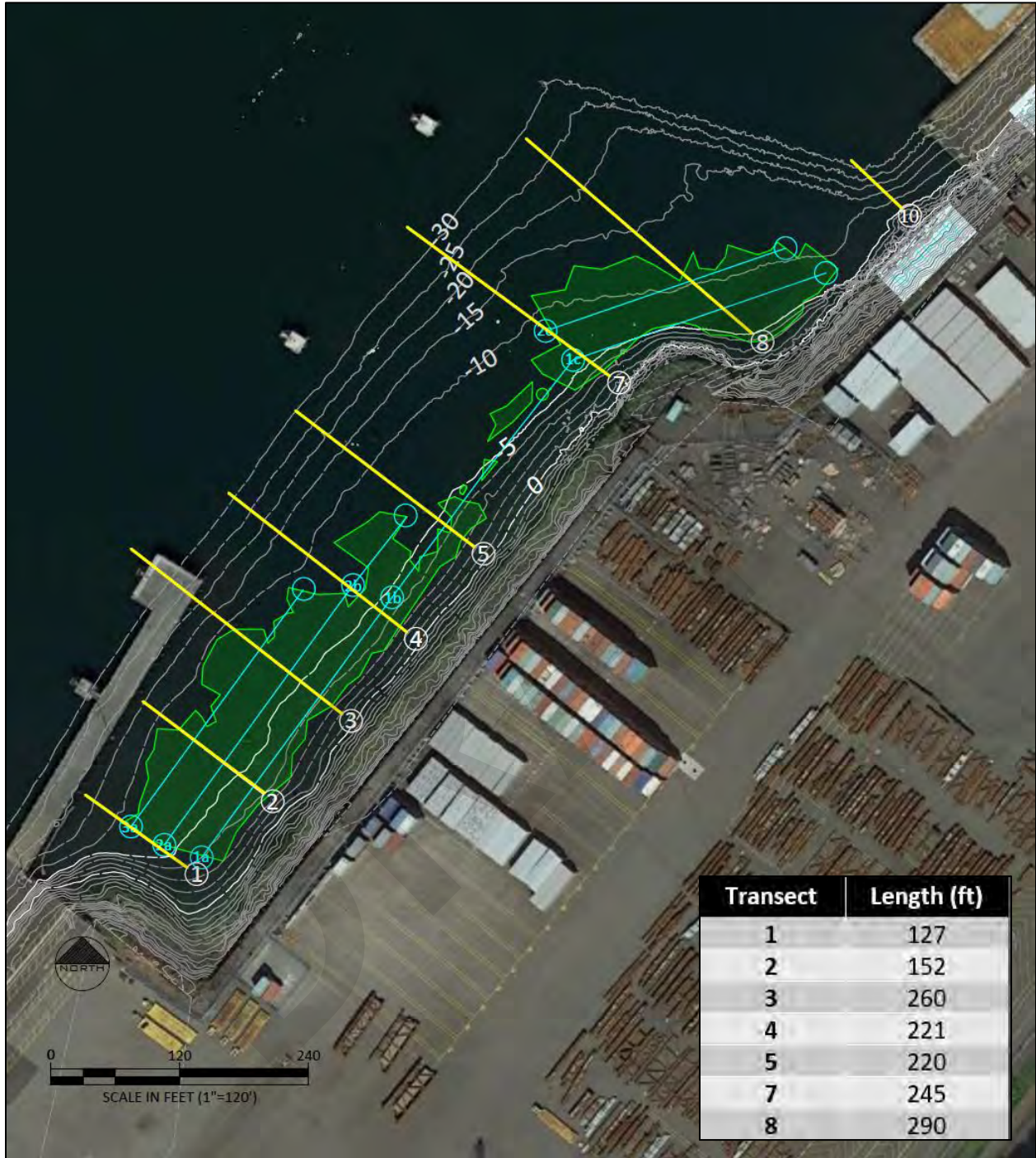


Figure 8. Perpendicular macroalgae and substrate survey transects (yellow) in the Southern portion of the Site.



## 3.3.2 Results

### 3.3.2.1 Substrate/Habitat

Substrate conditions are relatively uniform across much of the Site. SCUBA surveying efforts indicate sediments are primarily silty sand, particularly in the southern portion of the northern area (e.g., transects 1-3) and in the southern area (transects 12-14). Larger substrates are occasionally intermixed with the softer sediments, including: cobble, riprap, and shell hash. Debris in and near eelgrass transects includes: logs, woody debris (North area, transect 4), pile, and pile stubs. Additional debris near the macroalgae and substrates survey locations includes: tires, assorted metal debris and cables, concrete chunks, and more pile/woody debris. Substrate in the southern area (transects 12-14) is dominated by silty sand.

Substrate probe refusal depth ranges from 0 to 24 in, with an average refusal of 9.6 in across all transects (see datasheets; Appendix D). In the Northern Zone, probe depths were highly variable, from 3-5 inches in transects 1 and 2, up to 20 inches in transects 3 and 4 with occasional very shallow readings (e.g., 2 inches), and up to 24 inches in transect 5. On transect 10, which includes quarry spalls and riprap on the surface, probe depths were 0. In the Southern Zone, probe depths generally increase farther south. On transect 12, which is adjacent to the wharf, probe depths are limited to 4 inches. On transect 13, depths increase to 6-12 inches, then on transect 14 depths are as high as 16 inches. These readings indicate a varied depth to refusal, with unknown substrate beneath causing refusal.

Similar to conditions observed in the Southern Zone during the Shoreline survey, some areas contain sandy sediments with holes leading to burrowed invertebrates (Photograph 15).

**Photograph 15. Sandy substrates with invertebrate burrows.**



### **3.3.2.2 Macroalgae**

Macroalgae species along the perpendicular transects include: Sea lettuce , Sugar kelp , and Gut weed. No macroalgae was encountered when surveying Transects 3 and 8. The water depth at which macroalgae coverage ends varies from approximately -11 ft MLLW to as deep as -20 ft MLLW in the Northern Zone. Observed macroalgae maximum depth generally increased farther north, with the shallowest maximum macroalgae depth encountered in transects 1 and 2 (10-22 ft), and the deepest macroalgae encountered in Transect 10 (-20 ft MLLW). Macroalgae generally continued to the inshore extent of transects in the Northern Zone.

In the Southern Zone, the waterward limit of macroalgae occurs at much shallower depths, as deep as approximately -6 ft MLLW. This may be explained by a steeper benthic slope in the Southern Zone and greater exposure to tidal currents than in the Northern Zone.

#### 4 REFERENCES

Ecology (Washington State Department of Ecology). 2012. Weyerhaeuser Mill A Former Site. Publication number 12-09-061. June 2012. URL: <https://apps.ecology.wa.gov/publications/documents/1209061.pdf>

Washington Department of Fish and Wildlife (WDFW) 2022. Forage Fish Spawning Map (online mapper). Available at <https://wdfw.maps.arcgis.com/home/webmap/viewer.html?webmap=19b8f74e2d41470cbd80b1af8dedd6b3&extent=-126.1368,45.6684,-119.6494,49.0781>. Accessed December 27, 2022.

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# **PORT OF EVERETT: WEYERHAEUSER MILL A CLEANUP PROJECT**

## **BASELINE EELGRASS AND SHORELINE HABITAT SURVEY**

### **APPENDIX A: SHORELINE SURVEY DATA SHEET**

\*For ease of interpretation, field datasheets have been digitized. Raw survey datasheets from the field are available upon request.

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# **PORT OF EVERETT: WEYERHAEUSER MILL A CLEANUP PROJECT**

## **BASELINE EELGRASS AND SHORELINE HABITAT SURVEY**

### **APPENDIX B: EELGRASS SURVEY DATA SHEETS**

\*For ease of interpretation, field datasheets have been digitized. Raw survey datasheets from the field are available upon request.

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Grette Associates<sup>LLC</sup> Mill A 2022

Transect: 1a

Date: 09/27/2022

Tide Level: +4 ft MLLW

Observers: Sydney Gebers, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	2	9	15	cobble/sand				
20	6	4	11	mud	Macroalgae - 0 %			Mud firm
40	8	4	5	sand				Little macroalgae present, heavy epiphytes
60	9	3	7	mud	Macroalgae - 0 %			Mud firm
80	8	11	15	sand	Saccharina, Ulva			
100	1	3	6	mud				
120	6	16	2	log	Ulva			Log thru plot; ulva on log
140	7	5	4	mud				
160	0	0	0	sand	Gracilaria	154		Log present
180	12	17	18	sandy silt/shellhash				
200	15	15	13	sand			164	Little macroalgae present, heavy epiphytes
220	7	6	12	silty sand	Macroalgae - 0 %			No algae
240	19	16	13	sand	Saccharina, Ulva	270		
260	5	9	10	silty sand	Saccharina, Ulva - 70%			
280	22	10	19	sand	Saccharina, Ulva		275	Heavy epiphytes

Eelgrass presence

**Grette Associates<sup>LLC</sup> Mill A 2022**

Transect: 1b

Date: 09/27/2022

Tide Level: +5.8 ft MLLW

Observers: Sasha Ertl, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	0	10	4	mud	Ulva - 40%	0	36	Most of the eelgrass East of the tape
20	33	23	24		Ulva	50		
40	0	0	0	mud	Ulva - 80%	43	48	Eelgrass just North
60	0	0	0	rocky	Saccharina, Ulva			Rocky
80	0	0	0	mud/debris/cobble	Saccharina, Ulva - 90%	71	78	Mud at ~95ft to cobble
100	27	20	18		Ulva	113	93	
120	0	0	0	cobble	Gracilaria, Saccharina, Ulva - 70%	93	112	Eelgrass patch - 2x8 ft of 50 turions at 135 ft
140	0	0	0	rocky	Saccharina, Ulva			Rocky
160	0	0	0	cobble	Saccharina, Ulva - 80%			
180	0	0	0	rocky	Saccharina, Ulva			Rocky
200	0	0	0	cobble/mud	Saccharina, Ulva - 90%	230	240	Eelgrass patch - 2x3 ft of 30 turions
220	0	0	0	rocky	Saccharina, Ulva			Rocky
240	0	0	0		Saccharina, Ulva - 90%	242	244	
260	8	8	6		Saccharina, Ulva			
280	25	9	20	mud	Saccharina, Ulva - 40%	253		

Eelgrass presence

Transect: 1c

Date: 09/27/2022

Tide Level: +5.8 ft MLLW

Observers: Sasha Ertl, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	10	10	13	mud	Saccharina - 40%	0		
20	4	4	5					
40	0	2	10	riprap/mud	Saccharina - 30%		65	
60	0	5	7					Freshwater influx, water mixing
80	0	0	0			86	96	
100	0	0	0					Depth 12ft
120	11	6	8	mud	Saccharina - 30%	108		
140	2	8	4					
160	3	7	9	mud	Saccharina - 30%			
180	10	16	11	silt				Silt substrates
200	12	8	19	mud	Saccharina - 30%			
220	4	11	6				238	

Eelgrass presence

Grette Associates<sup>LLC</sup> Mill A 2022

Transect: 2a  
 Tide Level: +4 ft MLLW

Date: 09/27/2022  
 Observers: Sydney Gebers, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	0	0	5	cobble/sand/mud	Macroalgae - 0%	0		No macroalgae
20	6	9	10	mud	Macroalgae - 0%			
40	2	20	16	mud				Little macroalgae
60	13	8	0	mud				
80	8	8	1	mud				Little macroalgae
100	0	4	1	mud				
120	11	18	20	mud				Little macroalgae
140	18	13	14	mud				
160	0	8	16	mud				Log present; no macroalgae
180	21	18	12	silty sand				
200	10	15	18	mud				Log present; no macroalgae
220	6	7	15					
240	0	0	0	sand	Saccharina, Ulva - 100%		230	
260	0	0	0	silty sand	Saccharina, Ulva - 80%			
280	0	0	0	sand	Saccharina, Ulva - 100%	282	289	

Eelgrass presence



**Grette Associates<sup>LLC</sup> Mill A 2022**

Transect: 2c

Date: 09/27/2022

Tide Level: +5.8 ft MLLW

Observers: Sydney Gebers, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	0	0	0	mud/shells	Saccharina - 60%	5		
20	10	13	4	silt	Saccharina, Ulva			
40	12	20	14	mud/shells	Saccharina, Ulva			
60	25	10	16					
80	10	12	13	mud/shells	Saccharina - 40%			
100	16	18	8					
120	12	5	12	mud	Saccharina - 30%			
140	9	2	4					
160	10	13	2	mud				
180	14	18	8					
200	10	13	19	mud	Saccharina - 30%			
220	3	3	9					
240	3	12	4	mud	Saccharina - 30%		244	

Eelgrass presence

Grette Associates<sup>LLC</sup> Mill A 2022

Transect: 3a

Date: 09/27/2022

Tide Level: +4 ft MLLW

Observers: Sydney Gebers, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	3	2	0	cobble	Saccharina			Heavy coverage Saccharina
20	0	8	0	mud	Macroalgae - 0%			
40	7	2	17	cobble				Little macroalgae; 17 to 9 in shore side
60	7	8	2	mud	Macroalgae - 0%			Mud (firm); no macroalgae
80	10	0	0	sand/mud				Old log/pile present ~90ft down tape
100	5	5	9	sand				
120	11	14	22	sand/mud				Little macroalgae
140	2	6	3	sand	Macroalgae - 0%			No macroalgae
160	15	0	2	mud/sand	Saccharina - 40%			Debris and pile stub present
180	15	7	6	sand	Ulva - 80%			
200	17	25	16	mud/sand	Saccharina, Ulva - 40%			
220	1	3	0	sand	Saccharina, Ulva - 20%			
240	11	0	8	soft sand/animal parts	Saccharina, Ulva - 50%			Pile stub present
260	4	13	12	sand	Saccharina, Ulva - 40%			
280	0	0	0	soft sand			280	Pile stub present

Eelgrass presence

Grette Associates<sup>LLC</sup> Mill A 2022

Transect: South ("S")

Date: 09/27/2022

Tide Level: +7 ft MLLW

Observers: Sydney Gebers, Jay Dirkse

Dist	0.25-m <sup>2</sup> shoot count			Substrate Type (ex. mud, sand, gravel)	Notes (macroalgae, invertebrates)	Eelgrass Begin	Eelgrass End	Comments
	2	6	10					
0	5	5	25	sand	Filamentous Green Algae	0	31	Depth: 2ft
20	21	32	18	sand				Dense eelgrass
40	0	0	0	sand	Filamentous Green Algae			
60	8	10	4	sand				
80	27	31	26	sand	Filamentous Green Algae	47		
100	7	11	14	sand			135	
120	4	4	2	sand				
140	0	0	0	sand				Gap in an otherwise very dense eelgrass band
160	26	26	20	sand				Lots of eelgrass die off, many dead turions; Density = live turions
180	11	18	12	sand		145		
200	26	28	32	sand	Filamentous Green Algae			
220	11	16	24	sand			157	
240	17	32	26	sand	Filamentous Green Algae			
260	0	0	4	sand	Filamentous Green Algae			Gap w/filamentous green algae
280	30	26	26					
300	5	3	6	sand		164		Still pretty healthy
320	6	17	17					
340	8	9	5	sand				
360	12	17	20					
380	12	9	6	sand			120	

Eelgrass presence



**PORT OF EVERETT: WEYERHAEUSER MILL A CLEANUP  
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**BASELINE EELGRASS AND SHORELINE HABITAT SURVEY**

**APPENDIX C: EELGRASS TRANSECT COORDINATES**

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North Eelgrass Transects					
Transect	Start		End		Length (ft)
	Northing	Easting	Northing	Easting	
1a	358732.8832	1298973.7951	358974.8024	1299151.2073	300
1b	358974.8024	1299151.2073	359195.7875	1299319.7149	277
1c	359195.7875	1299319.7149	359276.9111	1299555.4259	249
2a	358744.5129	1298938.9757	358986.3102	1299114.7753	300
2b	358986.3102	1299114.7753	359051.0185	1299163.7897	81
2c	359222.9468	1299294.2274	359299.8647	1299517.7186	236
3a	358761.4308	1298908.0021	358982.7138	1299068.9439	273

South Eelgrass Transect							
Transect	Start		Middle		End		Length (ft)
	Northing	Easting	Northing	Easting	Northing	Easting	
S	357785.1216	1297788.7629	357955.3165	1297985.3175	357982.2734	1298101.6777	300

Coordinate System:  
*Washington State Plane North, NAD83, US Feet*

# **PORT OF EVERETT: WEYERHAEUSER MILL A CLEANUP PROJECT**

## **BASELINE EELGRASS AND SHORELINE HABITAT SURVEY**

### **APPENDIX D: SUBSTRATE & MACROALGAE SURVEY DATA SHEETS**

\*For ease of interpretation, field datasheets have been digitized. Raw survey datasheets from the field are available upon request.

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Transect: 8

Date: 09/28/2022

Time: 11:55 am

Tide Level: +4.9 ft MLLW

Observers: Sydney Gebers, Sasha Ertl

Dist	Substrate Type (ex. mud, sand, gravel)	Probe depth of refusal (inches)	Macroalgae, invertebrates	Eelgrass?	Depth gauge	Comments
137	mud	18	Macroalgae - 0%	Y	19	Eelgrass starts; no macroalgae
290	mud/wood debris	8	Macroalgae - 0%	N	40	~4:1 slope











**PORT OF EVERETT: WEYERHAEUSER MILL A CLEANUP  
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**BASELINE EELGRASS AND SHORELINE HABITAT SURVEY**

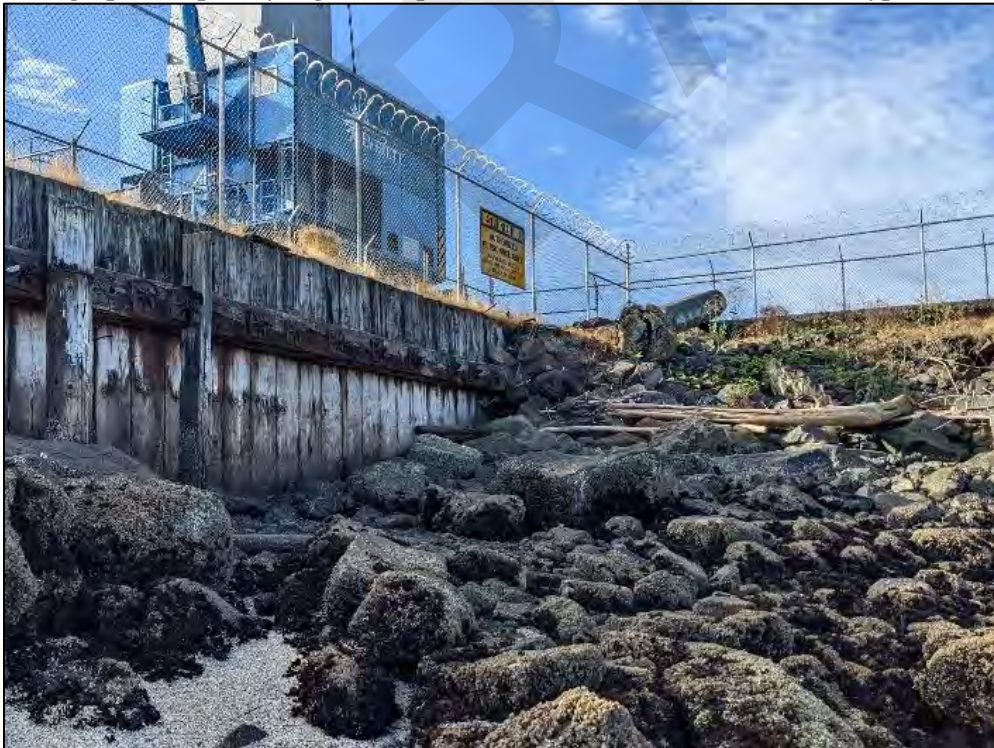
**APPENDIX E: SITE PHOTOGRAPHS**

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**Photograph 16. Sparsely vegetated upland areas of the Northern shoreline; typical conditions.** Area 1 (above) near the Pacific Terminal facing southwest, and Area 2/3 (below) facing southwest near the northern edge of the South Terminal.



**Photograph 17. Sparsely vegetated upland areas of the Northern shoreline; typical conditions.**





**Photograph 18. Sparsely vegetated upland area above timber abutment of the Northern shoreline (Area 2); typical conditions. Photograph taken facing South.**



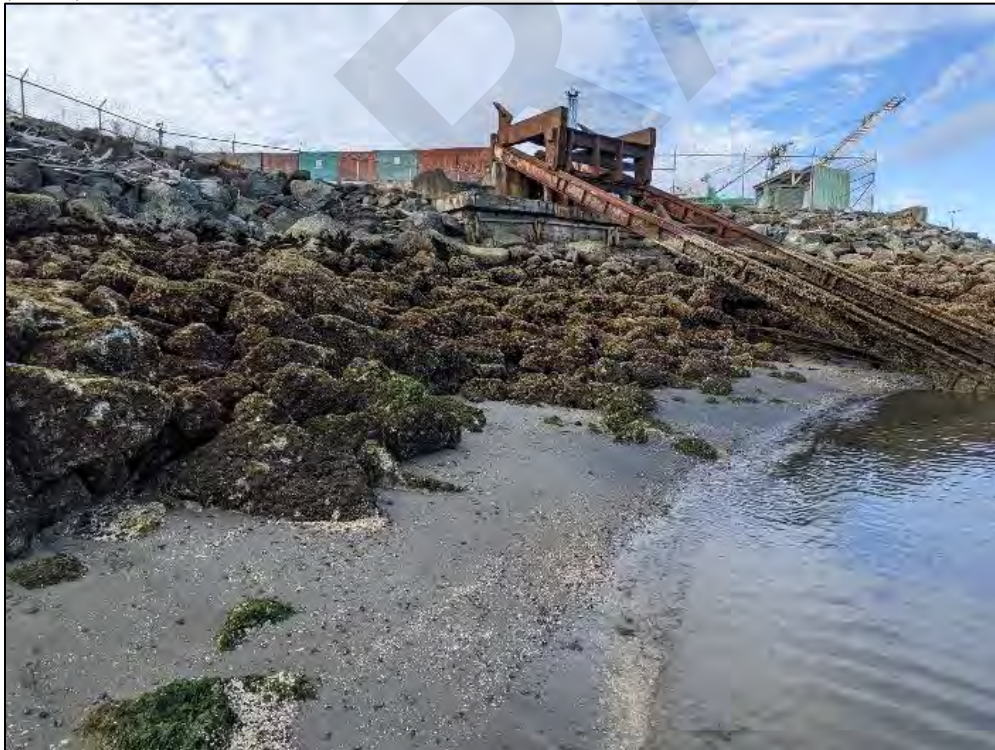
**Photograph 19. Macrofauna and algae along the Northern shoreline; typical conditions.** Example of Turkish washcloth, mussels, and barnacles covering riprap in Area 1 (above), and Ulva growing on rocky substrates in Area 2 (below).



**Photograph 20. Macrofauna and algae along the Northern shoreline; typical conditions.**



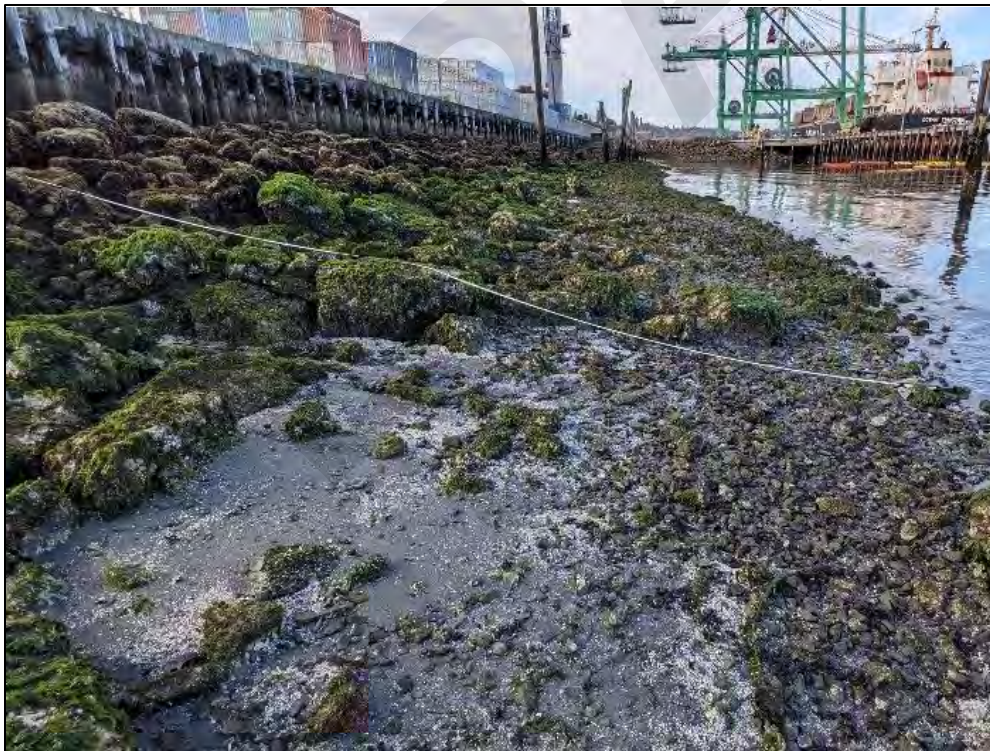
**Photograph 21. Beach-like areas in Area 1 of the Northern shoreline** next to the northern set of derelict rails (location of tracks in Figure 3). Photograph taken facing southeast (above) and further up the slope facing north (below).



**Photograph 22. Beach-like areas in Area 1 of the Northern shoreline**



**Photograph 23. Small beach-like areas within Area 2 of the Northern shoreline.** Photographs taken facing southeast towards the South Terminal.



**Photograph 24. Small beach-like areas within Area 2 of the Northern shoreline.**



**Photograph 25. Large beach area within Area 2 of the Northern shoreline, adjacent to the South Terminal facing southwest towards the terminal.**



**Photograph 26. Beach area within Area 2, facing upslope.**



**Photograph 27. Derelict piles along the Northern shoreline of Area 1. Facing southwest near the Pacific Terminal.**



**Photograph 28. Derelict piles along the Northern shoreline of Area 2. Facing northeast.**



**Photograph 29. LWD along the Northern shoreline of Area 1, taken from the Pacific terminal facing southwest.**



**Photograph 30. LWD along the Northern shoreline of Area 1 (above) and Area 3 (below), taken adjacent to the northern edge of the South Terminal facing southwest.**



**Photograph 31. Armored slopes of the southern shoreline in Area A north of Pigeon Creek. Riprap slopes near the South Terminal facing North.**



**Photograph 32. Armored slopes of the southern shoreline in Area A north of Pigeon Creek.** Large concrete blocks facing South.



**Photograph 33. Mudflat conditions within the Southern shoreline; typical.** Occasional standing pools of water and invertebrate burrows.





**Photograph 34. Mudflat conditions within the Southern shoreline; typical. *Ulva* spp. (below) commonly covering mudflat sediments.**



**Photograph 35. Southern shoreline conditions near Pigeon Creek in Area B; typical. Gravel substrates surrounding Pigeon Creek, facing South.**



**Photograph 36. Southern shoreline conditions near Pigeon Creek in Area B; typical.** Vertical rock wall supporting the adjacent railroad tracks, facing South.

