MITIGATION PLAN - Revised Preliminary Design Draft

BRADWOOD LANDING TERMINAL AND PIPELINE

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1.0 INTRODUCTION

Bradwood Landing LLC ("Bradwood") proposes to develop the Bradwood Landing Liquified Natural Gas ("LNG") Terminal (the "Terminal") and an associated pipeline (the "Pipeline") (together with the proposed mitigation, collectively referred to as "Project"), along the lower Columbia River in Oregon and Washington.

1.1 Purpose

This mitigation plan wholly replaces the conceptual mitigation plan dated November 2006 that was filed with the Federal Energy Regulatory Commission ("FERC") and submitted with permit applications. This version is intended to serve as a preliminary design plan and is written to address three different, but related, mitigation needs:

- Wetland Mitigation: Terminal and pipeline construction in Oregon, and pipeline construction in Washington, would result in unavoidable impacts to wetlands. Wetland mitigation plans are provided for approval by federal and state regulatory agencies.

- Wildlife Habitat Mitigation: The mitigation for wildlife habitat is focused on impacts to wildlife from the Terminal, and roughly half of the Pipeline. Mitigation for wildlife impacts specifically addresses Oregon regulations governing habitat. No equivalent regulations exist in Washington; however, wildlife benefits will accrue from wetlands mitigation. The wildlife habitat mitigation also addresses the impacts on habitat for the Columbian white-tailed deer (the "CWTD"), listed under the Endangered Species Act (the "ESA").

- ESA-listed Salmonid Habitat Mitigation: Impacts to federally listed salmonids and their habitat would be mitigated by restoring and protecting estuarine habitat in order to provide an overall significant net positive benefit to listed salmonids and their habitat.

Because varied mitigation needs overlap and benefits of each mitigation component are best understood in the context of all the compensatory mitigation, all three mitigation needs are addressed in a single document. Figure 1-1 indicates the location of each mitigation site relative to the Terminal and Pipeline corridor.

1.2 Organization of the Plan

Following introductory and background information, this Mitigation Plan addresses wetland, wildlife, and fish mitigation independently. Each section would include a description of the following:

- Impacts to be mitigated.
- Proposed mitigation sites, including existing conditions.
- Proposed actions to generate the mitigation value.
- Appropriate performance standards, monitoring, and protective measures.
- Applicable regulations, including distinctions between Oregon and Washington regulations where they occur (i.e., wetlands).

1.3 Environmental Commitment: Background and Philosophy

Bradwood's Mitigation Philosophy
In keeping with NorthernStar's commitment to sustainable development—improving economic, environmental, and community health—the Project has been designed to provide an overall net benefit to the environment of the lower Columbia River ecosystem. The Bradwood philosophy to achieve the net benefit includes three components: (1) innovative project design, construction, operations, and maintenance plans to minimize and avoid adverse environmental impacts; (2) robust mitigation measures for unavoidable impacts; and (3) implementation of the Salmon Enhancement Initiative (the "SEI").[1]

Avoidance and Minimization in Design
The proposed Terminal would impact 60 acres during construction and permanently impact 40 acres of relatively flat plain between the Hunt Creek estuary and the Columbia River, and would be located entirely within an approximately 411-acre parcel of land controlled by Bradwood. The proposed Terminal and associated site facilities are in an area that was formerly used for a wood products mill and worker housing and that is currently a designated site for the disposal of material dredged from the Columbia River navigation channel. Almost all the area to be developed for these facilities is zoned Marine Industrial ("MI") pursuant to the Clatsop County Comprehensive Plan. The MI zone allows water-dependent industrial uses, such as the proposed Terminal. The mill pond is currently zoned for Aquatic Development ("AD"), which authorizes in-water industrial development, but the Clatsop County Comprehensive Plan anticipates that it will be filled in conjunction with the development of the site and rezoned to MI. In addition, Bradwood proposed to fill relatively small wetland areas on the edges of the Terminal and rezone these areas to MI.

Of the 411 acres, 393 acres are controlled by Bradwood and 18 acres consist of a railroad right-of-way ("ROW"). Clifton Road, which parallels Hunt Creek, is an existing paved road that provides access to the site from U.S. Highway 30. Hunt Creek Bridge will be replaced with a new one in the same location. An existing railroad ROW owned by the Oregon Department of Transportation and leased to the Portland & Western Railroad runs through the site and will be relocated slightly to accommodate the proposed terminal.

The Facility would also include the approximately 36-mile long natural gas send-out Pipeline extending from the Terminal through Clatsop and Columbia counties, Oregon and across the Columbia River north of Clatskanie, Oregon, to an interconnection with the Williams Northwest pipeline system east of the Cowlitz River and north of Kelso in Cowlitz County, Washington.

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[1] For the third component of the plan to ensure an overall significant and sustained net benefit to the lower Columbia River ecosystem, Bradwood has created the SEI. It is separate from the avoidance and mitigation measures and exceeds what could be expected of compensatory mitigation requirements. The SEI makes a substantial monetary commitment both at the beginning of the project and throughout the life of the project to fund enhancement projects and efforts through existing entities applying best available science and plans with relevant experience and expertise. In order to establish a clear separation between the compensatory mitigation and the SEI measures, the SEI measures are not discussed further in this Mitigation Plan.

Throughout the conceptual design phase, the Bradwood Landing development team has taken proactive steps to avoid and minimize the potential for impacts to natural resources located at the site. At several key development stages, the project footprint was reevaluated and redesigned to avoid wetland areas on the site (one area to the southwest and one larger area to the northwest) as shown on the accompanying figure (Figure 1-2). Although much more of the property is zoned MI, the Terminal design and resulting footprint were made as compact as practicable without substantially compromising safety and operational functionality.

An early concept design showed a different orientation of the facility to the site, because it was thought that the footprint would need to include the creation of a slip for the ship, rather than a wharf. That design was soon modified to eliminate the slip and that allowed the site to be much more compact, resulting in an initial significant reduction in wetland impacts (early design concepts were cartoon-like and not accurate enough for impact calculations). Specifically, under the original site layout, approximately 16 acres of wetlands would have been permanently impacted at the terminal site. Then, as noted above, in July 2006, the development team made site layout modifications that reduced impacts to wetlands by 1.44 acres for a total proposed impact to wetlands of 13.35 acres. Later that year, in August 2006, the site layout was finalized. At that time, the total site footprint was adjusted with a reduction in permanent impact acreage to a total of 12.96 acres. The resulting modified area is shown in Figure 1-2, with a total wetland avoidance acreage of 2.99 acres, or an 18.75% reduction in wetland impacts. Table 1-1 below presents a pre- and post-project .comparison of site conditions, essentially cover type, on the Bradwood parcel.

Table 1-1 **Summary of Pre- and Post-Project Conditions at Bradwood Landing Terminal**[2]

Baseline on 411-acre parcel	**Acres**	**Percent of Site Covered**	**Post-Project on 411-acre parcel**	**Acres**	**Percent of Site Covered**
Railroad ROW	18	4.38%	Railroad ROW	18	4.38%
Wetlands	55.3	13.45%	Wetlands	42.34	10.3%
Log pond	2.3	0.56%	N/A		
Dredge sand piles/bare ground	22.6	5.5%	Dredge sand piles/bare ground	3.3	0.8%
N/A			Terminal footprint	40	9.7%
Hunt Creek/Clifton Channel Estuary (beyond delineated wetlands)	62	15.1%	Hunt Creek/Clifton Channel Conservation Easement	61.4	14.9%
Bradwood Road	4	0.1%	Bradwood Road	2.3	0.56%
F80 zoned forested lands	246	59.8%	F-80 Forested lands	244	59.37%

[2] Figures were based on GIS analysis and cover type as determined for habitat typing. Some overlap exists between cover types as designated here, for example some of the Hunt Creek conservation area is also zoned F80, and contains forested wetlands, so these numbers may not match exactly with other similar numbers in tables presented in this document. The primary purpose for this assessment was to present the pre- and post-project conditions in terms of developed and undeveloped states for ease of comparison.

At this time no additional reduction in the area of the project footprint is possible because remaining areas of the Terminal site are the minimum needed for maintaining safety and functionality of Terminal facilities, operations, utilities, maintenance, and circulation, as well as the laydown areas required for Terminal construction.

The primary proposed Terminal components will consist of:

- A marine berth, mooring dolphins, unloading platform, transfer system, and turning basin
- Screened water intake, pumps, and piping to supply water to unloading ships for cooling and ballast
- Three LNG storage tanks
- LNG pumps, vaporization, metering, and send-out facilities
- Utilities, buildings, infrastructure, and support equipment
- Stormwater surface infiltration facility
- Instrumentation and control facilities
- Vapor management system
- Fire protection and detection system
- Site security system
- Fuel gas system

As noted above in Table 1-1, the completed Terminal will occupy only approximately 10 percent of the 411-acre parcel, and approximately 15 percent (or 61.4 acres) would be set aside in a conservation easement to protect Hunt Creek and associated confluence wetlands. Except for the access road and electric power line, and temporary construction impacts to the soil disposal area and the quarry, the remainder of the property beyond the conservation area would be left undeveloped. It is instructive to note that the 40-acre Terminal site is very small in relation to the acreage occupied by the three existing FERC-approved LNG facilities that have a similar output capacity; Elba Island (120 acres), Dominion Cove Point (108 acres), and Lake Charles (382 acres). The majority of land at all three of these sites has been cleared and developed in order to support LNG-related facilities.

Avoidance and Minimization in Construction

While Bradwood began with a relatively compact site design and layout, project design, construction, operations, and maintenance plans have continued to evolve during the development process to include substantive and innovative ways to avoid impacts to the extent feasible, and to minimize the magnitude, extent, and duration of unavoidable impacts. During construction, Bradwood would implement an adaptive management approach and select appropriate best management practices ("BMPs") in order to capitalize on avoidance and minimization opportunities that cannot be predicted.

A complete list of avoidance and minimization measures can be found in Table 1-2, Avoidance and Minimization Actions, at the end of this section. A few significant measures are listed below for both the Terminal and Pipeline.

For the Terminal, special construction techniques and measures (BMPs) have been developed and will be applied to the extent possible to avoid or minimize impacts to wetlands, waterways, and other resources, including the following:

- The required buffer zones shall be maintained between construction activities and significant wildlife resources.
- Leaving a vegetative buffer zone between wetlands and upland construction areas.
- Installing and maintaining erosion control measures such as silt fences, interceptor dikes, and hay bale structures to minimize sediment transport into otherwise unaffected wetlands.
- Upon completion of construction, temporary use areas will be restored.
- Techniques will be applied to minimize the potential impacts from pile driving required to construct the marine wharf facilities.
- Selecting larger diameter pilings for the wharf at the Terminal (48-inch, 54-inch, 84-inch, and 96-inch steel piles) to minimize the number of piles and driving all piles vertically within a bubble-filled caisson to minimize acoustic impacts on fish, waterfowl, marine mammals, and other aquatic resources.
- Installing screened water intakes at the wharf to provide cooling and ballast water to the LNG carriers while docked to avoid entrainment and impingement of juvenile fish.
- Minimizing the amount of water drawn from the Columbia River by filling ballast tasks with the same water used to cool the engines.

Similarly for the Pipeline, BMPs have been developed to avoid or minimize impacts to wetlands, waterways, and other resources, including the following:

- Reducing the construction corridor width from 100 feet to 85 feet in unsaturated wetlands less than 100 feet in length.
- Stockpiling wetland soils in upland areas where practicable.
- Where necessary to prevent rutting or mixing of topsoil and subsoil, using a temporary board road to allow passage of equipment with minimal disturbance of the surface and vegetation.
- Cutting trees to grade, but removing stumps only within 15 feet of the edge of the pipe trench, or where safety concerns dictate otherwise.
- Segregating topsoil from subsoils.
- Using horizontal directional drilling (“HDD”) to cross selected roads, waterbodies, and wetlands along the proposed Pipeline ROW to minimize surface disturbance.
- Considering stream volume and velocity and available backfill materials in establishing the depth of cover over the Pipeline in each stream in order to minimize the potential for scour and the ultimate exposure of the Pipeline.
- Using concrete-coated pipe or concrete weights to counteract buoyancy forces in saturated soils.
- Leaving a vegetative buffer zone between the wetland and the upland construction areas, except for over the pipe trench itself, and installing and maintaining erosion control measures such as silt fences, interceptor dikes, and hay bale structures to minimize sediment transport into the wetland.

- Installing trench plugs where necessary to prevent the unintentional draining of water from wetlands.
- Upon completion of construction, restoring the ROW, with the exception that a 10-foot-wide path directly over the Pipeline will be maintained in a herbaceous state, and trees greater than 15 feet in height will not be allowed to grow within 15 feet of the Pipeline.

Summary and Conclusions from 404(b)(1) Alternatives Analysis

The 404(b)(1) alternatives analysis process was applied as part of the project development to prepare the project for permitting. The following are some of the highlights relative to the least environmentally damaging practicable alternative, including various components for which alternatives are feasible.

Terminal

After considering multiple layers of alternatives, the proposed Terminal location was determined to be the least environmentally damaging location that would meet the purpose and need. The layout of the Terminal was designed and reconfigured to minimize the amount of wetlands and waters of the United States that would be filled.

Some of the key criteria for sizing the ship turning basin were to allow for safe berthing and clearances of LNG carriers, tugboats, and other vessels while limiting the potential for an incident that might compromise safety. An analysis demonstrated that the marine basin was not oversized and that it would require the largest tugs on the lower Columbia and highly trained pilots to utilize the optimally sized marine basin to safely maneuver the LNG carriers. A separate analysis demonstrated that reducing the size of the turning basin would have essentially the same (relatively low) impacts on aquatic organisms.

The final two dredge disposal alternatives (of five first considered) were determined to be (1) all onsite upland disposal or (2) a combination of some amount of on-site disposal and the remainder "in-water" to offset potential erosion effects from sediment depletion. The proposed site for in-water disposal is at a Wahkiakum County sand pit site on Puget Island, which although placement may initially technically occur above mean higher high water ("MHHW") along the shoreline, because of the rapid rate of erosion at the site, will actually become resuspended and redistributed in the Columbia River by flow and wave-induced erosive forces. Upland placement of most of the remaining material will occur at Bradwood Landing as fill to raise the elevation of the site before construction. Some of the dredged material in the sand pit itself will provide public benefit by providing material to repair the failing containment levee and providing a source of material for emergency repairs on other Wahkiakum County levees. Therefore the disposal alternative that is a combination of on-site upland disposal and in-water disposal was determined to be the least environmentally damaging, providing benefits for aquatic organisms and riverine processes by returning some of the dredged sediments to the river, and also human benefits by allowing a beneficial use of the material as Bradwood construction material and reducing construction and disposal costs.

Two wharf steel piling alternatives were considered: (1) a typical 36-inch steel pile and (2) a large monopile design using 54- to 96-inch piles. The larger pile is preferred because a caisson

(larger diameter sleeve pipe) can be installed and the pile driving can take place inside. This will give at least a one-foot space surrounding the piling being driven, within which a large amount of bubbles forming a "bubble-curtain" will be maintained during pile driving. With this alternative, the effects on fish will be avoided or minimized to the greatest extent possible.

Pipeline

Two potential pipeline routes were reviewed (of four first considered), and it was determined that the least environmentally damaging practical alternative would be the proposed route extending from the Terminal eastward past Wauna and Westport, crossing the Columbia River near Port Westward, because it would also provide a balance of benefits by allowing for the most reduction in impacts to sensitive resources while also providing access to industrial gas users to support the purpose and need of the project.

Compensatory Mitigation

After a comprehensive process of avoiding and minimizing impacts as required by multiple regulatory drivers,[3] Bradwood's proposed compensatory mitigation would occur at three geographically distinct locations in Oregon and Washington.[4] Oregon mitigation sites (specifically Svensen Island) are located in the lower Columbia River estuary ("Estuary means a body of water semi-enclosed by land and connected with the open ocean, within which salt water is usually diluted by fresh water derived from the land. In the general sense, 'estuary' includes all estuarine waters, tidelands, tidal marshes and submerged lands extending upstream to the head of tidewater. However, the Columbia River Estuary has been more narrowly defined to extend to the western edge of Puget Island [ORS 54.605])." The Peterson Point Terrestrial Habitat Mitigation Site would be associated with the estuary in the general sense in that it is located just upstream in the Westport Slough area. The remaining site, known as the Delameter Creek Wetland and Riparian Enhancement Mitigation Site, is located in Cowlitz County, Washington. Each mitigation site was selected based on its ability to provide compensatory mitigation for wetlands, ESA-listed fish, and/or wildlife. For example, the restoration efforts at the Peterson Point Terrestrial Habitat Mitigation Site would target wildlife (i.e., CWTD), while those at Svensen Island would focus on habitat improvement and access for listed salmonids. Compensatory mitigation for wetland impacts would occur at Svensen Island (Oregon) and at the Delameter Creek (Washington) mitigation site. Because mitigation requirements for impacts to wetlands and listed salmonids are not mutually exclusive (fish habitat functions being one of the wetland functions), the riparian enhancements at Delameter Creek and restoration activities at Svensen Island sites serve the dual purpose of addressing mitigation requirements of both.

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[3] MEMORANDUM OF AGREEMENT BETWEEN the Department of the Army AND The Environmental Protection Agency CONCERNING THE DETERMINATION OF MITIGATION UNDER THE CLEAN WATER ACT SECTION 404(b)(1) GUIDELINES (February 8, 1990); Oregon Administrative Rules ("OAR") 141-085-0240 through 141-085-0257 (pertaining to estuarine mitigation as it relates to issuance and enforcement of removal-fill authorizations within waters of Oregon including wetlands); Washington State Water Pollution Control Act (chapter 90.48 RCW), Growth Management Act (chapter 36.70A RCW), Aquatic Resources Mitigation Act (chapter 90.74 RCW), Water Quality Regulations (chapter 173-201A WAC); Oregon Division 415 Fish and Wildlife Habitat Mitigation Policy.

[4] Negotiations for some of the proposed mitigation properties are in advanced stages and expected to be successfully completed. However, if agreements cannot be reached, then these sites will be replaced with other suitable sites.

Compensatory mitigation for unavoidable impacts is designed to exceed existing mitigation standards. Following temporary impacts, such as those resulting from Pipeline installation (Figures 1-3 and 1-4) or Terminal construction (Appendix A – Shoreline Revegetation Plan), habitat and ecosystem functions would be restored in place (post-construction site restoration). Permanent impacts to wetlands, fish, or wildlife habitat would be mitigated by restoring habitat with similar ecological function. Mitigation would occur in areas substantially larger than that lost to permanent impacts, and would be restored to a higher level of ecosystem function. Adaptive management through monitoring, maintenance, and contingency measures are part of the commitment to successful implementation of this Mitigation Plan.

Table 1-2 Avoidance & Minimization Actions for Bradwood Landing Project

Project Action	Category of Effect	Potential Project Effect	Pre-Project (Baseline) Condition	Post-Project (Proposed) Condition	Avoid or Minimize	Description of Avoidance or Minimization
Filling for Terminal construction (permanent)	Direct habitat loss	eAbout 13 acres of tidal wetland is accessible to and presumed fully used by Chinook, chum, and coho salmon subyearlings for rearing habitat during high tides. Also designated critical habitat for Snake River sockeye, spring-summer Chinook, and fall Chinook.	Filled to become Terminal site	Avoid Minimize	Selected a former industrial site to avoid more pristine sites	
					Minimized the facility footprint and reconfigured the terminal to reduce fill impacts by about 20%	
Pilings for wharf (permanent)	Direct habitat loss	Direct habitat loss of river area occupied by pilings totaling about 0.37 acre mostly in 20+ feet of water. Water functions would be lost.	About 0.37 acre, mostly in 20 to 40 feet of water, used as migratory corridor by upriver stocks of fish. Habitat not limiting.	Pilings would occupy the space. Current would go around pilings, changing currents locally.	Minimize	Minimized the number of pilings by using larger diameters
Filling for Terminal construction (permanent)	Direct habitat loss	Direct loss of riparian habitat at the Terminal	About 40 acres of river shore area that is accessible to Columbia white-tailed deer would be lost. This is a former industrial site, much of which has received dredged material. There are patches of Scot's broom and other weedy species that thrive on dredge spoils. There are small patches of cottonwoods and willows. While the site is accessible to CWTD, it has little habitat value for them and is not a corridor leading to or from high value habitat.	The site will have no forage or cover and will be fenced.	Avoid	Selected a former industrial site to avoid more pristine sites
					Minimize	The Terminal site has been minimized and is much smaller than existing LNG terminals.

Project Action	Category of Effect	Potential Project Effect	Pre-Project (Baseline) Condition	Post-Project (Proposed) Condition	Avoid or Minimize	Description of Avoidance or Minimization
Clearing for transmission line	Direct habitat loss	Loss of old-growth timber			Avoid	The transmission line route was moved to avoid loss of old-growth forest.
Turning basin dredging (three months)	Temporary disturbance of habitat	Dredging of the turning basin will deepen and temporarily eliminate common benthic invertebrates.	46 acres of bottom habitat ranges in depth from 21 to 42 feet. Benthic invertebrates common to those depths are relatively sparse. Salmonid use is primarily as a migration corridor. Sturgeon and flounders may forage here.	Depth will be greater and uniform. Benthic invertebrates expected to recolonize over a period of months. Salmon migration and foraging by other fish would continue.	Avoid	Site was located where no shallow water habitat would be dredged
					Minimize	Site was located where only water deeper than 21 feet will be dredged
Disposal of dredged material to fill terminal site (three months)	Temporary disturbance of habitat	Return water from upland dredge disposal will add some turbidity locally.	Shallow water near the Terminal location is highly used by juvenile salmon for rearing and has abundant benthic invertebrates. Suspended sediment has the potential to bury benthic organisms and adversely affect salmon activities.	Local habitat would recover very rapidly when turbidity returns to normal.	Avoid	
					Minimize	Bradwood will use BMPs to minimize sedimentation impacts from dredging, resulting in only minor, nonlethal effects.
Disposal of dredged material in the river system (three months)	Temporary disturbance of habitat	In-water dredge disposal return water will add some turbidity locally.	Dredge disposal sites similar in function to terminal site, but already affected by previous and ongoing dredged material disposal	Local habitat would recover very rapidly when turbidity returns to normal.	Avoid	Loss of sediment for downstream habitat would be partially avoided by placing as much as possible of the dredged material back in the river system.
					Minimize	Bradwood will use BMPs to minimize sedimentation impacts from dredging, resulting in only minor, nonlethal effects.
Maintenance dredging of turning basin (one month,	Temporary disturbance of habitat	Maintenance dredging and disposal will have similar impacts as the original dredging, but to a lower	Bottom sediments accumulating will develop benthic invertebrate communities by influx from	Recolonization would start over.	Avoid	Loss of sediment for downstream habitat would be partially avoided by placing dredged material back in the river system.

Project Action	Category of Effect	Potential Project Effect	Pre-Project (Baseline) Condition	Post-Project (Proposed) Condition	Avoid or Minimize	Description of Avoidance or Minimization
repeated every two to four years)		degree and for less time because much less material would be moved from generally deeper water and the impacts would last much less time.	immediately upriver areas.		Minimize	Bradwood will use BMPs to minimize sedimentation impacts from dredging.
Pipeline crossings of major streams (one day to two weeks per crossing)	Temporary disturbance of habitat	Potential fracture-out of HDD drill mud could put clay particles in the water. The effects of that sediment to fish would vary with the volume of mud versus the volume of water and with the fish in the location. It could range from inconsequentially small to moderate in impact.	Undisturbed stream bottom habitats	Drill mud would settle on downstream habitat as fine sediment unless or until high flows disperse it.	Avoid	HDD is a method of choice to avoid impacts to the water.
					Minimize	Bradwood will use BMPS to minimize the potential impacts from accidental fracture-out.
Pipeline crossings of streams (one to five days per crossing)	Temporary disturbance of habitat	Potential direct habitat disturbance and sediment and blockage effects on salmonids from pipeline crossings of streams	Undisturbed stream bottom habitats	Fluming or cofferdams would minimize sediment effects. Restoration of substrate would allow quick recolonization of benthic organisms.	Avoid	Use HDD or other boring to cross salmon streams.
					Minimize	Use BMPs for crossings where boring is not feasible to minimize effects on salmonids and other aquatic organisms; restore habitat features.
LNG carrier cooling and ballast water intake during terminal operation (about 17 hours every three days)	Direct effects on fish and aquatic organisms	Entrainment of juvenile fish (including ESA-listed salmonids) with ship ballast and cooling water intake while unloading at the dock	N/A	N/A	Avoid	Changed project design to provide screened water to ships at dock for cooling engines and filling ballast tanks, thus avoiding entrainment impacts to juvenile fish (including listed salmon)

Project Action	Category of Effect	Potential Project Effect	Pre-Project (Baseline) Condition	Post-Project (Proposed) Condition	Avoid or Minimize	Description of Avoidance or Minimization
Installation of pilings for wharf (four months)	Direct effects on fish and aquatic organisms	Pile driving sound pressures may harm Stellar sea lions that could be in the area during the construction period.	N/A	N/A	Minimize	Monitor for Stellar sea lions within the 190 dB effect area and don't start pile driving until the Steller sea lion has moved outside the protective zone
Installation of pilings for wharf (four months)	Direct effects on fish and aquatic organisms	Pile driving sound pressures may harm fish that could be in the area during the construction period.	N/A	N/A	Avoid	Most fish will be avoided by doing pile driving during the in-water work window.
					Minimize	Bradwood changed the design to use fewer, all vertical piles to be able to use BMPs (caissons full of bubbles) to minimize impacts from pile driving.
LNG carriers transiting river (one every three days during operation of terminal)	Direct effects on fish and aquatic organisms	Stranding of subyearling salmon by ship wakes is possible	N/A	N/A	Avoid	The speed of LNG carriers in the river will be limited by the tethered tug to speeds below which most wake stranding occurs.
					Minimize	LNG carriers will only traverse the lower 38 miles of the river, where very little wake stranding has been documented.
Turning basin dredging (three months)	Direct effects on fish and aquatic organisms	Dredging entrainment of fish	N/A	N/A	Minimize	Most fish will be avoided by doing dredging during the in-water work window. BMPs during dredging will minimize effects.

2.0 WETLAND MITIGATION

Due to the separate regulatory jurisdictions in Oregon and Washington, wetland impacts will be mitigated separately for each state. Temporary wetland impacts in both states will be mitigated immediately following construction through site restoration activities. Section 2.1 discusses the proposed mitigation plan for compensating impacts to wetlands and other waters in Oregon. Section 2.2 discusses the proposed mitigation plan for compensating forested wetland conversion impacts in Washington.

2.1 Oregon Wetland Mitigation

Construction of the proposed Terminal in Oregon will result in permanent and temporary estuarine and nonestuarine wetland and waterway impacts (see Figure 2-1). In addition, construction of the Pipeline will result in temporary impacts to wetlands and waterways. Three other components of construction that will occur in Oregon to support the proposed Terminal include the electric transmission line, temporary construction crew parking lot, and Clifton Road improvements. These construction areas have been designed to avoid impacts to wetlands and, as such, are not discussed in this plan.

2.1.1 Summary of Wetland/Waterway Impacts to Be Compensated

Impacts to wetlands and waterways in Oregon are summarized below.

Temporary Impacts in Oregon

- Terminal: Up to 1.5 acres
- Pipeline: Up to 75.64 acres

Permanent Terminal Impacts

- Fill of a 5.05-acre log pond under tidal influence with open water and emergent wetland habitat that is accessible to fish

- Fill of 7.60 acres of additional tidal wetlands that are a mix of forested, scrub-shrub, and emergent habitat (a maximum of 4.97 acres of this is fish accessible on higher tides, probably none at tides lower than 4 feet)

- Fill of about 0.69 acre of nontidal wetland

- Dredging of 45 acres for the 58-acre turning basin below the jurisdictional boundary of the Columbia River

- Fill (pilings) of about 0.37 acre below the jurisdictional boundary of the Columbia River

2.1.2 Mitigation Goals and Objectives

Temporary Impact Restoration

Mitigation goals were established to avoid and minimize any temporal loss of wetland and other water functions. This will be accomplished by quick restoration of impacts to all wetland areas that cannot be avoided. Biologists and/or environmental inspectors will inspect the construction-related impacts and the level of restoration success during construction. Contractors will have the incentive to reduce impacts and restore conditions appropriately, as inspectors will be recording data used to produce as-built drawings that would document any negligence. Included below are descriptions of the general mitigation goals to avoid, minimize, or replace short-term construction losses to the wetland and other water functions:

- Pre-construction
  - Demarcate and maintain construction fencing through stages of construction as appropriate to protect and avoid wetlands and other waters.
  - Avoid all shrubs and trees within wetlands, other waters, and riparian areas where practicable.
- Avoid important wetland and other water habitat for endangered species.
- Minimize the width of the construction corridor in wetlands, riparian areas, and other waters.
- Avoid construction in wetlands and other waters during critical life stages of endangered species or during seasons when such species are known to occur.
- Remove any flow diversions and restore the hydrology of the site immediately after completion of construction.
- Restore vegetation structure in impacted areas by replanting native vegetation salvaged during Pipeline installation. For areas with undesirable vegetation (i.e., 100 percent cover of reed canarygrass), a native seed mix may be applied to the site to encourage establishment of native vegetation.
- Restore stream channels to pre-construction condition, including riffle-pool morphology and stream channel substrate.
- Install water breaks along the Pipeline, as necessary, to prevent lateral movement of groundwater within the Pipeline trench backfill.
- Restore soil profiles and impervious soil layers to resemble pre-construction conditions.

The following goal will be measured by performance standards (Section 2.1.8) to determine the overall success of the many goals listed above:

> **Goal 1:** Restore temporarily impacted wetlands quickly to minimize temporal loss of wetland functions. The objective of this goal is to ensure that all temporarily impacted wetlands and waterways will be restored immediately following construction by:
>
> 1. Grading aquatic sites back to their original contours with the topsoil replaced above the subsoils,
> 2. Applying a native seed mix to all bare soil areas, and
> 3. Ensuring that there are no impediments to baseline water inputs and/or outfalls.

Estuary Resource Replacement

The foremost goal for mitigating the permanent estuarine wetland impacts in Oregon is to provide in-kind compensation for lost wetland acreage and functions by restoring tidal influence to an area currently isolated from tidal influence such that the restored tidal wetland acreage and resulting functional lift will be provided in quantities that more than offset the impacts. Based on this, the following goal will be measured by performance standards:

> **Goal 2:** Restore tidal influence to convert existing palustrine wetlands to tidal wetlands and convert some upland areas into tidal wetlands at Svensen Island. This would be done to compensate for the loss of tidal and nontidal wetland habitat at the Terminal. An overall objective is to provide better habitat, in terms of both wetland and fish habitat functions, than that being lost.

A key function at the impact site that will be impacted by Terminal construction is the provision of off-channel fish habitat, especially for juvenile salmon. In order to specifically address this loss and to also address the widely expressed need for such habitat within the lower Columbia River ecosystem, the following goal was developed[5] and will be measured using performance standards:

> **Goal 3:** Restore or create off-channel tidal habitat that is accessible to fish, including juvenile salmonids. The objective of this goal is to offset the direct impacts to wetland/waterway fish species as a result of loss and/or degradation of aquatic habitats used by these fish due to construction of the Terminal. Restoring the tidal estuarine habitat in the lower Columbia River is a priority in many conservation plans for the area including the Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (LCFRB 2004), and recovery plans for the evolutionary significant unit ("ESU") of salmonids of the lower Columbia River (NMFS 2006).

To facilitate Goals 2 and 3, the applicant proposes to create aquatic habitats in-kind with those at the impact site through mitigation actions on Svensen Island, including the restoration (in the case of middle Svensen Island) and the further restoration, enhancement, and preservation (in the case of lower Svensen Island) of tidal influence on lands formerly isolated from the tides by dikes. The goals would be achieved via the following actions:

On middle Svensen Island:

- Protect two existing home sites by placing fill around one and raising the eastern cross-dike
- Remove three tidegates on the south side of the island

[5] A separate section of this Mitigation Plan has been developed to specifically address impacts to fish habitat (see Section 4.0 of this report), however, this plan attempts to recreate similar wetland/waterway habitats at the mitigation site such that this function is mitigated in terms of wetland area as it relates to section 404 of the Clean Water Act (the "CWA") and the Oregon State Removal-Fill Law.

- Breach the northern dike near the cross-dike between middle and lower Svensen Island (the above actions will flood about 65 acres at normal high tide)
- Provide a large culvert connection through the cross-dike to facilitate wetland vegetation seed transport from lower to middle Svensen Island to speed wetland establishment
- Fill or reconfigure existing drainage ditches
- Excavate new low-tide channels
- Place some excavated material along selected dike areas to facilitate growth of shrubs and trees to be planted
- Add anchored large woody debris ("LWD") at tidal channels as fish habitat features
- Control invasive weeds

On lower Svensen Island:

- Control invasive weeds
- Add anchored LWD at tidal channels as fish habitat features
- Further restore fish accessibility by removing two remaining tidegates from existing culverts
- Further restore fish habitat value by removing several (up to eight) remaining culverts on former farm roads that block fish escape with receding tides
- Further restore wetland and riparian habitat by removing remaining buildings and facilities so that plants can grow (possibly adding soil)
- Remove remaining fuel tanks that might pose a risk to aquatic organisms

2.1.3 Baseline Conditions of Impact Sites

The baseline conditions of the impact sites (Terminal, Pipeline, and Power Line) are described below.

Terminal

The following subsections (A through J) provide baseline information for the Terminal impact site.

A. Responsible Parties

Applicant and Pending Site Owner [6]

Bradwood Landing LLC
Gary Coppedge
Senior VP Development
905 Commercial Street
Astoria, OR 97103
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Wetland Mitigation Plan Preparer

URS Corporation
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Portland, OR 97201
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B. Location Information

The impact site is on the south shore of the Columbia River at approximately River Mile ("RM") 38, in Sections 4 and 9, Township 8 North, Range 6 West of the Willamette Meridian ("W.M."). The latitude and longitude coordinates are 46.19773° N, 123.43810° W. The site is located immediately south of the Clifton Channel of the Columbia River, at the confluence of Hunt Creek and the Columbia River. The site is accessed by Clifton Road, approximately 2.5 miles north of its intersection with U.S. Highway 30. The impact site location is shown on Figure 1-1.

C. Wetland Delineation

Descriptions of the wetlands and waterways delineated at the impact sites are based on information reported in wetland delineations by CREST (2003) and URS Corporation ("URS") (2006a).

A brief summary of all wetlands delineated within the Bradwood Landing construction area is provided below. Wetlands 1, 2a, 2b, 3, 4, 5, and 6 were delineated by CREST in 2003, but described in the CREST report as Wetlands A through E. A description of these wetlands can be found in the CREST report. Subsequent to the CREST delineation, Rhea Environmental Consultants ("REC") delineated additional areas at the site, and changed the CREST wetland names from letter designations to numeric designations. In December 2005, URS delineated two additional wetlands at the site. URS wetlands were given letter designations to differentiate them from REC wetlands. For consistency, URS has retained the numeric nomenclature for the CREST wetlands, as designated by REC, in this mitigation plan. Table 2-1 identifies the wetland names used in this report that correspond to the original CREST wetland names.

[6] The pending site owner is also the responsible party for the impact site and proposed mitigation. Upon obtaining all permits for site construction, Bradwood will purchase the Bradwood Landing site from the current landowner as per an existing purchase agreement.

Table 2-1. Wetland Naming Reference Table

CREST Wetland Name (CREST 2003)	URS Wetland Name (URS 2006)
A (north)	6
A (south)	5
B	4
C	3
D (north)	2a
D (south)	2b
E	1

From a geomorphic perspective, wetlands at the impact site occur on or within two landforms: tidal plains and tidal channels. All wetlands within the impact site are within the freshwater salinity regime of the Columbia River estuary. The upstream extent of saltwater intrusion from the Pacific Ocean occurs at least 10 miles downriver at RM 28 (USACE 1999).

Construction of the former Bradwood mill and town site, roads, a railroad, and placement of dredge disposal material derived from dredging of the Columbia River have resulted in fragmentation of the existing wetlands. Some of the wetlands are remnants of the historic tidal marsh surrounding the confluence of Hunt Creek and the Columbia River. Table 2-2 provides a brief summary of wetlands and waterways delineated at the Terminal that would be permanently impacted by site construction. Table 2-3 provides a brief summary of the wetlands and waterways delineated at the Terminal that would be temporarily impacted by site construction.

Table 2-2. Summary of Wetlands and Waterways to Be *Permanently* Impacted

Wetland Feature	Cowardin Classification	HGM Classification	Estuarine Classification (Tidally-Influenced Wetlands Only)	Impact Acres	Description of Wetland Feature
Wetland A	Palustrine, emergent, seasonally flooded (“PEMC”)	Depressional Closed	N/A	0.33	Irregularly shaped herbaceous wetland situated in slight depression in area historically filled for the housing associated with mill town.
Wetland E	Palustrine, emergent, saturated (“PEMB”)	Slope Valley	N/A	0.36	Herbaceous wetland mosaic containing 10% upland areas. Wetland was entirely filled prior to 1960 but has since been scraped down with the removal of historic structures. Now developing into wetland.

Wetland Feature	Cowardin Classification	HGM Classification	Estuarine Classification (Tidally-Influenced Wetlands Only)	Impact Acres	Description of Wetland Feature
Wetland F	PEMB	Depressional Closed	N/A	0.003	Small depression in a large area of fill associated with mechanical scraping. Ground surface now close enough to seasonally high water table to develop into herbaceous wetland.
Wetland 1	Palustrine, emergent, seasonal tidal ("PEMR")	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/ herbaceous swamp vegetation	5.05	Previous log pond with large portions of emergent wetland. Has an open channel connection to the Columbia River.
Wetland 2a (including expansion area)	Palustrine, scrub-shrub, seasonal tidal ("PSSR")	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub swamp vegetation	1.65	Scrub-shrub, tidally influenced natural wetland fragmented from other historically connected wetlands by fill material placed prior to the CWA.
Wetland 2b (including expansion area)	Palustrine, scrub-shrub, seasonally flooded ("PSSC")	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub swamp vegetation	0.98	Scrub-shrub, tidally influenced natural wetland fragmented from other historically connected wetlands by fill material placed prior to the CWA.
Wetland 3	PSSR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub swamp vegetation	0.13	Scrub-shrub, tidally influenced wetland containing fill material placed prior to the CWA. This wetland surrounds Hunt Creek and is wetted by fluctuating surface and groundwater associated with the tides.
Wetland 4	PSSR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub swamp vegetation	0.08	Scrub-shrub, tidally influenced wetland containing fill material placed prior to the CWA. This wetland is adjacent to Hunt Creek and is wetted by fluctuating surface and groundwater associated with the tides.
Wetland 5 (including expansion areas)	PSSR/PEMR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub and emergent swamp vegetation	2.10	Scrub-shrub/emergent, tidally influenced wetland with areas containing fill material placed prior to the CWA. Northwestern portion directly inundated by Columbia River.
Wetland 6 (including expansion areas)	Palustrine, forested, seasonal tidal ("PFOR") and PEMR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub and emergent swamp vegetation	2.66	Forested/emergent, natural wetland containing fill along eastern edge associated with dredge spoils pile. Northwestern portion directly inundated by Columbia River.

Wetland Feature	Cowardin Classification	HGM Classification	Estuarine Classification (Tidally-Influenced Wetlands Only)	Impact Acres	Description of Wetland Feature
Columbia River	Estuarine intertidal ("E2USR")			0.37	Perennial waterway under tidal influence that provides navigation for international cargo and habitat for several species of endangered fish.

Table 2-3. Summary of Wetlands and Waterways to Be *Temporarily* Impacted at the Terminal

Wetland Feature	Cowardin Classification	HGM Classification	Estuarine Classification (Tidally-Influenced Wetlands Only)	Impact Acres	Description of Wetland Feature
Wetland B	PSSC	Depressional Closed	N/A	0.10	Circular-shaped excavated wetland situated in slight depression at base of steep cliff.
Wetland C	Palustrine, forested, seasonally flooded, saturated ("PFOE")	Depressional Closed	N/A	0.02	Small wetland at base of steep hill associated with groundwater seepage where lateral flow is intercepted by the railroad grade and impounded.
Wetland D	Palustrine, forested ("PFO") and palustrine emergent ("PEM")	Depressional Outflow	N/A	0.01	Long, narrow wetland at base of steep hill associated with groundwater seepage where lateral flow is intercepted by the railroad grade and impounded. Continues off-site.
Wetland F	PEMB	Depressional Closed	N/A	0.001	Long, narrow wetland at base of steep hill associated with groundwater seepage where lateral flow is intercepted by the railroad grade and impounded. Continues off-site.
Wetland 3 (including expansion areas)	PSSR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub swamp vegetation	0.50	Scrub-shrub, tidally influenced wetland with areas containing fill material placed prior to the CWA.
Wetland 5 (including expansion areas)	PSSR/PEMR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub and emergent swamp vegetation	0.69	Scrub-shrub/emergent, tidally influenced wetland with areas containing fill material placed prior to the CWA. Northwestern portion directly inundated by Columbia River.

Wetland Feature	Cowardin Classification	HGM Classification	Estuarine Classification (Tidally-Influenced Wetlands Only)	Impact Acres	Description of Wetland Feature
Wetland 6 (including expansion areas)	PFOR/PEMR	River-Sourced Tidal Fringe	Freshwater/ sandy-mud substrate/scrub-shrub and emergent swamp vegetation	0.18	Forested, natural wetland containing fill along eastern edge associated with dredge spoils pile. Northwestern portion directly inundated by Columbia River.
Columbia River (below MHHW)	E2USR	N/A	N/A	3.24	Sand piles (dredge disposal material).
Ditch 1	Riverine	N/A	N/A	0.04	Rock-lined railroad drainage feature that outflows to Columbia River. Ditch 1 is not fish-passable due to a four-foot drop at the east end of its channel.

D. Wetland Classification

The 10 wetlands identified at the site were classified according to the hydrogeomorphic ("HGM") classification (Adamus 2006) and Cowardin classification systems (Cowardin et al 1979). The results of wetland classification are presented in Tables 2-2 and 2-3.

HGM Classification

The majority of wetland acres in the impact area are tidally influenced. These wetlands were classified according to the *HGM Assessment Guidebook for Tidal Wetlands of the Oregon Coast*. Specifically, Wetlands 1 through 6 have been assigned to the River-Sourced Tidal Fringe subclass. Nontidal wetlands were classified using the *HGM-based Assessment of Oregon Wetland and Riparian Sites*. Nontidal wetlands include Wetlands A, B, C, D, E, and F (delineated by URS 2006). These are generally classified as slope valley, depressional outflow, or depressional closed wetlands.

Cowardin Classification

Wetland 1 includes a mosaic of estuarine intertidal, emergent ("E2EM") and estuarine intertidal, unconsolidated shore ("E2US") wetlands. Wetlands 2 through 5 are PSSR wetlands or PEMR wetlands. Wetland 6 is partly PEMR but with a portion of PFOR. URS wetland A is a palustrine emergent, seasonally flooded wetland on spoils ("PEMCs"). URS wetland B is a palustrine scrub-shrub, seasonally flooded, broad-leaved deciduous ("PSSC1") wetland.

E. Aquatic Resource Functions

URS previously completed a wetland functions assessment for all wetlands delineated at the Terminal (URS 2006a). The functions assessment included wetlands that will not be impacted by the project. To provide a more accurate assessment of aquatic resource functions that would be impacted by construction of the project, URS completed a supplemental functions assessment for only those wetlands that would be permanently impacted by the project (Table 2-2).

The original functions assessment (URS 2006a) was completed using data obtained during the wetland delineations, additional data gathered in the field on May 25, 2006, and additional resources such as topographic maps, soil survey maps, and aerial photographs. Wetland functions were assessed using the *Rapid Assessment Method for Tidal Wetlands of the Oregon Coast* (Adamus 2005). The method was developed using reference data collected from 120 reference wetlands on the Oregon coast, excluding the Columbia River estuary. Although Columbia River estuary reference sites were not used to develop this method for tidal wetlands, this methodology was judged to be more applicable to the Terminal wetlands than the HGM judgmental method, which was not developed for tidal wetlands.

The supplemental functions assessment was completed (Appendix B) using the same data and methodology as were used for the original functions assessment. The supplemental functions assessment also made use of additional data obtained during the wetland delineation completed at the Terminal in September 2006.

The functions assessment method evaluates the following 12 wetland functions:

- Produce Aboveground Organic Matter
- Export Aboveground Plant & Animal Production
- Maintain Element Cycling Rates & Pollutant Processing; Stabilize Sediment
- Maintain Habitat for Native Invertebrates
- Maintain Habitat for Anadromous Fish
- Maintain Habitat for Visiting Marine Fish
- Maintain Habitat for Other Visiting & Resident Fish
- Maintain Habitat for Nekton-feeding Wildlife
- Maintain Habitat for Ducks and Geese
- Maintain Habitat for Shorebirds
- Maintain Habitat for Native Land Birds, Small Mammals, & Their Predators
- Maintain Natural Botanical Conditions

The method assigns two scores for each function, one score for the wetland's functional capacity to perform the function and one score for the wetland's value of providing the function (opportunity to provide the function). Capacity is scored on a 0 to 1 scale, with 1 being the highest possible capacity to perform a function, and 0 representing no capacity to perform a function. Value is similarly scored on a 0 to 1 scale, with 1 representing a high value for a given function, and 0 representing no value for a function. Functional capacity and value scores for the impact site wetlands are provided in Table 2-4. The following text provides a summary of the overall functional capacity and values for wetlands at the impact site.

Table 2-4. Functional Capacity and Value Scores for Wetlands at Impact Site

Function	Functional Capacity			Functional Value	
	Unadjusted	Adjusted (0 to 1 Scale)	Relative Certainty (Unscaled)	Score (Indicator Maximum)	Relative Certainty of the Score
Produce Aboveground Organic Matter	0.12	0.39	0.82	0.80	1.00
Export Aboveground Plant & Animal Production	0.45	0.17	0.86	0.80	1.00
Maintain Element Cycling Rates & Pollutant Processing; Stabilize Sediment	2.56	0.58	0.87	0.80	1.00
Maintain Habitat for Native Invertebrates	0.17	0.39	0.77	0.40	0.90
Maintain Habitat for Anadromous Fish	1.16	0.30	0.58	0.90	0.90
Maintain Habitat for Visiting Marine Fish	0.35	0.42	0.62	0.30	0.70
Maintain Habitat for Other Visiting & Resident Fish	1.00	0.34	0.59	0.30	0.70
Maintain Habitat for Nekton-feeding Wildlife	1.56	0.26	0.71	0.50	0.90
Maintain Habitat for Ducks and Geese	2.65	0.69	0.77	0.40	0.90
Maintain Habitat for Shorebirds	0.69	0.54	0.81	0.40	0.90
Maintain Habitat for Native Landbirds, Small Mammals, & Their Predators	1.45	0.61	0.82	0.50	0.90
Maintain Natural Botanical Conditions	Not scored[1]	Relatively high[1]	Not scored[1]	0.50	0.80

[1] Scoring of capacity for this function requires site-specific vegetation data that was not collected for this project. Rather, the function was evaluated based on vegetation data obtained during the wetland delineations and best professional judgment.

Overall, the supplemental assessment resulted in slightly to significantly lower functional scores for the majority of functions when compared to the functional scores for all wetlands at the Terminal (as communicated in the original functions assessment). This is particularly true for the following three functions related to fish: (1) Maintain Habitat for Anadromous Fish, (2) Maintain Habitat for Visiting Marine Fish, and (3) Maintain Habitat for Other Visiting & Resident Fish. The functions assessment methodology calculates scores for these three functions based on up to 15 separately scored functional indicators. Of these, five indicators exhibit a strong influence on the overall functional score for fish-related functions. These functional indicators are:

- Indicator No. 27 (ShadeLM): The percent of the low marsh that is shaded by trees or topography.
- Indicator No. 32 (LWDChan): Number of pieces of LWD in wetland's tidal channel network.
- Indicator No. 36 (Fresh): Types of freshwater sources that feed the wetland internally.
- Indicator No. 53 (Exits): Number of internal channel *exits*. Exits are where internal channels flow into unvegetated waters or mudflats outside of the wetland.
- Indicator No. 54 (JuncMax): Number of internal channel *junctions*. Channel junctions are visible confluences between two internal tidal channels regardless of their relative sizes.

Each of these indicators scored significantly lower for the impact site compared to all wetlands at the Terminal. The primary reason for the lower scores is the exclusion of Hunt Creek and wetlands at the mouth of Hunt Creek from the impact site. Exclusion of these wetlands reduced the percent of marsh shaded by trees or topography, particularly at the south end of the site where forested wetlands and uplands are present. The impact wetlands receive no freshwater inputs, unlike the excluded wetlands in and adjacent to Hunt Creek, which do receive freshwater inputs from Hunt Creek. Wetlands within the impact site each have only one internal channel exit, and channel junctions are minimal or absent. Finally, LWD is generally lacking within the impact wetlands. Some LWD is present around the perimeter of the log pond (at the wetland's upland edge), but this location provides minimal benefit to fish within the log pond because it is available to fish, if they are present, only at high tides (generally above about 7 feet).

In addition, most of the impacted wetlands are not accessible to fish at times other than peak high tide. The majority of impacted wetlands are at elevations 2 to 4 feet above mean tide level. The only wetland that is accessible to fish throughout most of the diurnal tidal cycle is the log pond (Wetland 1 on Table 2-2) The development of Wetland 1 via excavation for a log storage pond can be seen in the historic and current aerial photos (Photos 1 and 2 in Appendix C). Photo 3 in Appendix C provides a current photo of Wetland 1. This man-made wetland is roughly rectangular and is approximately 700 feet long by 250 feet wide. The log pond has a well-established connection with the Columbia River, which may be more prominent during the winter months than dry summer months, when it is likely tidally dependant. Dense emergent vegetation has established on sand-silt deposits in the middle of the pond, but open water remains in the deeper, eastern third of the pond. Reconnaissance-level depth surveys were taken at 15 random locations using a rowboat and fiberglass stadia rod. Measurements were taken approximately midway through the receding morning tide (approximate elevation 5.8 feet with high tide at 7.75 feet at 7:15 a.m.). Measurements may have taken up to 45 minutes, indicating some reduction in tide elevation during the measurement period. Depths ranged from a low of 0.5 foot to a high of approximately 6.5 feet. No salmonids were observed in the log pond during one exploratory survey (using electrofishing and seining) in December 2005.

It would appear from the above information that a zero tide would make all of the log pond dry except a puddle at the southeastern end. Even a +2.0 tide would not provide fish access to the entire log pond. However, observations by other biologists noted water flowing out of the log pond during low tides during wetter seasons, perhaps indicating some groundwater input to the pond, rather than simply the lag time in pond draining attributable to the constriction of the outlet. Juvenile salmon, especially subyearling fry, are not strong swimmers. It would appear

that even if water flows out of the pond at low tide and forms a continuous water connection with the river, these conditions would not necessarily indicate accessibility to juvenile salmon during low tide.

A generous estimate of the area of the log pond that is accessible to juvenile salmon from the river at low tide (a +2.0 tide) is approximately one acre. At tides between 4 and 5 feet, about half of the pond would be accessible (approximately 2.5 acres), and the whole pond would be accessible at tides above 5 feet.

F. Existing Hydrology

The site is located at the confluence of Hunt Creek and the Columbia River. Existing hydrologic features at the impact site are shown on Figure 2-1. The Columbia River drains a 258,000-square-mile watershed in the United States and Canada. Average annual flow at the river mouth is 265,000 cubic feet per second. Flow in the river is usually greatest in the winter and spring, peaking in May or June as a result of snowmelt. Flow declines in the summer and fall, increasing again in December as storms pass over the Pacific Northwest.

The Hunt Creek watershed (Figure 2-2) lies to the south of the impact site. Its watershed consists primarily of undeveloped forestlands that have been used historically for timber production. The watershed includes one main highway (U.S. Highway 30), county rural paved roads, and numerous private and public gravel logging roads. Commercial and industrial development is generally absent, although there are several residences within the watershed. Flows are greatest during the winter, particularly during heavy rainfall events, and decline throughout the summer, with the lowest flows occurring in late summer and early fall.

Construction of the former Bradwood mill and town site, roads, a railroad, and placement of dredge disposal material derived from dredging of the Columbia River have historically affected the site topography, and the majority of upland areas within the impact site are the result of historical placement of fill. Prior to anthropogenic impacts, the impact site was likely a contiguous tidal marsh wetland, but placement of fill has resulted in some fragmentation of the wetland into individual wetland areas. The majority of these wetland areas remain hydrologically connected to one another as well as to the Columbia River, and thus most of the wetlands experience tidal effects to a similar degree.

The depth to groundwater is variable across the site, and is primarily a function of ground surface elevation above the level of tidal fluctuation. In general, the depth varies from 0 inches to more than 20 inches below ground surface ("bgs"). Because of the site's proximity and direct connection to the Columbia River and associated diurnal tidal fluctuations, groundwater elevations are primarily a function of adjacent surface water elevations. Highest groundwater elevations would be expected to occur during high river stage periods in the Columbia River, either in the winter during winter storms or in late spring during the spring freshet.

In terms of water budget, the hydrology of the impact site is influenced primarily by diurnal tidal cycles, and therefore much of the tidal plain includes tidal marsh, a network of small tidal channels, and areas of mud flats and open water. Wetlands within these features are described above. As such, the primary water source that supports wetlands at the site is the diurnal tidal

cycle. Direct precipitation and flows within Hunt Creek are secondary hydrologic inputs to part of the wetlands, but do not directly support wetlands to the extent of the diurnal tides. The majority of the precipitation likely infiltrates into the sandy fill material, or to a lesser extent, flows overland to surface water features. Because the site hydrology is supported primarily by diurnal tides, the water budget for the site generally does not vary greatly between wet and dry years.

G. Existing Vegetation

The Terminal site consists of upland dredged spoil areas, native upland conifer/deciduous forest, tidal marsh at the confluence of Hunt Creek and the Columbia River, and shrub and forested swamp associated with the riparian area of Hunt Creek. Upland dredged spoil habitat is located adjacent to the access road and along the shoreline. Additional buildup of this area may have been augmented by past industrial activities and placement of the existing road and railroad berm. This area appears to have been disturbed by past grading and industrial activities associated with the old mill. Vegetation in this area consists primarily of disturbance-oriented species including a number of nonnative plants dominated by Scot's broom[7] to the south of the old railroad and everlasting peavine along the shoreline.

Upland conifer/deciduous forest is located at the southern end of the site on relatively steep slopes above the Hunt Creek and Columbia River floodplain. This area has been intensively logged and currently consists of a forest canopy dominated by Douglas fir, red alder, and bigleaf maple. The average diameter at breast height ("dbh") of canopy trees is approximately 6 to 10 inches. Common understory species include red elderberry, sword fern, Pacific bleeding heart, western oxalis, palmate coltsfoot, fringecup, and false lily-of-the-valley.

The riparian area adjacent to Hunt Creek consists of a relatively wide alluvial bench containing forested and scrub-shrub wetlands, as well as areas of high-marsh emergent wetland. The floodplain is tidally influenced and is considered part of the estuarine system. The upper portion of the floodplain, located just below Hunt Creek Falls, contains a forested wetland community dominated by red alder in the canopy and salmonberry and lady fern in the understory.

Forested wetlands located in the central portion of the floodplain are dominated by Sitka spruce with the scrub-shrub wetlands being dominated by Douglas' spiraea. Subdominant plant species associated with both wetland communities include red osier dogwood, Sitka willow purple loosestrife, small-fruited bulrush, slough sedge, skunk cabbage, reed canarygrass, and yellow flag iris. The segment of Hunt Creek flowing through this portion of the basin is a low gradient meandering stream with a muck bottom.

The lowest portion of the site contains tidal mudflats and associated low-marsh wetland communities and backwater pools at, or near, the mouth of Hunt Creek. The low-marsh wetland plant communities are dominated by common spikerush, small-fruited bulrush, reed canarygrass, and yellow flag iris.

[7] For ease of readability, common names were used throughout the text, except in tables and appendices, and Botanical, or scientific, names are referenced Appendix D.

H. Existing Soils

Based on Natural Resource Conservation Service (the "NRCS") soil survey data for Clatsop County (USDA-NRCS 1984), the impact site includes four soil series and water. Seventy-four percent (45.8 acres) of the site is covered by Udipsamments, nearly 15 percent (9.1 acres) is covered by Locoda silt loam, 5 percent (3.1 acres) is covered by Harslow-Kilchis very gravelly loams, and only 0.02 percent (0.01 acre) is covered by the Scaponia-Braun silt loams. Water comprises slightly more than 6 percent (3.9 acres) of the area of the site. This 3.9-acre area of water is associated with the Terminal berth facility, which would be located over water.

Udipsamments occupy all of the northern, and most of the eastern and southern, portions of the site. Small areas of Locoda silt loam are located in the southwestern corner of the site along Hunt Creek and the Columbia River, and in low-lying areas near the current railroad ROW. Harslow-Kilchis very gravelly loams are present in a limited area along the proposed railway realignment at the far eastern extent of the proposed Project site, and a small area of Scaponia-Braun silt loams is located at the western edge of the site. Water is present along the northeast margin of the site, within the footprint of the berth facility.

Udipsamments

Udipsamments (Series 69) are comprised of stratified dredged sand fill on slopes ranging from 0 to 15 percent. Historically this soil consists of dredged material removed from the Columbia River that was used as fill to establish constructible lands. Typical sections of Udipsamments in the vicinity of the proposed Terminal site consist of an approximately 2-inch-thick, loose, single-grain, dark grayish brown sand with common very fine roots underlain by a 1-foot-thick layer of loose, single-grain, dark gray sand. This dark gray sand layer is generally underlain by loose, single-grain, light gray sand to a depth of 60 inches or more. This soil unit can range in thickness from 40 inches to in excess of 30 feet. It is excessively drained with very rapid permeability. Organic content for this soil is not reported, but is expected to be very low. It is not listed as a hydric soil by the NRCS.

Harslow-Kilchis Series

Harslow-Kilchis soils (Series 22F) are predominantly found on mountainsides between elevations of 200 and 1,600 feet above mean sea level ("MSL"), although they extend to an elevation of less than 50 feet at the proposed project site. Harslow-Kilchis loams are typically the substrate in areas of woodland and wildlife habitat. The typical profile of this soil unit consists of 10 to 18 inches of dark brown very gravelly loam, with moderate very fine granular structure, underlain by 8 to 16 inches of dark brown to brown, very to extremely cobbly loam with a moderate fine subangular blocky structure. This in turn is underlain by basalt at depths of 18 to 34 inches. The deposit is a shallow to moderately deep colluvial soil unit that is well drained and has moderately rapid permeability. Organic content is 4 to 10 percent. It is not listed as a hydric soil by the NRCS.

Locoda Series

Locoda soils (Series 39A) are found in tidal-influenced floodplains. Typical uses include wildlife habitat, but they can also be used as cropland if the soil can be adequately drained. The typical soil profile consists of 10 inches of very dark to dark grayish brown, mottled silt loam with moderate very fine subangular blocky structure. The surface layer is generally underlain by

a 16-inch-thick layer of gray, mottled, massive silty clay loam. The bottom layer of this soil unit is an approximately 34-inch-thick gray, massive silt loam. The soil unit is very deep and can extend to depths beyond 60 inches. It is very poorly drained with moderately slow permeability. Groundwater elevations are typically within one foot of the ground surface, and ponding of storm runoff is common in areas where this soil unit is present. The organic content is 2 to 4 percent. It is listed as a hydric soil by the NRCS.

Scaponia-Braun Series

Scaponia-Braun soils (Series 57E) are predominantly found on mountainsides between elevations of 200 to 1,600 feet above MSL, although they extend to an elevation of less than 50 feet above MSL at the proposed project site. Scaponia-Braun silt loams are typically the substrate in areas of woodland and wildlife habitat. The typical profile of this soil unit consists of 3 to 7 inches of very dark grayish brown silt loam with moderate fine granular structure, underlain by 17 to 36 inches of dark yellowish brown, yellowish brown, and brown silt loam with moderate fine subangular blocky structure. This in turn is underlain by 5 inches of strong brown, massive silt loam, and then weathered siltstone bedrock. The deposit is a moderately deep colluvial soil unit that is well drained and has moderate permeability. The organic content is 2 to 4 percent. It is not listed as a hydric soil by the NRCS.

I. Existing Fish and Wildlife

Impacted wetlands at the Terminal are used primarily by fish, amphibians, and macroinvertebrates. Raptors use the surrounding upland forest areas off-site for hunting perches. Geese, blue herons, and ducks use the wetlands for foraging. Deer and other land mammals pass through the site from upland areas to gain access to the Columbia River for drinking water. No evidence of beaver has been documented at the site; however, nutria have been seen in Hunt Creek by wetland biologists during 2005 field investigations. Fish populations at the Terminal site are representative of shallow water and water column communities for the Columbia River estuary. Juvenile Chinook are present in large numbers throughout the year. Three-spine sticklebacks are also found throughout the year and throughout the site. Some other salmonids are present seasonally, with chum, coho, and steelhead spending limited time at the site during the summer rearing months. There are also a number of bottom-feeding species that utilize the shallow water and sandy bottom of the area; notable among these are the starry flounder and the pea mouth. For more information on fish use at and around Bradwood Landing, see Section 4.0 (Fish Habitat Mitigation).

J. Watershed Context and Surrounding Land Uses

The impact site consists of a tidal plain at the confluence of Hunt Creek and the Columbia River. This area of tidal plain is isolated from other tidal plain areas along the Columbia River by steep cliffs in both the upstream and downstream directions of the river (Figure 2-1).

It is the site of a former sawmill and town, and as described previously, construction of the former Bradwood mill and town site, roads, a railroad, and placement of dredge disposal material have historically affected the site topography, and the majority of upland areas within the impact site are the result of historical placement of fill. Currently the site is vacant. Former structures associated with the mill have been removed.

The proposed future use of the site is for the LNG receiving Terminal (about one-tenth of the property). Because the site was previously used for industrial purposes, it has a high potential for use in the future as an industrial site (recognized by Clatsop County zoning as MI for small to medium facilities). Surrounding areas are undeveloped forest lands that have been used for timber production, and across Highway 30 is an active rock pit, and Bonneville Power Administration transmission lines traverse the general area running north-south. There are several residences within one mile of the site. Across Clifton Channel, the U.S. Fish and Wildlife Service ("USFWS") maintains Tenasillahe Island for management of CWTD, and across the Columbia navigation channel, Puget Island is relatively heavily populated and dominated by rural homes and agricultural uses. Approximately four miles upriver, the Georgia-Pacific Paper Mill (locally and historically known as the Wauna Mill) has been in operation for many years. Cathlamet, a community of 535, is located 2.5 miles away across the Columbia River in Wahkiakum County.

Pipeline

The Oregon section of the Pipeline alignment is located within the historic Columbia River floodplain. Although many of the wetlands in the project area are located in close proximity to the Columbia River or several large sloughs connected to the river, the hydrologic connection of wetlands to the river and sloughs has been altered due to the historic construction of numerous levees and berms in the Columbia River floodplain, mainly due to the agricultural land use of the area. In addition, numerous ditches have been excavated in agricultural fields. Wetland hydrology in the project area is fed mainly by a seasonally high groundwater table associated with the nearby Columbia River and precipitation falling on poorly drained soils. The system of levees and berms in the project area prevents regular overbank flooding of the river, sloughs, and ditches into adjacent wetlands; however, it is likely that most of the existing wetlands receive overbank flooding during large storm events. Table 2-5 provides descriptions of wetlands and waterways delineated within the Pipeline corridor.

Table 2-5. Summary of Wetlands and Waterways to Be *Temporarily* Impacted by Pipeline Construction

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
A0505	Palustrine, scrub-shrub, broadleaf deciduous, saturated/ semipermanent/ seasonal ("PSS1Y")	Flats	0.0031	0.0255	Consists of two wet areas separated by a sand path. Hydrology supported by high groundwater, surface runoff, and occasional overbank flooding from Ditch A0505. Saturated soils present. Soil consists of sandy dredge material. Vegetation includes a mix of emergent and scrub-shrub species.
A0508	Palustrine, forested, broadleaf deciduous, seasonally flooded ("PFO1C"), palustrine, scrub-shrub, broadleaf deciduous, seasonally flooded ("PSS1C"), PEMC	Slope/Flats, Flats, Riverine Impounding	0.2537	0.8479	Hydrology supported by high groundwater table and some surface runoff from the surrounding area. Associated with Driscoll Slough. Saturated soils present. Soil consists of silt loam with organic content in the upper portions of the profile, and sand content increasing with depth. Vegetation includes a mix of emergent, scrub-shrub, and forest species.
A0510	PFO1C, PSS1C, palustrine, emergent, persistent, seasonally flooded/saturated ("PEM1E")	Slope/Flats, Riverine Impounding, Riverine Flow-through	0.0173	0.0417	Hydrology supported by high groundwater table, some surface runoff from the surrounding area. Associated with Driscoll Slough. Saturated soils present. Soil consists of native silt loam. Vegetation includes a mix of emergent, scrub-shrub, and forest species.
A0511	PFO1C, PSS1C, PEM1E	Slope/Flats, Riverine Impounding, Riverine Flow-through		0.0046	Hydrology supported by high groundwater table, some surface runoff from the surrounding area. Associated with Driscoll Slough. Saturated soils present. Soil consists of native silt loam. Vegetation includes a mix of emergent, scrub-shrub, and forest species.
A0606	Palustrine, emergent, intermittently flooded excavated ("PEMJx"), palustrine, emergent, seasonally flooded/saturated ("PEME")	Depressional	0.2365	0.6990	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Saturated soils present. Soil consists of gleyed silty clay loam and clay loam. Vegetation includes emergent species.

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
A0608	PFO1C, palustrine, emergent, persistent, seasonally flooded/saturated (“PEM1C”), palustrine, scrub-shrub, deciduous, seasonally flooded/saturated (“PSS6C”)	Flats	1.6602	5.0124	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Areas of surface saturation present. Soil consists of silt loam with organics and fine sands. A hybrid poplar plantation makes up the western portion of the wetland. Vegetation includes a mix of emergent and scrub-shrub species.
AA0508	Palustrine, forested, broadleaved deciduous, temporarily flooded (“PFO1A”), palustrine, emergent, persistent, temporarily flooded (“PEM1A”), PEM1C, palustrine, emergent, seasonally flooded/saturated farmed (“PEMEf”)	Flats, Riverine Impounding	2.6975	9.1070	Hydrology is the result of direct precipitation, a seasonal high groundwater table, and backwater flooding associated with Randa Slough. Areas of saturation and shallow inundation present. Soil consists of silty clay loam. Vegetation includes a mix of emergent species and hybrid poplars.
AA0509	PEM1A, PEM1C	Flats	1.4498	5.5080	Wetland is a flat grass field with hummocky topography. Hydrology is the result of direct precipitation and a seasonal high groundwater table. Four ditches are associated with the wetland in the study area. Soils were saturated and areas of shallow inundation present. Soil consists of silty clay loam. Vegetation includes emergent species.
AA0511	Palustrine, emergent, persistent, seasonally flooded/saturated farmed (“PEM1Ef”)	Flats	0.1808	0.5462	Actively farmed pasture. Hydrology is the result of direct precipitation and a seasonally high groundwater table. Saturated soils present. Soil consists of silty clay loam and silt loam. Vegetation includes emergent species.
AA0512	PEM1Ef	Flats	0.0041	0.0309	Pasture disturbed from grazing. Hydrology is a result of direct precipitation and a seasonally high groundwater table. Saturated soils present. Soil consists of silt loam and silty clay loam. Vegetation includes emergent species.

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
AA0515	PFO1A, PEM1A, PEM1C	Flats, Riverine Impounding	2.9062	8.7821	Hydrology is the result of backwater flooding, direct precipitation, and a seasonal high groundwater table. Areas of surface saturation and inundation present. Soils were not sampled due to deep ponding. Vegetation includes a mix of aquatic and emergent species and hybrid poplars.
AA0519	PEM1Ef	Flats, Riverine Flow-through	0.1588	0.6011	Actively grazed pasture. Hydrology is the result of direct precipitation and a seasonally high groundwater table. Deep soil cracks present. Soil consists of silty clay loam. Vegetation includes emergent species.
AA0523	PEMEf	Flats	0.8805	1.8064	Hydrology is the result of direct precipitation and a seasonally high groundwater table. Also receives surface water inputs from Ditch 4 to McLean Slough. Soils moist throughout and areas of ponding observed nearby at same elevation. Soil consists of silt loam and silty clay loam. Vegetation includes emergent species.
AA0605	PEME	Flats	0.2467	0.8770	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Soils slightly moist; likely meets hydrology criterion earlier in growing season. Soil consists of silty clay loam. Vegetation includes emergent species.
AA0615	Palustrine, forested, broadleaved deciduous, seasonally saturated (“PFO1E”), PEM1C	Flats	0.7215	0.8658	Hydrology is a result of direct precipitation and a seasonal high groundwater table. Saturated soils present. Soil consists of silt loam, silty clay loam, and muck. Vegetation includes a mix of emergent species and hybrid poplar.
AA0620	PEM1E, palustrine, scrub-shrub, seasonally flooded/saturated (“PSSE”)	Depressional Closed	0.0384	0.1439	Located within a depressional area. Hydrology is the result of direct precipitation and a seasonal high groundwater table. Saturated soil and areas of shallow inundation present. Soil consists of silt loam and silty clay loam. The vegetation in the majority of Wetland AA0620 has been recently cleared. Vegetation includes emergent species.

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
B0511	PFO1C, PSS1C, PEM1E	Slope/Flats, Riverine Impounding, Riverine Flow-through	0.0112	0.0243	Low-scoring functions: resident fish habitat support, breeding waterbird support. Moderate-scoring functions: water storage and delay, sediment stabilization and phosphorous retention, nitrogen removal, primary production, thermoregulation, invertebrate habitat support, amphibian and turtle habitat, wintering and migratory waterbird support. High-scoring functions: songbird habitat support, support of characteristic vegetation.
B0606	PEMJx, PEME	Depressional	0.1289	0.1578	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Saturated soils present. Soil consists of gleyed silty clay loam and clay loam. Vegetation includes emergent species.
B0608	PFO1C	Riverine Flow-through	0.0029	0.0067	Hydrology is the result of direct precipitation, a seasonal high groundwater table, and occasional overbank flooding from Westport Slough. Wetland does not appear to be tidally influenced. Areas of surface saturation and shallow inundation present. Soil consists of silt loam with organics and sands. Vegetation includes a mix of emergent, scrub-shrub, and forest species.
BB0511	PEM1Ef	Flats	1.2013	4.3581	Pasture actively grazed in the western portion and recently plowed in the eastern portion. Hydrology is the result of direct precipitation and a seasonally high groundwater table. Saturated soils present. Soil consists of silt loam and silty clay loam. Vegetation includes emergent species.
BB0512	PEM1Ef	Flats	0.3321	1.1468	Pasture disturbed from grazing. Hydrology is a result of direct precipitation and a seasonally high groundwater table. Saturated soils present. Soil consists of silt loam and silty clay loam. Vegetation includes emergent species.

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
BB0519	PEM1Ef	Flats	0.6225	2.1995	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Deep soil cracks present. Soil consists of silty clay loam and silt loam. Vegetation includes emergent species.
BB0523	PEM1C	Slope/Flats	0.2284	0.7994	Hydrology is a result of direct precipitation and a seasonally high groundwater table. Likely meets hydrology criterion earlier in growing season. Soil consists of silt loam and sand. Vegetation includes emergent species.
BB0615	PEM1E	Flats	0.7539	1.0528	Hydrology is a result of direct precipitation and a seasonal high groundwater table. Soils very moist; likely meets hydrology criterion earlier in growing season. Soil consists of silty clay loam. Vegetation includes emergent species.
BB0620	PEM1E, PSSE	Depressional Closed		0.0005	Located within a depressional area. Hydrology is the result of direct precipitation and a seasonal high groundwater table. Saturated soil and areas of shallow inundation present. Soil consists of silt loam and silty clay loam. The vegetation in the majority of Wetland AA0620 has been recently cleared. Vegetation includes emergent species.
BB0622	PEM1E	Depressional Closed, Flats	0.4418	0.4716	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Soils slightly moist with glistening peds; likely meets hydrology criterion earlier in growing season. Soil consists of silt loam with organics and silty clay loam. Vegetation includes mix of emergent species and hybrid poplar.
C0505	Palustrine, emergent, broadleaf deciduous, saturated/ semipermanent/ seasonal (“PEM1Y”)	Flats	0.0180	0.0514	Hydrology supported by shallow groundwater, some surface runoff from the surrounding area. Saturated soils and areas of shallow inundation present. The area appears to pond throughout. Soils are atypical, containing dredge sand. Vegetation includes a mix of emergent and scrub-shrub species.

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
C0511	PFO1C, PSS1C, PEM1E	Slope/Flats, Riverine Impounding, Riverine Flow-through	0.0815	0.2029	Low-scoring functions: resident fish habitat support, breeding waterbird support. Moderate-scoring functions: water storage and delay, sediment stabilization and phosphorous retention, nitrogen removal, primary production, thermoregulation, invertebrate habitat support, amphibian and turtle habitat, wintering and migratory waterbird support. High-scoring functions: songbird habitat support, support of characteristic vegetation.
C0606	PFO1E	Flats	0.7420	2.3768	Hybrid poplar plantation. Hydrology is the result of direct precipitation and a seasonal high groundwater table. Soils very moist; likely meets hydrology criterion earlier in growing season. Soil consists of silty clay loam and clay loam. Vegetation includes mix of emergent species and hybrid poplar.
CC0519	PEM1Ef	Flats	0.2794	0.5450	Actively grazed pasture. Hydrology is the result of direct precipitation and a seasonal high groundwater table. Likely meets hydrology criterion earlier in growing season. Soil consists of silt loam. Vegetation includes heavily grazed emergent species. The site appears to have been recently seeded.
CC0523	PFO1C, PSSC, PEM1C	Flats	0.6660	3.3540	Wetland contains depressional areas and hummocks throughout. Hydrology is a result of direct precipitation and a seasonally high groundwater table. Saturated soils are present. Soil consists of silt loam with sands and gravels. Soils in the northwestern portion of contain fill. Vegetation includes a mix of emergent and forest species.
CC0622	PEM1E	Depressional Closed, Flats	0.0249	0.1488	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Soils slightly moist with glistening peds; likely meets hydrology criterion earlier in growing season. Soil consists of silt loam with organics and silty clay loam. Vegetation includes mix of emergent species and hybrid poplar.

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
DD0519	PEM1Ef	Flats		0.6665	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Likely meets hydrology criterion earlier in growing season. Soil consists of silty clay loam. Vegetation includes emergent species.
DD0523	Palustrine, forested, seasonally flooded ("PFOC"), PSSC, riverine tidal, emergent ("R1EM")	Depressional		0.0004	Hydrology assumed to be the result of direct precipitation and a seasonally high groundwater table. Soils were not sampled due to difficult access. Vegetation includes a mix of emergent, scrub-shrub, and forest species.
Ditch 1 to Beaver Slough			0.0061	0.0195	
Ditch 1 to Larson Slough			0.0046	0.6278	
Ditch 1 to McLean Slough			0.0092	1.9035	
Ditch 1 to Tributary to Westport Slough			0.0058	0.0189	
Ditch 11 to McLean Slough			0.0007	0.0049	
Ditch 17 to Uncle Tom Slough			0.0046	0.0133	
Ditch 2 to Beaver Slough (Part 1)			0.1288	0.2173	
Ditch 2 to Beaver Slough (Part 2)				0.2917	
Ditch 2 to McLean Slough			0.0023	0.0058	
Ditch 20 to Uncle Tom Slough				0.0044	
Ditch 21 to Uncle Tom Slough				0.0005	

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
Ditch 3 to McLean Slough			0.0023	0.0051	
Ditch 4 to McLean Slough			0.0024	0.4559	
Ditch 5 to McLean Slough			0.0023	0.0051	
Ditch 5 to Tributary to Westport Slough			0.0046	0.0147	
Ditch 5 to Uncle Tom Slough			0.0046	0.0115	
Ditch 7 to McLean Slough			0.0024	0.0054	
Ditch 9 to McLean Slough			0.0024	0.0051	
Ditch A0505			0.0093	0.0182	
Ditch A0523			0.0194	0.0417	
Ditch AA0519			0.0058	0.0192	
Ditch B0523			0.0067	0.0395	
Ditch BB0511			0.0046	0.0228	
Ditch BB0519				0.0578	
Ditch BB0523			0.0008	0.0029	
Ditch CC0509			0.0057	0.0185	
Ditch CC0519			0.0023	0.0799	
Ditch DD0509			0.0057	0.0184	
Ditch EE0509			0.0058	0.0188	
Ditch FF0509			0.0059	0.0192	
Ditch GG0515			0.0059	0.0194	

Wetland Feature	Cowardin Classification	HGM Classi-fication	Impact Acres (Re-moval)	Impact Acres (Fill)	Description of Wetland Feature
EE0519	PEM1Ef	Flats	0.4078	0.6043	Hydrology is the result of direct precipitation and a seasonal high groundwater table. Likely meets hydrology criterion earlier in growing season. Soil consists of silty clay loam. Vegetation includes emergent species.
EST-1	PEM	Flats	0.4720	1.5612	Extends from Woodson Road to Tributary to Kelli Slough
EST-2	PEM	Flats	1.2946	4.8075	Extends from Ditch 2 to Tributary to Westport Slough east to Ditch 5 to Westport Slough; possibly connected to Wetland BB0511
EST-3	PEM	Flats	1.2275	4.5911	Extends from Westport Slough/Midland Canal east to likely connect to Wetland AA0519
EST-4	PEM, PFO	Flats	1.3839	4.1839	Mapped NWI wetland; extends from Ditch 7 to Uncle Tom Slough east to Uncle Tom Slough; likely connects to Wetland C0606
EST-5	PEM	Flats	0.2098	0.8462	Likely an extension of Wetland AA0605
EST-6	PEM	Flats	0.2056	0.6562	Likely connected to Wetland A0606
EST-8	PFO	Unknown	0.0462	0.0943	Extends from Point Adams Road to Beaver Slough
Larson Slough			0.0242	0.0612	
McLean Slough 1			0.0115	0.0278	
McLean Slough 2			0.0115	0.0280	
Uncle Tom Slough			0.0895	1.3056	
Uncle Tom Slough 1			0.0605	0.1506	
Uncle Tom Slough 2			0.0006	0.2693	

Source: URS Corporation. 2006b. Wetlands and Other Waters Delineation Report, Bradwood Landing Pipeline. October 2006. Portland, Oregon.

For ease of discussion, the Oregon portion of the Pipeline has been split into four subareas, as shown on Figure 1-1:

- Subarea 1: Bradwood Terminal to Westport Slough (West); Maps 1-4
- Subarea 2: Westport Slough (West) to Westport Slough (East); Maps 4-7
- Subarea 3: Westport Slough (East) to Beaver Slough; Maps 7-9
- Subarea 4: Beaver Slough to Columbia River; Maps 9-12

General wetland conditions within each subarea are described briefly below in terms of their Cowardin classification and dominant vegetation.

Subarea 1: Bradwood Terminal to Westport Slough (West)

Wetlands delineated in the northernmost portion of the alignment, just south of the proposed Terminal, include Wetland AA0505, an emergent wetland dominated by spreading rush, tufted hairgrass, and red alder seedlings; and Wetland BB0505, a forested headwater sloped drainage with areas of skunk cabbage and bracken fern.

Fourteen wetlands were delineated on the Georgia-Pacific Paper (Wauna) Mill property. These include (from west to east) Wetlands A0512, B0512, A0516, A0510, B0510, A0511, B0511, C0511, A0508, A0509, A0505, B0505, C0505, and D0505. These wetlands fall into three Cowardin wetland classes: PFO; palustrine, scrub-shrub ("PSS"); and PEM. Most of the wetlands on the Wauna Mill property contain a mix of all three Cowardin classes. Forested wetlands include species such as red alder, black cottonwood, Pacific willow, Sitka spruce, red osier dogwood, Douglas' spiraea, slough sedge, skunk cabbage, hooked buttercup, orange balsam, and water parsley. Scrub-shrub wetlands are dominated by Pacific willow, Hooker willow, Sitka willow, red osier dogwood, Douglas' spiraea, slough sedge, skunk cabbage, American speedwell, orange balsam, and water parsley. Emergent wetlands are dominated by spreading rush, soft rush, tapered rush, slough sedge, skunk cabbage, Dewey's sedge, sawbeak sedge, orange balsam, water parsley, and western mannagrass.

Subarea 2: Westport Slough (West) to Westport Slough (East)

Ten wetlands were delineated within Subarea 2 of the project corridor. These include (from west to east) Wetlands B0608, A0608, AA0515, AA0509, AA0508, BB0515, AA0512, BB0512, BB0511, and AA0511. These wetlands fall into three Cowardin wetland classes: PFO, PSS, and PEM. Forested wetlands consist mainly of densely planted poplar plantations with an herbaceous layer of soft rush, western mannagrass, water foxtail, and meadow foxtail (Wetland AA0508). The western portion of forested Wetland A0608 had recently been clearcut and was mainly devoid of vegetation on the day of the field investigation. The forested wetland located immediately east of Westport Slough (B0608) consists of a dense community of red alder, willow, rose, reed canarygrass, and stinging nettle. Emergent wetlands on the property managed by Ducks Unlimited are typically dominated by soft rush, water foxtail, meadow foxtail, common velvetgrass, fowl bluegrass, creeping buttercup, and birdsfoot trefoil, with a large open-water slough in the western portion of the Ducks Unlimited site (AA0515). Emergent wetlands located on several privately owned parcels generally consist of pastures dominated by soft rush and common horsetail, meadow foxtail, water foxtail, bluegrass, and common velvetgrass. Pastures are heavily grazed in areas. In places where pastures had not been recently grazed, a greater diversity of vegetation species was observed, including small areas of slough sedge and bigleaf sedge. Two wetlands (A0608 and BB0515) also contain small scrub-shrub areas of rose, spiraea, willow, salmonberry, red osier dogwood, and red alder saplings.

Subarea 3: Westport Slough (East) to Beaver Slough

Eleven wetlands were delineated within Subarea 3 of the project corridor. These include (from west to east) Wetlands AA0519, BB0519, CC0519, DD0519, EE0519, BB0615, AA0615, CC0606, AA0605, AA0606, and BB0606. Wetlands were classified mainly as PEM. Emergent wetlands generally consist of pastures dominated by meadow foxtail, bluegrass, common velvetgrass, reed canarygrass, soft rush, common horsetail, and creeping buttercup. Most pastures are actively grazed. In one pasture wetland (AA0615) that had not been recently grazed, sawbeak sedge was also noted. Two wetlands (AA0615 and CC0606) consisted of densely planted hybrid poplar plantations with reed canarygrass, common horsetail, and creeping buttercup in the understory. A scrub-shrub wetland fringe was present along an unditched stream in Wetland AA0519. Scrub-shrub vegetation consisted of Oregon ash, red alder, black hawthorn, willow, rose, salmonberry, red osier dogwood, and Himalayan blackberry.

Subarea 4: Beaver Slough to Columbia River

Nine wetlands were delineated within Subarea 4 of the project corridor. These include (from west to east) Wetlands BB0620, AA0620, CC0622, BB0622, AA0622, AA0523, BB0523, CC0523, and DD0523. Several emergent wetlands on Greenwood Management Organization ("GMO") property were dominated by soft rush, common velvetgrass, and common horsetail between rows of young planted hybrid poplar plantations; a cover of hybrid poplar saplings was 10 to 20 percent. The majority of vegetation in Wetland AA0620, also located on GMO property, had been recently cleared, and there was a small area of remaining emergent wetland dominated by reed canarygrass and soft rush. Emergent wetlands on the Port of St. Helens property were mainly dominated by reed canarygrass and common horsetail, and there were also areas where slough sedge, small-fruited bulrush, and soft rush were co-dominant, along with the reed canarygrass. One wetland (AA0523) on the Port of St. Helens property was actively farmed, one portion was planted with mint, and another portion had been recently plowed. Small areas of forested and scrub-shrub wetlands were also present in the eastern portion of the Port of St. Helens property near Bradbury Slough. Forested areas were dominated by black cottonwood, and scrub-shrub wetlands were dominated by Douglas' spiraea, willow, and native rose. Wetland DD0523 was located near the confluence of Bradbury Slough and the Columbia River and was dominated by Oregon ash and black cottonwood, along with willow shrubs, red osier dogwood, rose, and native black hawthorn.

2.1.4 Site Selection: Rationale and Justification

Site Selection Rationale

The driving factor in selecting a site for restoration was the ability of a given site to replace estuarine functions that would be lost at the Terminal. An estuarine functions assessment of the impact site (URS 2006b) determined that providing rearing habitat for anadromous fish species (ESA-listed Chinook, coho, and chum salmon in particular) was one of the most important functions provided by the impact site. To this end, the site selection process placed finding sites with the opportunity to restore fish habitat as the highest priority. This also addresses the widely expressed need within the lower Columbia River ecosystems to restore wetlands that once received tidal influence and were accessible to fish, especially juvenile salmon (LCRFRB 2004).

These priorities made it necessary to find sites where restoration could be done in a time frame useful for the permitting of the project. It also meant that landowners who were willing to make the land available for such purposes had to be found. Those constraints required that a significant length of the lower Columbia River had to be considered in the search in order to have enough possibilities to assure adequate coverage when negotiations over site control were concluded. Therefore, while the mitigation sites are relatively close to the impact sites with respect to the lower Columbia River ecosystems, they are not necessarily within the same subbasins as the impacts (multiple subbasins for the Pipeline impacts). The concern to find and control the best possible sites for overall mitigation value overrode the desire to have the mitigation site located within the same subbasin as the permanent estuarine impact sites.

Justifications

The middle Svensen Island site met all the search criteria and was deemed suitable for replacing estuarine habitat in Oregon. The site is located 14 river miles west of the Terminal impact site within the portion of the Columbia River designated as estuarine by the Department of State Lands ("DSL"). Salinity and tidal influence are similar at both the impact and mitigation sites, and both are within the lower Columbia River watershed. The restored site would be accessible to all of the ESA-listed salmon affected by construction of the Terminal.

Sites in both the lower and middle portions of Svensen Island are proposed for restoration under this plan, and the two sites will be joined by dike breaching, resulting in a substantial increase in fish-accessible tidal wetland habitat.

In addition, preservation of the estuarine wetland adjacent to the Terminal at the confluence of Hunt Creek and Clifton Channel will protect and maintain high-value estuarine wetland habitat. This site serves the same ESA-listed salmon as the Terminal impact site.

Fish Habitat Benefit

The middle Svensen Island site has the potential to provide substantial benefits to surrounding fish habitat. The following estimates of fish use in the vicinity of Svensen Island rely on the results of two different study locations to estimate salmonid use of the Svensen Island Mitigation Site (Bottom et al. 2003, McConnell and Blahm 1983). These studies produced beach seine data from a variety of locations throughout the saline and freshwater habitats of the lower Columbia River.

Because Svensen Island is located in the primarily freshwater portion of the estuary, average fish densities from beach seine data collected in the freshwater portion of the estuary are used to estimate maximum densities of rearing juvenile salmonids currently utilizing accessible aquatic habitat at the lower end of Svensen Island. It is expected that salmonids utilization would increase at Svensen Island with the increase in fish-accessible habitat that would occur with the breaching of the dike in several places around middle Svensen Island via tidegate removal and removing the dike in one section. Maximum densities of rearing subyearling Chinook, coho, and chum salmon utilizing nearshore habitat in the Columbia River estuary occur between May and June for Chinook and in May for coho and chum. During these periods, estimates of approximately 30,000 Chinook, 11,000 coho, and 1,000 chum salmon may rear in the 170 acres

of usable habitat of lower Svensen Island during high tide. Proportionally similar numbers would be expected to use the 65 acres gained at middle Svensen Island.

The preservation and further restoration of tidal marsh habitat at the lower end of Svensen Island, together with the restoration of tidal influence on middle Svensen Island will preserve and further restore habitat critical for listed juvenile salmonids rearing in the lower Columbia River. Due to the location of Svensen Island in relation to the brackish salinity zone located just downstream, the restoration of off-channel habitat is of great benefit to salmonids, several of which are imperiled, as they adapt to changes in salinity and reach an appropriate size to enter the marine environment. Subyearling Chinook salmon belonging to the Lower Columbia River, Snake River Fall, and Upper Willamette River Chinook salmon ESUs, juvenile coho salmon belonging to the Lower Columbia River coho ESU, and juvenile chum salmon belonging to the Columbia River chum ESU utilize nearshore marsh habitat in the Lower Columbia River as temporary rearing habitat during their out-migration for several days to weeks while they undergo this process.

Beneficial Surrounding Land Use

The middle Svensen Island site has the benefit of surrounding land uses being dominantly aquatic and agricultural. As such, they are completely compatible with the proposed conservation land use of the site and are likely to stay that way. The island is surrounded by river habitat already designated as aquatic conservation land.

Practicality of Construction and Likelihood of Success

The middle Svensen Island site is practical for restoration because it is surrounded by dikes and the entire site contains historic hydric soils, indicating that the site was under tidal influence prior to construction of the dikes. Removal of a portion of the dike system will allow tidal influence while the remaining dike system will keep the altered hydrology on-site and will not affect adjoining landowners. In addition, no site constraints limit achieving the proposed functions as described in Section 2.1.7. In general, the most difficult part of a mitigation site to design is the water budget. Sites relying on permanent surface water inputs, rather than groundwater or precipitation modeling, generally are easier to design for correct water input and correct if water input is too high or low (Pierce 1993). This site will benefit from the input of surface water from the Columbia River. Thus it is unlikely that the site will lack the necessary hydrology to perform as intended. The lower Svensen Island site had most of the hydrology functions restored with the breach in the dike that occurred in December 2003. The additional restoration measures proposed are ones that are practical from both a feasibility point of view and from a least damage perspective.

2.1.5 Baseline Conditions at Proposed Estuarine Resource Replacement Site (Middle Svensen Island)

A. Site owner (name, address, phone)

The land proposed for mitigation at the middle Svensen Island site is currently owned by Charles Haglund, Jr. (tax lot 200). The Haglund tax lots are on Clatsop County tax map T8N R8W 14 W.M. The Haglund site is under option for purchase by Bradwood.

B. Site Location

The middle Svensen Island mitigation site is located in Clatsop County, within Section 14, Township 8 North and Range 8 West. The latitude and longitude coordinates are 46.1786°N, 123.6461°W (NAD83/WGS84). The site is accessed from U.S. Highway 30 by Svensen Island Road, about 4 miles west of Knappa, Oregon. The mitigation site location is shown on Figure 1-1. The existing conditions of the mitigation site are shown on Figure 2-3.

C. Existing Vegetation

Two basic vegetation communities were observed at the site.

Wetland herbaceous/emergent: Low areas (elevations of 5 to 6 feet) within the dikes are dominated by soft rush and reed canarygrass. Subdominant species in this community include bentgrass (assume FAC), common velvetgrass (FAC), field horsetail (FAC), and birdsfoot trefoil (FAC). There are a few wetland shrubs growing along the ditch on the west side of the site, including Douglas' spirea and willow species.

Upland invasive shrub and herbaceous community: Areas determined to be upland within the dikes are dominated by bentgrass, common velvetgrass, quackgrass (FACU), and reed canarygrass. Some of the ditch construction spoil berms were dominated by Himalayan blackberry (FACU). The dikes surrounding the site on all four sides are generally dominated by tall fescue (FAC-), bentgrass, and common velvetgrass. Approximately one-third of the north dike is dominated by Himalayan blackberry with a minor component of red elderberry (FACU).

D. Existing Soils

Middle Svensen Island is mapped by the NRCS as Coquille-Clatsop complex, protected, 0 to 1 percent slopes (Clatsop County soil map unit 12A). This soil type is comprised of 60 percent Coquille soil and similar inclusions, 30 percent Clatsop soil and similar inclusions, and 10 percent contrasting inclusions. These soils are found on tidal influenced flood plains of 0 to 1 percent slopes at elevations of 5 to 10 feet. Approximately half of these soils are protected behind tidegates. They are very deep, very poorly drained silt loams and mucks with slow permeability. Vegetation on these soils generally includes rushes, marsh grasses, sedges, and willows. The Clatsop soil inclusions also support cattail and skunk cabbage.

In a representative profile, the surface layer of the Coquille soil is a very dark gray silt loam about 6 inches thick. The subsoil of the Coquille soil is a dark grayish brown, mottled silt loam about 24 inches thick and the substratum, to a depth of about 60 inches bgs, is a dark gray silt loam. In a representative profile, the surface layer of the Clatsop soil is a very dark grayish brown muck about 6 inches thick. The subsoil of the Clatsop soil is a very dark grayish brown and dark gray silt loam about 18 inches thick and the substratum, to a depth of about 60 inches bgs, is a very dark gray silt loam. The Coquille-Clatsop complex, protected, 0 to 1 percent slopes is listed as hydric by the NRCS.

Soils observed at the site match the mapped soil description. Soils throughout the site display a reduced matrix and contain redoximorphic features (mottles and live oxidized root channels) throughout the profile. Upland inclusions within the wetland contained soils with a marbled matrix. This is consistent with their origin as spoils piles created from ditch construction and

ditch maintenance activities. Areas delineated as upland within the dikes do not contain living oxidized root channels.

E. Existing Hydrology Within Proposed Restoration Area

Wetland hydrology is the result of a perched water table. The water budget for the site is dependent on a combination of annual variations in precipitation and river levels, which control outflow through the tidegates that currently drain the site. Portions of the site are depressional and precipitation remains perched upon the poorly drained substrate. Other portions of the site drain, via surface flows and extremely slow lateral groundwater throughflow, to the numerous ditches that drain the site. The ditches are connected to the river by three culverts fitted with tidegates along the southern dike. The tidegates trap water within the site until river elevations are low enough to allow outflow through the tidegates (see Photo 7, Appendix E). The system of maintained dikes prevent regular tidal or storm-related overbank flooding of the river into the wetland. In fact, during the February 1996 Columbia River flood, residents at the site report that the river rose to the top of the dikes but did not overtop (pers. com. Chuck Haglund, Jr., January 2007). However, there have been high tide events since 2003 where water did come over the dikes, including the December 2003 event when the Lower Svensen Dike breached (pers. com. Charles and Marie Haglund, February 2007).

Because the wetland is adjacent to tidally influenced surface water features, it was assumed that shallow groundwater elevations would fluctuate as a function of tidal and seasonal water levels. However, test pits were left open throughout the first day of delineation and checked in the morning, at lunch, and at days end. No fluctuation in the water elevation within the pits was observed. Thus it was determined that the site is not currently influenced by diurnal tidal fluctuations. Wetland hydrology within the site is predominantly the result of perched precipitation and not influenced by river-related groundwater. Since the hydrology of the Middle Svensen Wetland is not directly influenced by daily tidal fluctuations of the Columbia River, it was determined that the wetland was palustrine, not estuarine, for the purposes of the HGM assessment.

F. Summary of the Calculation of Tidal Elevations at the Proposed Middle Svensen Island Mitigation Site

Background

Prior to establishing MHHW and mean lower low water ("MLLW") elevations at the middle Svensen Island mitigation site, a process for establishing site-specific tidal water surface elevations based on upstream and downstream gage records was determined. Initially this process was established for use at the proposed Terminal and has since been applied to other locations in relatively close proximity to the gage stations. A summary of the process is described below.

To estimate MHHW and MLLW elevations in the vicinity of the proposed Terminal (RM 38.5), URS obtained the gage records at the Wauna (approximately RM 42) and Skamakowa (approximately RM 34) gage stations. Gage information was originally obtained in the Columbia River Datum ("CRD") from the National Oceanographic & Atmospheric Administration ("NOAA") tides and currents Web site.

URS met with the Portland Branch of the Army Corps of Engineers (the "COE") in June and July 2006 to verify methodology and datum corrections and to ensure that the COE was in agreement with the assumptions made in establishing the MHHW and MLLW elevations for use at the Terminal location using data from WEST Consultants. The COE has historically had difficulty baselining the CRD datum across state lines (the Skamakowa gage station is located in Washington and the Wauna station is in Oregon) and indicated that an elevation difference upwards of six inches was found to exist between the CRD in Washington and in Oregon. The COE recommended using the Wauna gage records and the original Columbia River flood profile downstream of Bonneville Dam to correct for the MHHW and MLLW elevations (in the CRD) at the Terminal site. The original Columbia River flood profile could also be used to determine a site-specific datum correction between CRD and the National Geodetic Vertical Datum ("NGVD"). Finally, the COE recommended the use of the Corpscon program to determine site-specific datum corrections between NGVD and the North American Vertical Datum ("NAVD") (the datum currently being used for design).

Analysis at the Mitigation Site

As the proposed mitigation site (RM 24) is relatively distant from the Wauna gage station (RM 42, Station number 9439099) used in the analysis of tidal elevations for the Terminal site, the Astoria gage station at Tongue Point (~RM 17.5, Station number 9439040) was used to calculate tidal elevations at Svensen Island. Hydraulic conditions at Svensen Island are mapped in Figure 2-4. Analyses were initially conducted for both the Astoria and Wauna gage stations in order to compare the resulting elevations using the same methodology and data assumptions used to generate tidal elevations at the Terminal site. It was clear that the use of the Astoria gage station data resulted in more accurate elevations.

Using the Columbia River flood profile, as provided by the COE, and interpolating between the varying elevation of the low water plane (CRD) in the proximity of the Astoria (Tongue Point) gage station and the proposed mitigation site, the Astoria gage records were corrected by -0.42 feet. A datum correction of -2.61 feet between NGVD and CRD was determined from the Columbia River flood profile as well. Finally, using the general coordinates of middle Svensen Island (the proposed mitigation site), the Corpscon program was used to generate an elevation correction of +3.36 feet between the NGVD and NAVD datum. The MHHW, mean tidal level ("MTL"), and MLLW in NGVD and NAVD were calculated accordingly. The resulting tidal elevations at Svensen Island, based on the reference gage station, are reported in Table 2-6.

Table 2-6: Elevations at Svensen Island Using the Astoria (Tongue Point) Gage Records

Gage Station Information at Astoria-Tongue Point (~RM 17.5)		Calculated Water Surface (ft) at Svensen Site (RM 24)			
	Astoria (CRD)	Elevation Correction	CRD	NGVD[1]	NAVD[2]
	(ft)	(-0.42 feet)	(ft)	(ft)	(ft)
MLLW	2.23	1.81	1.81	-0.80	2.56
MLW	3.40	2.98	2.98	0.37	3.73
MTL	6.78	6.36	6.36	3.75	7.11
MHW	10.17	9.75	9.75	7.14	10.50

Gage Station Information at Astoria-Tongue Point (~RM 17.5)		Calculated Water Surface (ft) at Svensen Site (RM 24)			
	Astoria (CRD)	Elevation Correction	CRD	NGVD[1]	NAVD[2]
MHHW	10.84	10.42	10.42	7.81	11.17

[1] The elevation correction between CRD and NGVD was -2.61 feet.
[2] The elevation correction between NGVD and NAVD was +3.36 feet per the Corpscon program.

The elevations shown in Table 2-6 will be used for preliminary design and analysis of the proposed mitigation site. Again, it should be noted that these elevations are extremely preliminary and should be field-verified prior to further design. Currently, no site survey has been completed to qualify these elevations. The Columbia River location of the mitigation site (RM 24), used to baseline the MHHW and MLLW elevations, was interpolated from the associated location of the mitigation site along the navigation channel. Therefore other factors may influence the tidal effects of the Columbia River at this location. Field verification and survey would not only help determine whether technical assumptions are correct, but could also be used to verify the datum corrections used.

G. Existing Wetland Delineation

Baseline Data Review

Wetland biologists reviewed existing site information prior to conducting the on-site wetland delineation. The following information sources were reviewed:

- NRCS Soil Survey of Clatsop County, Oregon (NRCS, 1988) (Figure 2-3)
- NRCS Hydric Soils list for Clatsop County (1999)
- National Weather Service climate data for Astoria, Oregon, 2006 and 2007
- Tidal records for the Columbia River at Tongue Point (RM 14) (NOAA 2007)
- LIDAR 1-foot contour data captured in July 2006 (Terrapoint)
- Precipitation normals for Astoria, Oregon (WETS, 2002)
- Field notes from the October 2006 site visit to lower Svensen Island (URS unpublished)

Soil Survey

Soil information was described in Section 2.1.5.D.

Precipitation Data

The following precipitation data was gathered from the National Weather Service Center for Astoria, Oregon to characterize the climate-sourced hydrology for the wetland assessed on January 10, 12, 24, and 25. Total precipitation amounts for the two weeks prior to each field visit are provided in Table 2-7.

Table 2-7: Precipitation Summary for Recent Period Preceding Wetland Delineation

	Dates of Field Investigation (January 2007)			
	10	**12**	**24**	**25**
Total Precipitation 14 Days Prior (in.)	6.52	6.55	1.09	1.19
Water Year-to-Date (in.)	41.53	41.66	42.63	42.73
Normal Water Year-to-Date (in.)	29.70	30.32	34.03	34.33
Departure from Normal	140%	137%	125%	124%

- Total rainfall for January 2007: 7.62 inches
- Normal rainfall for January: 9.62 inches
- Departure from normal: 79 percent

While the water year-to-date for the days of field work was well above normal, the majority of that precipitation fell during November 2006 (10+ inches). Precipitation for December 2006 was well within the range of normal. Precipitation for January 2007 was two inches below normal. Precipitation totals for the two weeks prior to each day of field investigation show that the majority of precipitation that fell in January fell in the first half of the month.

This indicates that while the water year-to-date was above average, average rainfall in the first part of January likely kept the water table representative of normal conditions. Less than normal rainfall in the two weeks prior to January 24 and 25 may have slightly lowered the water table resulting in less observable hydrologic indicators.

On-Site Methods

Biologists used 2006 Light Detecting and Ranging ("LiDaR") contour data with six-inch accuracy plotted on an aerial photography base map (NAIP 2005) at 1:2400 scale and one-meter resolution to identify all potential uplands within the dikes. Biologists then traversed the entire site in several transects and investigated all areas showing upland contour signatures on the base map. Where potential upland areas were encountered, sample plots were taken to determine the potential presence of existing uplands within the greater wetland area. Where portions of the study area did not meet all three wetland criteria, biologists delineated out the uplands from within the greater wetland area. At each sample plot location, the 1987 U.S. Army Corps Wetland Delineation Manual methodology was used to document presence or absence of wetland criteria.

The study area for the Middle Svensen Mitigation Site includes all areas within the dikes surrounding the middle portion of the island with the exception of approximately three acres surrounding the existing occupied home of Chuck Haglund, Jr. The three-acre exclusion area is not part of the proposed mitigation as it will be isolated from the surrounding Middle Svensen wetlands, prior to the proposed dike breaching, and will continue to serve as the residence of Mr. Haglund, Jr.

The outer edge of the wetland, along the interior of the dikes, and the boundary of internal upland areas, were flagged using pink "wetland delineation" flagging. Sample plots were flagged using pink pin flags with additional blue ribbon around the stem (to distinguish from

wetland boundary flags). All boundary flags and sample plots were surveyed using a GeoXT Geographic Positioning System ("GPS") receiver with sub-meter accuracy. No local monuments could be found at the time of the field work on which to base survey accuracy; however, points taken at features visible on the aerial photography were recorded in the field. Upon postprocessing the GPS data, these points matched up with the aerial photograph leading biologists to assume that the standard sub-meter survey accuracy was obtained.

Results

Middle Svensen Island was visited on January 10, 12, 24, and 25 to assess the proportion of the site that is currently wetland within the proposed restoration area. Initial site reconnaissance indicated that Middle Svensen Island consists of a single large wetland with distinct upland inclusions associated with ditch construction (dredged spoils berms). Using the technique described above, 15 distinct upland areas were delineated out of the wetland. These include Uplands 1-15. Wetland sample plot datasheets corresponding to the sample plot locations shown on Figure 2-3 can be found in Appendix F.

The soils observed in the wetland, as well as some adjacent uplands, displayed a reduced matrix and contained several redoximorphic features. However, it was uncertain how much of the observed indicators of reducing conditions were due to current moisture conditions, rather than historic conditions that existed prior to diking and ditching the site. Hydrology was directly observed in areas under six feet in elevation, but due to the time of year, and lower than normal precipitation for January, it was assumed that portions of the site meeting the vegetation and soil criteria also met the hydrology criteria. The wetland boundaries, as mapped in Figure 2-3, are based on detailed sample plot data and field observations, as well as the one-foot contours created from six-inch resolution LiDaR data flown in 2006. A brief description of the delineated wetland follows:

Wetland A is entirely contained within the system of dikes and contains numerous upland inclusions created during ditch creation and maintenance. A network of ditches crosses the site, draining the wetland through three tidegates located on the southern dike/county road. A three-acre parcel surrounding the Haglund house was not investigated, as it is not part of the proposed mitigation property.

The wetland is relatively flat, with a very gentle slope to the west, with hummocky terrain due to cattle use and vegetation clumps. Elevations (in NAVD) on the site vary from four feet in the ditches to six feet in general across the site, with areas up to seven or more feet at the highest points on the spoils berms. The northern dike rises to 15 feet at its highest point, and the remaining three dikes have an average height of 12 feet. Dike slopes are generally steep rip-rap, with the wetland boundary occurring at the toe of the slope in most areas.

Sample plots sp-1 through sp-55 document conditions within the wetland. In addition, numerous undocumented soil pits were examined in order to assist with the delineation of wetland boundaries not documented as formal sample plots. These included areas where the wetland-upland boundaries were not easily recognizable by distinct vegetation or topographic changes, areas dominated by upland vegetation but saturated by recent precipitation, and/or areas with prior site disturbance.

The entire wetland is regularly mowed and is used for seasonal cattle grazing (no livestock were present during the field visits). Dominant vegetation consists primarily of an herbaceous community, with a few small pockets of scrub-shrub vegetation along the northern and western dike edges. Herbaceous vegetation dominants consist of reed canarygrass, bentgrass, common velvetgrass, common horsetail, and dock. Shrubs on site include Douglas' spiraea, willow, and young red alder. The only trees on-site are rooted within upland areas. Soils in the wetland matched the soil description for Coquille-Clatsop complex, protected, 0 to –1 percent slopes. The hydrology of the wetland is supported by direct precipitation perching on the poorly drained soils. Hydrology was observed on-site as saturation within 12 inches bgs and live oxidized root channels within 10 inches bgs. Due to the time of year and below average rainfall in the second half of January, hydrology in some areas of the site was assumed based on elevation data, predominance of hydrophytic vegetation, and strong hydric soil indicators. In addition, areas adjacent to ditches may experience a lowered water table due to a hydraulic edge effect. The wetland is currently isolated from tidal influence. The Middle Svensen wetlands do not currently provide fish habitat.

H. Wetland Classification

The Cowardin classification of Wetland A is PEMC. The HGM classification of Wetland A is "depressional outflow" due to the dikes surrounding the wetland and the tidegate outflow points. The wetland at this site is currently classified as palustrine, or nontidal, under the Cowardin system. Due to this fact, it cannot be evaluated using an estuarine functions assessment tool, as was the impact site.

The HGM classification of Wetland A is consistent with the "Guidebook for Hydrogeomorphic (HGM)–based Assessment of Oregon Wetland and Riparian Sites: Statewide Classification and Profiles" (Adamus 2001). Wetland A is classified as "depressional outflow" because the steep dike walls act as a basin, contributing surface drainage from upgradient areas on all sides of the wetland and containing water within the lower topographic areas of the site. The site drains to the Columbia River via a series of drainage ditches that connect to the river via three tidegates in the southern dike (thus the outflow).

I. Wetland Functions

URS conducted on-site wetland functions assessment concurrently with the wetland delineation. The HGM classification system was used to classify the wetland, and wetland functions were assessed using the Judgmental Method of the HGM-based Assessment Method developed by the Oregon DSL (Adamus and Field 2001). Appendix G contains the raw data used to generate summary Table 2-8. One wetland (Wetland A) was delineated within the proposed restoration area. Wetland A will be modified by the proposed restoration plan and therefore is described below in detail.

Table 2-8. Summary of Functions Provided by Existing Wetlands at the Middle Svensen Island Site

Functions Assessment Unit	Wetland A
HGM Class	Depressional outflow
Cowardin Classification	PEMC
Water storage and delay	0.3
Sediment stabilization and phosphorus retention	0.3
Nitrogen removal	0.3
Primary production	0.4
Thermoregulation	0
Resident fish habitat support	0
Anadromous fish habitat support	0
Invertebrate habitat support	0.3
Amphibian and turtle habitat	0.5
Breeding waterbird support	0.4
Wintering and migratory waterbird support	0.4
Songbird habitat support	0.5
Support of characteristic vegetation	0.4

The HGM classification of Wetland A is "depressional outflow," and its Cowardin classification is PEMC. Soils in these wetlands are comprised of very poorly drained silt loams. Soils have been recontoured by agricultural practices, including ditch construction and maintenance, cattle grazing, and mowing. Vegetation is dominated by soft rush, wetland-facultative pasture grasses, and reed canarygrass. Function capacities for 10 of the 13 categories were rated low to moderate (range of 0.2 to 0.5). Water storage and delay, sediment stabilization and phosphorus retention, and invertebrate habitat support functions rated low because although the wetlands are vegetated and comprised of loamy soils, they lack extensive surface water, complex microtopography, plant species diversity, and mature soil microbial processes. Nitrogen removal rated low because soil microbial processes are not developed, and the site has a history of disturbance and lacks extensive surface water.

Primary production rated moderate because the site is fully vegetated and has a mostly natural contributing watershed. Amphibian and turtle habitat rated moderate because although the site lacks turtle habitat, it likely supports amphibians with seasonal ponding and a somewhat natural buffer and proximity to other wetlands. Breeding and wintering/migratory waterbird functions rated moderate because although the site is dominated by reed canarygrass and lacks deeper ponds with adjacent nesting shelter, it is expected to sustain some seasonal ponding and is surrounded by large acreages of wetlands with a different water regime. Songbird habitat and characteristic vegetation support rated moderate because although the site is within a rural setting, the vegetative community lacks diversity of plant species and plant forms. Three of the categories (thermoregulation, resident fish habitat support, and anadromous fish habitat support) rate at zero functional capacity due to the absence of riverine conditions and fish habitat elements.

In general, the wetland located within the site currently has minimal capacity to support the functions that are supported by wetlands at the Terminal impact site. Although the ditches are connected to the Columbia River and are subject to daily tidal fluctuations, the connection is through tidegates, which prevent fish passage. Ditches are maintained to minimize both tidal and storm-related overbank flooding. During the summer months, the majority of Middle Svensen Island is dry. In addition, the dominant vegetation within the proposed mitigation area consists of invasive and nonnative herbaceous species, including purple loosestrife and reed canarygrass. As such, the mitigation site currently provides little to none of the wetland functions that are provided by the impact site.

2.1.6 Mitigation Work Plan for Temporary Wetland/Waterway Impact Areas

Construction activities will impact portions of the Terminal work area and Pipeline corridor temporarily. These impacts are deemed temporary because the features that are impacted during construction will be restored immediately following construction as described below. Because the impacts are different at the Terminal and Pipeline construction areas, they are discussed separately here. Performance standards designed to measure the efficacy of restoring wetlands to preexisting conditions are outlined in Section 2.1.8.

A. Terminal

Temporary impacts within the Terminal construction area at Bradwood will consist of shoreline impacts resulting from the construction of a berm that would protect the proposed Terminal from high-level floodwaters in the Columbia River as well as serve the dual purpose of containing industrial spills if they should occur. Mitigation for permanent impacts to wetlands and waterways due to Terminal construction are discussed separately in Section 2.1.7. Shoreline restoration, as described here, is taken from the Shoreline Revegetation Plan (Appendix A). This plan proposes reconstruction of the shoreline below the berm and revegetation of the shoreline to restore natural lower Columbia River shoreline conditions and thus result in only temporary impacts to wetland and waterway functions. The berm will be constructed of sand. Concrete will be added to the sand to construct the exterior of the berm to stabilize the outer face from effects of erosion. Where space permits along the length of the berm, sand will be piled against the exterior surface to present a more natural sloping surface. These natural surfaces and other areas above the Emergent Zone, as defined immediately below, will be vegetated with native species. MHHW occurs at approximately 9.45-foot elevation [NAVD 88] and MLLW occurs at approximately 2.41-foot elevation [NAVD 88].

Vegetation would be planted during the dormant season following construction of the facility berm and maintained until the revegetation areas met performance standards (outlined in Section 2.1.8). A temporary irrigation system would be installed to irrigate the new plantings above MHHW during the first growing season. No soil amendments are proposed, as the daily tidal inundation is expected to bring sufficient nutrients to the riparian community. Above the MHHW line, it is expected that the limiting factor for plant growth would be the excessively drained sandy substrate rather than a lack of available nutrients.

The planting plan is broken into four vegetation zones, based on hydrologic conditions and proximity to the toe of the berm. For security reasons, no large trees will be installed near the toe of the berm to prevent access to the area inside the fence line; this applies principally to a

narrow area on the southern half of the site. Elevations for the vegetation zones are described below. For representative cross sections of the proposed project site, depicting proposed typical berm and shoreline slope conditions, see Figures 2 and 3 in Appendix A. The revegetation zones are defined as follows and will be installed along the restored shoreline.

1. Emergent Zone
   This narrow zone would be located just below the MHHW line. Proposed species would consist of low-growing emergent vegetation, including Columbian sedge, Lyngby sedge, common threesquare, and slough sedge. In all sections, this zone would be located where daily tidal inundation occurs. Plants would consist of emergent plugs, and would be spaced densely at six inches on center.

2. Riparian Low-Shrub Zone
   This zone would be located where the berm is nearest to the shoreline, toward the southern edge of the property. This zone would be installed from the MHHW line where the toe of the berm is located. Species would consist of typical low-growing riparian shrub species including Columbia River willow and red osier dogwood. The understory would consist of slough sedge. Plants would consist of one- to two-gallon potted plants and emergent plugs, and would be spaced densely at 16 inches and six inches, respectively.

3. Riparian Shrub Zone
   This zone would be installed at the MHHW line, extending upslope to approximately two feet above MHHW. Species would consist of typical forested riparian trees and shrubs including black cottonwood, Pacific willow, Columbia River willow, and red osier dogwood. The understory would consist of slough sedge. Plants would consist of one- to two-gallon potted plants and emergent plugs, and would be spaced densely at 16 inches and six inches, respectively.

4. Upland Herbaceous Zone
   This zone would be located from the upper edge of the riparian zone up to the toe of the proposed berm and would be variable in width. This zone would be expected to be sparsely vegetated given the deep sand layer and lack of hydraulic connection to the Columbia River. Native herbaceous species would be spread by seed and include lupine species and native grass species. Plants would consist of plugs and a broadcast seed mix.

B. Pipeline

The Pipeline will be constructed using a combination of methods, including trenching, horizontal directional drilling, and boring. Directional drilling and boring will be used to avoid impacts to the larger waterbodies (i.e., Driscoll Slough, Westport Slough, and Beaver Slough) and several wetlands in the Project area. The width and depth of the Pipeline trench are determined by safety factors and are typically about five feet wide and eight feet deep (but can be significantly wider in very wet areas due to the difficulty of stabilizing saturated slopes).

To mitigate for these temporary wetland and water impacts, Bradwood will restore temporarily disturbed areas to their predisturbance conditions. Restoration activities will include the following construction specifications (see Figures 1-3 and 1-4):

- In nonsaturated soils, topsoil and subsoil will be stockpiled separately near the trench. After installation of the Pipeline, the trench will be backfilled with the excavated material with topsoil being replaced above the subsoil. The trench will be returned to preconstruction grade. Any excess excavated soil material will be disposed of in a designated upland location. Final grading will be conducted with backhoes or draglines operating from the temporary board road, or with low-ground-pressure tracked vehicles working in the spoil pile, depending on the ambient water level, the degree of soil saturation, and the bearing capacity of the soils.
- To preserve surface and subsurface hydrology characteristics, impermeable soil layers located within the Pipeline trench will be identified. During the backfilling, native on-site material, imported clay, or bentonite will be installed to ensure that the impermeable layer will be restored and site hydrology will not be altered from its preconstruction condition.
- Roots and stumps will have been removed only in the areas of the pipe trench, avoiding excessive soil disturbance and allowing preexisting vegetation to recover more rapidly in the remainder of the construction easement once the board roads and spoil piles have been removed.
- Revegetation will occur using seeds and native shrubs obtained from local commercial nurseries.
- Herbaceous specimens may also be collected from adjacent wetlands for transplanting into restoration areas (transplant specimens will be collected over a relatively large area to minimize negative impacts to the donor site). Transplant specimens may also be collected from within the easement prior to construction, stored in temporary nurseries, and replanted after Pipeline construction is complete.

C. Revegetation Plan for Temporary Pipeline Impacts

During construction of the Pipeline, every practical measure to avoid and minimize wetland impacts will be employed. As the Pipeline trench is backfilled where it has gone through a wetland, the original contours of the topography will be matched to make sure that wetland hydrology will be maintained. Trench plugs (low-permeability material) will be placed in the trench surrounding the pipe on each side of a wetland (especially the downslope side) to make sure that the wetland would not drain through the trench. The topsoil from the wetland will typically have been set aside during trenching and will be placed back in its surface location during backfilling. This will have the effect of repositioning many of the roots and seeds of the original wetland back in place. In addition, the wetland areas will be replanted with a native seed mix. Typically the vegetation of herbaceous wetlands is fully reestablished within one or two growing seasons.

Temporarily impacted wetlands will be revegetated immediately following completion of construction with native plant material to reduce the potential for erosion and possible impacts to water quality. A diverse mix of native plants and seed will be used for restoration to ensure the rapid, successful establishment of native plants. The revegetation plan is described below for each of the four subareas. The revegetation plan focuses on restoring the temporarily impacted

wetland areas to their existing (preconstruction) Cowardin class, with the exception of forested wetlands within the permanent Pipeline easement, which will be restored to emergent scrub-shrub wetlands.

Several of the subareas within the project area contain similar vegetation communities. Pastures and poplar plantations are common throughout the Pipeline alignment. The revegetation plans for these two community types are described below. The revegetation plans for the Wauna Mill wetlands located in Subarea 1 and the emergent wetlands located in Subarea 2 are discussed later in this section.

Pastures

There are several different vegetation communities as well as different management practices for the pastures and fields in the Project area. A few fields appeared to be regularly plowed and were planted to a monoculture of meadow foxtail. Many fields did not appear to have been recently plowed and contained a more diverse grass community; however, most fields and pastures were dominated by nonnative grasses. Many fields were actively grazed during the May and June 2006 site visits. Property owners will be contacted prior to implementation of the restoration plan in order to determine whether a specific pasture grass is recommended to return the disturbed area to the same vegetation community that existed prior to installation of the Pipeline. Actively managed or grazed areas will be seeded with Re-Green (sterile wheat hybrid) or a seed mix approved by the landowner immediately following completion of construction.

Poplar Plantations

A 50-foot-wide permanent easement will be established over the Pipeline corridor to facilitate future needs for repair or maintenance. In upland habitats, no trees will be planted within the permanent easement. In wetland and riparian habitats, no trees will be planted within a 10-foot-wide corridor centered over the pipeline. Upon completion of construction, the easement will be seeded with a mix of native emergent wetland species, most of which were documented as occurring in the poplar plantations in the Pipeline corridor. The seed mix includes species with varying soil moisture requirements to facilitate revegetation under variable hydrology conditions. Species recommended for planting include western mannagrass, water foxtail, spike bentgrass, and fowl bluegrass. Seeding rates will be determined based on site-specific conditions of the impact areas.

Subarea 1: Bradwood Terminal to Westport Slough (West)

Portions of the Pipeline in this area will be bored; therefore none of the wetlands delineated within the Pipeline bore areas will be impacted. Wetland areas immediately southeast of the proposed Terminal will be bored under to avoid impacts. Driscoll Slough, Westport Slough (West), and several wetlands on the Wauna Mill property will also be bored under to avoid impacts. Several wetlands and stream crossings located on the Wauna Mill property will be temporarily disturbed due to trenching to install the Pipeline. Most of the Wauna Mill wetlands contain a mix of all three Cowardin classes. Planting specifications are provided below for scrub-shrub and forested wetlands, and emergent wetlands.

Wauna Mill Scrub-Shrub and Forested Wetlands

In the Cowardin classification system, a palustrine forested wetland is defined as having at least 30 percent aerial tree cover. During the wetland delineation, the forested wetlands contained on the Wauna Mill property were observed to have an aerial tree cover ranging from 30 to 90 percent. Since the existing forested wetlands have a high percentage of tree cover, the removal of some trees in the Pipeline corridor and conversion of small areas to scrub-shrub wetlands will not likely cause a change in Cowardin classification of the overall wetland area, after restoration is complete. Table 2-9 displays the recommended species for restoration, plant material types, and planting densities.

Table 2-9. Wauna Mill Scrub-Shrub and Forested Wetland Restoration Planting Specifications

Common Name	Scientific Name	Plant Material Type	Suggested Density
SHRUBS			
Columbia River willow	*Salix fluviatilis*	bareroot or 1-2 gallon pot	4 ft. on center, clustered
Douglas' spiraea	*Spiraea douglasii*	bareroot or 1-2 gallon pot	5 ft. on center, clustered
Hooker willow	*Salix hookeriana*	bareroot or 1-2 gallon pot	5 ft. on center, clustered
Red osier dogwood	*Cornus sericea*	bareroot or 1-2 gallon pot	5 ft. on center, clustered
Sitka willow	*Salix sitchensis*	bareroot or 1-2 gallon pot	5 ft. on center, clustered
HERBS			
American speedwell	*Veronica americana*	seed or 4" pot	custom seed rate / 1 ft. on center, clustered
Hooked buttercup	*Ranunculus uncinatus*	seed or 4" pot	custom seed rate / 1 ft. on center, clustered
Orange balsam	*Impatiens capensis*	seed	custom seed rate
Skunk cabbage	*Lysichiton americanum*	seed or 4" pot	custom seed rate / 2 ft. on center
Slough sedge	*Carex obnupta*	4" pot	2 ft. on center
Water parsley	*Oenanthe sarmentosa*	seed or 4" pot	custom seed rate / 1 ft. on center, clustered
GRASSES			
Re-Green (sterile wheat)	N/A	seed	10-60 lbs/acre
Tufted hairgrass	*Deschampsia cespitosa*	seed	1-15 lbs/acre
Western mannagrass	*Glyceria occidentalis*	seed	2-3 lbs/acre

Wauna Mill Emergent Wetlands

Emergent wetlands generally contain a diverse assemblage of native species; therefore, the use of a diverse mix of native plants and seed is recommended for restoration. Table 2-10 displays the recommended species for restoration, plant material types, and planting densities.

Table 2-10. Wauna Mill Palustrine Emergent Wetlands Planting Specifications

Common Name	Scientific Name	Plant Material Type	Suggested Density
HERBS			
Dewey's sedge	*Carex deweyana*	seed or 4" pot	custom seed rate or 2 ft. on center
Orange balsam	*Impatiens capensis*	seed	custom seed rate to be determined
Sawbeak sedge	*Carex stipata*	seed or 4" pot	custom seed rate or 2 ft. on center
Skunk cabbage	*Lysichiton americanum*	seed or 4" pot	custom seed rate or 2 ft. on center
Slough sedge	*Carex obnupta*	4" pot	2 ft. on center
Small-fruited bulrush	*Scirpus microcarpus*	4" pot	2 ft. on center
Spreading rush	*Juncus patens*	seed or 4" pot	custom seed rate or 2 ft. on center
Tapered rush	*Juncus acuminatus*	seed or 4" pot	custom seed rate or 2 ft. on center
Water parsley	*Oenanthe sarmentosa*	seed or 4" pot	custom seed rate or 1 ft. on center, clustered
GRASSES			
Re-Green (sterile wheat)	N/A	seed	10-60 lbs/acre
Tufted hairgrass	*Deschampsia cespitosa*	seed	1-15 lbs/acre
Western mannagrass	*Glyceria occidentalis*	seed	2-3 lbs/acre

Subarea 2: Westport Slough (West) to Westport Slough (East)

Kelli Slough and Westport Slough (East) will be bored under to avoid impacts. The majority of wetlands in Subarea 2 will be temporarily impacted due to trenching to install the Pipeline. Wetlands to be impacted include mainly emergent pasture wetlands and poplar plantations. Several small sloughs and ditches will also be temporarily impacted due to trenching. Planting specifications for Subarea 2 are provided below.

Ducks Unlimited Managed Emergent Wetlands

Portions of Subarea 2 are managed by Ducks Unlimited. Ducks Unlimited is phasing in a system of flooding and drawdown to modify the wetland hydrology for vegetation management purposes. In the areas where wetland hydrology will be managed, existing topsoil will be used as a seed bank to facilitate establishment of native vegetation. Discing and mowing will be utilized to control invasive species. Areas of unflooded pastures will be seeded with a combination of native species included in Table 2-11 below. The species composition of the seed mix will be determined with input from Ducks Unlimited regarding hydrology of the wetland areas to be impacted.

Table 2-11. Subarea 2 Emergent Prairie Wetland Restoration Planting Specifications

Common Name	Scientific Name	Plant Material Type	Suggested Density
HERBS			
Checker-mallow	*Sidalcea campestris*	seed	custom seed rate to be determined
Dewey's sedge	*Carex deweyana*	seed	custom seed rate to be determined
Hooked buttercup	*Ranunculus uncinatus*	seed	custom seed rate to be determined
Sawbeak sedge	*Carex stipata*	seed	custom seed rate to be determined
Slender cinquefoil	*Potentilla gracilis*	seed	custom seed rate to be determined
Slough sedge	*Carex obnupta*	4" pot	2 ft. on center
Spreading rush	*Juncus patens*	seed	custom seed rate to be determined
Tapered rush	*Juncus acuminatus*	seed	custom seed rate to be determined
Willow dock	*Rumex salicifolius*	seed	custom seed rate to be determined
GRASSES			
Western mannagrass	*Glyceria occidentalis*	seed	2-3 lbs/acre
American sloughgrass	*Beckmania syzigachne*	seed	7-16 lbs/acre
Red fescue	*Festuca rubra*	seed	10-20 lbs/acre
Re-Green (sterile wheat)	N/A	seed	10-60 lbs/acre
Tufted hairgrass	*Deschampsia cespitosa*	seed	1-15 lbs/acre

Subarea 3: Westport Slough (East) to Beaver Slough

Beaver Slough will be bored under to avoid impacts. The majority of wetlands in Subarea 3 will be temporarily impacted due to trenching to install the Pipeline. Wetlands to be impacted include mainly emergent pasture wetlands and poplar plantations. Several small sloughs and ditches will also be temporarily impacted due to trenching.

Subarea 4: Beaver Slough to Columbia River

The majority of the Subarea 4 alignment is located in existing road right-of-ways, thereby avoiding impacts to several wetlands. Where temporary wetland impacts will occur due to trenching to install the Pipeline, impacts will be mainly to the outer, disturbed edges of wetlands. Wetlands to be temporarily impacted include mainly emergent wetlands, several of which are located in young poplar plantations. Impacts to the forested wetland in the east portion of the Port of St. Helens property adjacent to the confluence of the Bradbury Slough and the Columbia River will be avoided by boring. A few fields located to the west of the PGE Beaver Power Plant are currently in agricultural production and will be seeded with Re-Green (sterile wheat) immediately following completion of construction.

Custom Seed Mixes and Planting Densities

The suggested planting densities, plant material size, and seeding rates will need to be modified prior to restoration implementation. Once the temporary wetland impacts are quantified (acreages) for each wetland class, exact planting numbers and seed rates can be calculated. In general, shrubs will be restored at a density of five feet on center; herbs will be restored to a density of one to two feet on center, and seed will be sowed at the rates recommended for natural establishment densities. It is not recommended that all herbaceous species be seeded because some species are more robust than others, making them more likely to out-compete the less robust species. For this reason, robust species such as slough sedge are recommended for planting in four-inch pots rather than by seeding. The use of Re-Green (sterile wheat grass) is recommended for seeding in all disturbed areas. This grass becomes established very quickly (one to two weeks) and aids in controlling erosion. It can also provide shade and protection for other germinating seeds, which often improves the success of native plant seed establishment.

Native Plant Salvage

Options for native plant salvage will be evaluated in areas where native plants need to be removed for construction. In order for plant salvaging to be successful the salvaged plants must be collected when the optimal climatic and physiological conditions exist (e.g., wet weather, plants at active growing phase of life cycle). The species most likely to survive salvaging activities are slough sedge, spreading rush, and willow. If these species are targeted for salvaging, the herbaceous species would be dug up completely to preserve the root base, trimmed to promote a high root-to-shoot ratio, and stored in the shade until planting. Willows that are cleared during construction can provide a source of native local genetic stock for live cuttings. Willow cuttings would be made approximately one to two feet in length, and should be stored in buckets of water (in the shade) until planting.

Plant Material Source

All native plant material (bareroot, potted plants, and seed) would be obtained from a local source to ensure the highest success rate for establishment. If possible, plant material would be obtained from seed rather than clones to preserve and enhance the genetic diversity of the wetland restoration areas.

Restoration Timing

The wetland restoration seeding will occur in the early fall prior to the onset of fall rains (October 1-November 15). Seeding would take place at this time of the year because the seed mixes will contain some species that require a cold stratification (over the winter months) for germination in the spring. Planting of shrubs and herbaceous plants can occur either after the onset of the fall rainy season if container plants are used or can occur in the winter dormant period toward the end of the season if bareroot material is used. Either container or bareroot can be used, depending on seasonal availability and conditions. The planting of potted plants would be completed in the early fall to maximize the amount of time plants have to establish before the onset of the dry summer months.

Invasive Species Control

Invasive species control will be an important component of the restoration plan because bare ground areas are easily invaded by weedy species. The construction corridor will be an area that has a high level of equipment and foot traffic, which will likely serve as a mechanism for weed species transport throughout the corridor. Invasive species control is important not only for the preservation of biodiversity, but also for the successful establishment of restoration plantings. For this reason, weed control will be conducted annually in the early summer and fall for several years following planting. This will ensure that weed infestations are identified early and controlled before they cause detrimental impacts to the restoration areas.

Herbivore Control

Active herbivore use of the wetlands within the Wauna Mill property was observed during the 2006 wetland delineation, and likely occurs throughout the Project area, especially in areas in close proximity to water. Some mammals (e.g., beaver, nutria, rats, deer) are a threat to restoration areas because they often consume restoration plantings. In order to reduce plant mortality related to herbivory, browse protection will be installed on all bareroot and potted shrub plantings.

2.1.7 Mitigation Work Plan for Estuarine Resource Replacement Site (Middle Svensen Island)

As determined by historic hydric soils observed throughout the site, the landscape position of the site, the need for a system of dikes, and aerial photographs, the entire site was previously tidal wetland. The construction of perimeter dikes around the Svensen Island site and the installation of tidegates have resulted in disconnection of the site from diurnal tidal flows. Historic agricultural and pastoral land uses over the last century have degraded the wetland that currently exists at the site. As a result of diking, the site currently provides no habitat for fish. In addition, the site has no opportunity to provide water quality or detention functions because of its separation from the river by tidegates.

The overall objective is to convert the site back to tidal wetland and waterway habitat. This would be accomplished by opening tidegates and removing a portion of the dike to allow the Columbia River to flood the site at high tide. In addition, the site will be enhanced through the planting of a high marsh shrub area and riparian shrubs and trees around the wetland areas and tidal inundation area to provide habitat diversity. Areas inundated during low tides will be created to provide a full range of habitats to offset losses from the filling of the log pond and other tidal wetlands at the Terminal impact site. Lastly, the site will be maintained for weed control to ensure that the site does not become dominated by nonnative species, particularly purple loosestrife.

A. Restoration/Mitigation Concept

There are five components to the proposed estuarine resource mitigation plan. Each is designed to provide above-standard, in-kind compensation for permanently lost acreage and functions at the Terminal impact site. These five components are described below. The area of existing

wetland that will be restored to tidal influence and the area of existing upland that will be restored to tidal wetland can be seen in Figure 2-3. Note that all areas within the dikes at Middle Svensen Island, excluding a portion of the site reserved for the Haglunds, will become tidal wetland. Figures 2-5a and 2-5b depicts the proposed grading that will take place throughout Svensen Island, primarily in Middle Svensen Island, to accommodate the goals of this plan. Cross sections of the proposed grading activities are depicted in Figures 2-6a and 2-6b. The area of off-channel salmonid rearing habitat excavation and areas where shrubs and trees will be planted (noted as "riparian habitat construction") can be seen in Figures 2-5a and 2-5b.

Off-Channel Salmonid Rearing Habitat Excavation

This plan proposes to excavate permanent, low-tide open-water habitat that will be directly connected to the Columbia River. This habitat would provide wetland functions similar to those lost by filling in Wetland 1 (historic log pond) at the impact site, but over a wider range of tides. The proposed dike breach and the removal of three tidegates will result in the site being connected to fish-accessible, low-tide habitat. This area will provide fish habitat functions even during low tides as low as zero feet (for the culvert locations) and perhaps lower, depending on the natural scouring at the dike breach.

This area will constitute 2.3 acres of the site. By providing this habitat at the tide levels projected, the low-tide habitat lost at the Terminal will be more than compensated because more area will be accessible at low tides than the area being lost at the Terminal.

Large Wood Features in Low-Tide Open-Water Habitat

Large wood complexes will be placed strategically and anchored in tidal channels to provide specific value to juvenile salmon. Six such features are proposed, as shown in Figures 2-5a and 2-5b. These features will compensate for features lost at the log pond on the Terminal site. Their location at ideal tide elevations (i.e., the lowest tidal elevations feasible) should make them more valuable than those being lost.

Restore Tidal Influence to Existing Wetlands

Existing Wetland A will be restored from degraded, nontidal hay pasture to tidal wetland. Restoration will be achieved through removal of three tidegates, breaching of the north dike to the Columbia River, installation of a culvert connecting Middle Svensen Island to Lower Svensen Island, and excavation of a tidal channel network to achieve a tidal plane elevation that supports a tidal marsh plant community. Drainage ditches will be filled to become part of the surrounding contiguous tidal marsh or will be modified to become part of the tidal channel network.

Upon restoration, the site will become one large tidal marsh wetland area with shrub and tree plantings on patches of higher ground where the dike is wider or has had dredge spoils placed on it. Therefore, it will include both low marsh and high marsh.

The total acreage of wetland that will be restored to tidal marsh (both high and low marsh) is about 62 acres. In order to compensate for permanent filling of less than 14 acres of wetland at the Terminal, a 3:1 ratio for conversion of palustrine to tidal wetland would require that about 42 acres be counted for wetland mitigation. The remaining area would be available to count for other fish and habitat impacts and to account for impacts at the mitigation site that will be necessary to protect the residences on the island and accomplish the restoration of tidal habitat.

Tidal Wetland Restoration

Part of the site is not currently wetland (based on a January 2007 delineation) but was historically a wetland prior to the construction of dikes around the site. The upland area is made up of spoil piles from historical ditch excavation and maintenance that are generally above seven feet in elevation and the inner slopes of the dikes. The upland areas total about three acres on Middle Svensen Island. This entire area will be restored to tidal marsh via the actions described above (i.e., breaching of the dike, etc.).

The total acreage of upland that will be restored to tidal marsh (primarily scrub-shrub habitat) is three acres.

Wildlife Habitat Feature Creation

This plan proposes to construct 2.5 acres of wetland scrub-shrub (riparian) habitat and provide several habitat features for wildlife that will offset features or opportunities for features lost at the Terminal that might be associated with trees at the lost wetlands. The proposed features include a nest platform for ospreys, perch poles for raptors, and nest boxes for purple martins.

B. Predicted Improvement in Site Functions and Values Due to Proposed Restoration

This plan proposes to reintroduce tidal influence to the mitigation site, grade the site as needed to support a network of tidal channels and wetlands, plant part of the site with native shrub and tree species, control nonnative invasive weed populations, and enhance the site with habitat attributes such as LWD and perch poles. Based on the observations of the conditions at Lower Svensen Island, where tidal fluctuation was restored naturally more than three years ago, it is anticipated that the proposed mitigation plan will be successful at restoring the functional capacity of Middle Svensen Island resulting in a net gain in wetland functions that replaces and exceeds the wetland functions lost at the impact site.

The Rapid Assessment Method for Tidal Wetlands of the Oregon Coast (Adamus 2005) was used to predict the functional capacity of Middle Svensen Island. The assessment was completed based on the conditions that would be assumed to be present 10 years after completion of the proposed mitigation. Table 2-12 compares the functional capacity and values for the impact site with the predicted conditions at Middle Svensen Island 10 years after completion of the mitigation. The data and notes used to support Table 2-12 can be found in Appendix H.

For 10 of the 11 functions scored, Middle Svensen Island will replace the functions lost at the impact site. For most of these functions, Middle Svensen Island will result in a functional

increase. The only exception is the function Maintain Habitat for Native Landbirds, Small Mammals, and Their Predators. Middle Svensen Island scored lower than the impact site for this function. The primary reason is that the mitigation site is located on an island, which generally inhibits the use of the site by landbirds, small mammals, and their predators. However, impacts to terrestrial wildlife will be mitigated at the Peterson Point Terrestrial Habitat Mitigation Site. Refer to Section 3.0 for a description of how this mitigation site replaces terrestrial functions, including native landbirds, small mammals, and their predators.

The predicted value scores for Middle Svensen Island were generally similar to the value scores for the impact site. Increases in value were noted for fish-related functions. A slight decrease in value was noted for the function Maintain Habitat for Native Landbirds, Small Mammals, and Their Predators, again owing to the fact that the mitigation site is on an island.

It is not possible to provide a direct numeric comparison of all baseline functional capacity scores for the mitigation site with all predicted functional capacity scores for the mitigation site because of the two different assessment methods that had to be used, the former being a nontidal-based assessment method, the latter being a tidal-based assessment method. Functional capacity scores that can be compared directly include the functions Maintain Habitat for Anadromous Fish, and Maintain Habitat for Other Visiting and Resident Fish. Both of these functions received a baseline score of zero (see Table 2-7) because of the dikes and tidegates, which prevent fish access to the mitigation site. As shown in Table 2-12, the predicted functional capacity for fish-related functions ranges from 0.39 to 0.63, a significant improvement over the baseline conditions, owing to the restoration of a tidal-based hydrologic regime at the site. Other functions that would likely receive low baseline scores include Export Aboveground Plant and Animal Production, Maintain Element Cycling Rates and Pollutant Processing; Stabilize Sediment, Maintain Habitat for Nekton-Feeding Wildlife, and Maintain Habitat for Shorebirds, again owing to the hydrologic disconnection of the site from tidal flows. Restoration of a tidal-based hydrologic regime is expected to significantly improve the functional capacity for these functions.

Table 2-12. Comparison of Function and Value Scores for Impact Site with Predicted Function and Value Scores for the Mitigation Site After Five Years

Function	Functional Capacity			Functional Value		
	Impact Site	Middle Svensen Island (Predicted)	Functional Increase	Impact Site	Middle Svensen Island (Predicted)	Value Increase
Produce aboveground organic matter	0.39	0.57	0.18	0.80	0.80	0.00
Export aboveground plant and animal production	0.17	0.64	0.47	0.80	0.80	0.00
Maintain element cycling rates and pollutant processing; stabilize sediment	0.58	0.99	0.41	0.80	0.80	0.00

Function	Functional Capacity			Functional Value		
	Impact Site	Middle Svensen Island (Predicted)	Functional Increase	Impact Site	Middle Svensen Island (Predicted)	Value Increase
Maintain habitat for native invertebrates	0.39	0.46	0.06	0.40	0.40	0.00
Maintain habitat for anadromous fish	0.30	0.47	0.16	0.90	1.00	0.10
Maintain habitat for visiting marine fish	0.42	0.63	0.20	0.30	0.40	0.10
Maintain habitat for other visiting and resident fish	0.34	0.39	0.05	0.30	0.40	0.10
Maintain habitat for nekton-feeding wildlife	0.26	0.48	0.22	0.50	0.50	0.00
Maintain habitat for ducks and geese	0.69	0.71	0.02	0.40	0.40	0.00
Maintain habitat for shorebirds	0.54	0.56	0.02	0.40	0.40	0.00
Maintain habitat for native landbirds, small mammals, and their predators	0.61	0.37	-0.25	0.50	0.30	-0.20
Maintain natural botanical conditions	Not scored	Not scored	--	0.5	1	0.5

C. Reference Site

This project makes use of the Lower Svensen Island as its reference site. Lower Svensen Island is located directly west of the western tidegate that currently protects Middle Svensen Island from the Columbia River. Similar to Middle Svensen Island, Lower Svensen Island was protected from tidal influence by a periphery of dikes and a system of ditches that outflowed through tidegates. However, in December 2003, the perimeter dike was breached at approximately the northwestern-most point, resulting in the restoration of tidal influence. Since that time the vegetation within the site has changed from reed canarygrass dominance to the integration of native freshwater tidal species, including wapato. In addition, the current morphology of the reference site is reverting back to a system of tidal channels without assistance due to diurnal tidal processes. The reference site shares the general shape, elevation, and orientation of the Middle Svensen Island site.

Like Middle Svensen Island, Lower Svensen Island soils are also mapped by the NRCS as Coquille-Clatsop complex, protected, 0 to 1 percent slopes (map unit 12A). This soil unit is described in detail in Section 2.1.5.D.

Four plant communities were observed at the reference site: uplands (dikes), low-marsh emergent, high-marsh emergent, and scrub-shrub riparian. Upland communities at the reference site were dominated by reed canarygrass (FACW) and Himalayan blackberry (FACU).

Subdominant upland vegetation included American purple vetch (NI), Kentucky fescue (FAC-), trailing blackberry (NOL), field horsetail (FAC), and common shepherd's purse.

The low-marsh emergent plant community was dominated variously by cattail (OBL), soft rush (FACW), yellow iris (OBL), waterpepper (OBL), small duckweed (OBL), and wapato (OBL). Subdominant species in the low-marsh included large water-starwort (OBL), bulrush species (OBL), narrow-leaf burreed (OBL), hard-stem bulrush (OBL), broad-leaf water-plantain (OBL), and Eurasian water milfoil (OBL).

The high-marsh plant community is located along the toe of the dikes where the pre-dike-breach plant conditions are still somewhat intact but becoming progressively more diverse and native in composition. Dominant species in the high-marsh plant community include reed canarygrass (FACW), orange balsam (FACW), nodding beggarticks (FACW+), field horsetail (FAC), birdsfoot trefoil (FAC), and common velvetgrass (FAC). Subdominant species in this plant community include bitter dock (FAC), sedge species (assume FAC or wetter), purple loosestrife, and creeping buttercup (FACW).

In addition to the emergent wetland communities listed above, a riparian community growing along the open-water portion of the site has persisted through the dike breach and is still dominated by Columbia River willow (OBL).

Like all other observed wetland areas in the general vicinity, nonnative plants occupied a large percentage of the reference site. The site contained reed canarygrass (although much less than existed prior to the dike breach), Himalayan blackberry, purple loosestrife, and Eurasian water milfoil. The presence of these nonnative species at the reference site indicated that nonnative species will likely be very difficult to exclude from the proposed Middle Svensen Island mitigation site due to seed source in the river and adjoining lands. Performance standards were written to acknowledge that nonnative species will inevitably form a part of the vegetation community despite any efforts to control them. However, to address the inevitable propagation of nonnative species, wetland mitigation will include a weed control maintenance plan, as specified in Section 2.1.10.

D. Grading Plan

The current design uses available data from the tidal gauge at the Wauna Mill (corrected for the Middle Svensen Island site) to define MLLW, MTL, and MHHW. Based on field observations of tidal fluctuations relative to surveyed positions, these elevations are expected to be fairly accurate for planning purposes. Actual elevations ascribed to the proposed contours shown in Figures 2-5a and 2-5b may change as better data is obtained from a proposed water monitoring gauge on the site.

E. Description of Construction Methods

The order of construction will be as follows: (1) fill ditches using spoils berms created from ditch excavation, place fill around Haglund home, build up eastern cross-dike, and remove noxious weeds; (2) excavate site to contours shown in Figures 2-5a and 2-5b, cover bare soil areas below MTL with coir (coconut shell) fabric, cover stream and pond banks with jute mat and seed mix and mulch, cover remaining bare soil above MTL with seed mix and mulch, and

install habitat features; (3) water site until seed has germinated and soil areas are protected, begin removing the dike material at breach locations and installing culvert in western cross-dike, working with the tides as they progress to low tide; (4) secure work area from Columbia River using metal plates inserted at outside edge of dike making use of a tide table to select a time when tides will be especially low; (5) remove final portion of dike, then remove temporary plates at low tide and remove construction equipment; and (6) use existing dikes, which will be cleared of noxious weeds, to access dike removal area.

F. Proposed Hydrology

The Middle Svensen Island site will use primarily tidal water from the Columbia River and precipitation to provide wetland hydrology to the site. Currently, much of the site inside of the dike system is below the MHHW elevation (11.17 feet NAVD) and just at or below the MTL (7.11 feet NAVD) for Columbia River. Because of this, it is assumed that the site will receive an abundance of water upon removing the dikes. Because of the abundance of available water, no irrigation is proposed other than initial watering to help erosion control seed mixes germinate prior to dike removal.

G. Proposed Vegetation (Planting Plan)

Once the site has been graded, the higher elevation emergent seed mix (Table 2-13) and low-marsh seed mix (Table 2-14) will be applied to all bare soil areas for erosion control. Woody plantings will be installed during the following winter months with the species outlined in Table 2-15. Plants will be installed during their dormant period to avoid mortality due to heat stress or drought while the entire site is planted. Due to the abundance of available water, no irrigation is proposed for the plantings. Seeded areas may need to be watered by truck to facilitate germination.

Table 2-13. High-Marsh Emergent Herbaceous Community (Above 7.1 Feet NAVD)

Botanical Name	Common Name	Seeding Rate (lbs/acre)	Container	Total Pounds
Glyceria elata	Tall mannagrass	1.2	seed	Dependent on area of bare soil after construction
Deschampsia cespitosa	Tufted hairgrass	0.5	seed	
Agrostis exarata	Spike bentgrass	1.15	seed	
Festuca rubra ssp. *arenaria* or *commutata*	Coastal native red fescue	1.15	seed	

Table 2-14. Low-Marsh Emergent/River Willow Community (Below 7.1 Feet NAVD)

Botanical Name	Common Name	Seeding Rate (lbs/acre)	Container	Total Pounds
Scirpus microcarpus	Small-fruited bulrush	0.5	seed	Dependent on area of bare soil after construction
Eleocharis palustris	Creeping spikerush	0.02	seed	
Scirpus tabernaemontanii	Softstem bulrush	2	seed	
Scirpus acutus	Hardstem bulrush	2	seed	
Carex obnupta	Slough sedge	0.5	seed	
Carex amplifolia	Bigleaf sedge	0.5	seed	
Sagittaria latifolia var. *latifolia*	Wapato	2	seed	
Salix fluviatilis	Columbia River willow		1 gallon	

Table 2-15. Riparian Forest/Scrub-Shrub Wetland Community

Botanical Name	Common Name	Spacing (feet on center)	Container	Number
TREES				
Alnus rubra	Red alder	40	1 gallon	
Fraxinus latifolia	Oregon ash	20	1 gallon	
Picea sitchensis	Sitka spruce	40	Bareroot	
Populus balsamifera	Black cottonwood	40	Bareroot	
Thuja plicata	Western red cedar	40	Bareroot	
SHRUBS				
Cornus sericea	Red osier dogwood	20		
Myrica gale	Pacific bayberry	40		
Physocarpus capitatus	Pacific ninebark	20		
Ribes lacustre	Swamp gooseberry	20		
Ribes bracteosum	Stink currant	20		
Rosa gymnocarpa	Baldhip rose	20		
Salix hookeriana	Hooker's willow	40		
Salix lucida	Pacific willow	40		
Salix sitchensis	Sitka willow	20		
Spiraea douglasii	Douglas' spiraea	40		

H. Proposed Soils

This plan proposes to utilize existing hydric soils in situ. A majority of the site, excepting areas expected to be under water at MTL, will undergo only minor grading to retain the poorly-drained characteristics of the mapped Coquille-Clatsop complex silt loam hydric soils.

I. Proposed Buffers

Since the high-tide levels extend close to the top of the dikes, very little upland area exists that could be considered buffer. Because this is an island, the buffers will be primarily river.

J. Proposed Habitat Features

The following wildlife habitat features will be installed during site construction in order to bolster the habitat functions provided by the site: osprey nest platform, purple martin nest boxes, and raptor perch poles.

K. Acreage Replacement Assessment

Permanent wetland and waterway impacts (tidal and nontidal) will be jointly compensated by restoring tidal influence to degraded wetland pasture that is currently isolated from the tides by a system of dikes and tidegates. Where existing degraded, nontidal wetlands and waters will be enhanced by restoring tidal influence and tidal marsh habitat, the proposed ratio will be three acres of enhancement to mitigate one acre of impact. Where existing degraded nontidal upland areas will be restored to tidal wetlands or waterways, the proposed ratio will be one acre of restoration to mitigate one acre of impact. Wetland and waterway enhancement and restoration are considered separately as shown in Table 2-16 below. These ratios are in accordance with the DSL's Estuarine Mitigation, the Oregon Process (DSL 1984) and assumed to meet the mitigation requirements outlined in CWA Section 404(b).

Table 2-16. Assessment of Permanent Impacts and Compensatory Mitigation Credits

Aquatic Resource Type	Acres Impacted (tidal and nontidal combined)	Required Enhancement Credits (3:1 ratio)	Required Restoration Credits (1:1 ratio)	Required Upland Enhancement Credits (1:1 ratio)	Acreage Replacement Met?
Wetlands	13.35	40.05			Yes—62 acres of diked pasture wetland will be enhanced by dike breaching, plantings, and weed maintenance. Of this, 42 acres are specifically designated for estuarine resource replacement.
Waterways	0.37		0.37		Yes—breaching of the dike and connecting Middle Svensen Island with the main channel will allow development of at least that much waterway habitat.
Uplands below 11.0 feet NAVD[1]	2.39			2.39	Yes—2.5 acres of existing uplands will be enhanced with native plantings (shrub plantings along the dikes).

[1] 11.0 feet NAVD is the jurisdictional elevation for the Columbia River at RM 38.5. This elevation is also being used by the DSL for the jurisdictional boundary of the Columbia River estuary. Below this elevation, several areas do not meet the definition of a wetland (per Corps 1987 manual).

L. Construction Specifications

A biologist and/or environmental inspector (as appropriate) will be present during construction of the mitigation site to ensure that the site is built without impacting adjacent fish habitat and to monitor grading activities and advise on construction procedures in order to ensure that the site is constructed to plan. All seed mixes will be certified weed-free. This plan represents preliminary engineering or 30 percent design. Construction plans and specifications will be generated upon acceptance of this plan. Specifications will include work area isolation plans approved by NMFS and USFWS for dike removal activities.

2.1.8 Performance Standards

This mitigation project must succeed on several levels in order to offset resource impacts resulting from construction of the Terminal and Pipeline. Generally, success will be determined by Bradwood's ability to establish estuarine wetland conditions that will result in the capacity and opportunity to provide wetland functions at or greater than the capacity that will be lost at the impact site.

The performance standards detailed below are related directly to the goals of this mitigation plan and will be used to determine whether or not those goals are being met. The successful mitigation site will restore, create, or enhance aquatic and terrestrial habitat, promote native species richness, and preserve existing high-quality wetland areas. The following performance objectives and related performance standards are organized by goal, per Section 1.2 of this mitigation plan. For each performance standard, the applicable monitoring method is specified. In addition, one or more contingency measures are provided for each performance standard to demonstrate that there are additional actions that can be applied to the site if it is having difficulty meeting the standard.

Goal 1 - Restore temporarily impacted wetlands quickly to minimize temporal loss of wetland functions.

2.1.8.1: *Performance Objective:* Upon completion of Pipeline construction activities, all temporarily impacted wetlands and waterways will be graded back to their original contours with the topsoil replaced above the subsoils, a native seed mix applied to all bare soil areas, and no impediments to existing water inputs or outfalls.

Performance Standard: Following construction, temporarily impacted wetlands will match the surrounding grade of existing wetlands beyond the work area. Soil pits will reveal that the topsoil horizon was replaced on the subsoil horizon and that saturation is evident within 12 inches below the ground surface during the rainy portion of the growing season (mid-February to June). Within one year of construction, impacted soils will have 80 percent aerial cover by vegetation.

Monitoring Method: A biologist will walk the Pipeline corridor and fill out a wetland delineation datasheet in a representative portion of each wetland impacted by Pipeline construction.

Contingency: Areas with more than 20 percent bare soil will be reseeded with the native wetland seed mix. Failed plantings will be reinstalled at

2:1 ratios. Areas deprived of wetland hydrology will be modified through regrading or hydraulic controls to retain moisture.

2.1.8.2: *Performance Objective:* Upon completion of Terminal construction, all temporarily impacted wetlands and waterways will be graded back to their original contours with the topsoil replaced above the subsoils, a native seed mix applied to all bare soil areas, and no impediments to existing water inputs or outfalls.

Performance Standard: Following construction, temporarily impacted wetlands will match the surrounding grade of existing wetlands beyond the work area. Soil pits will reveal that the topsoil horizon was replaced on the subsoil horizon and that saturation is evident within 12 inches below the ground surface during the rainy portion of the growing season (mid-February to June). Within one year of construction, impacted soils will have 80 percent aerial cover by vegetation.

Monitoring Method: A biologist will fill out a wetland delineation datasheet in a representative portion of each wetland temporarily impacted by Terminal construction.

Contingency: Areas with more than 20 percent bare soil will be reseeded with the native wetland seed mix. Failed plantings will be reinstalled at 2:1 ratios. Areas deprived of wetland hydrology will be modified through regrading or hydraulic controls to retain moisture.

Goal 2 - Restore tidal influence to 42 acres of existing degraded wetlands to compensate for permanently lost tidal wetlands at the Terminal impact site.

2.1.8.3: *Performance Objective:* Restore tidal influence to mitigation site.

Performance Standard: At mean-high-water elevation, all restored tidal wetlands will be inundated.

Monitoring Method: Water monitoring gauges will directly record height of tidal inundation. Staff gauges in Columbia River will be used to verify mean-high-water elevations.

Contingency: Once the breaching of the dikes has occurred, the tidal elevation will govern. If water flow is restricted by the size of the openings, the breach in the outer dike could be widened. No further contingency measures are feasible.

2.1.8.4: *Performance Objective:* Protect native species richness.

Performance Standard 1: No more than 25 percent of the aerial cover by plant species in wetlands will consist of nonnative species after Year Five due to restoration of tidal hydrology regime and active weed control.

Monitoring Method: A sampling design, based on statistical analysis of appropriate sample size, will be created using parallel north/south transects that will start at an established baseline spanning the southern boundary of the site. At 10-meter regular intervals along each transect, a one-meter plot will be dropped over the existing vegetation and all species

within the plot will be recorded along with their representative cover within the plot. Bare soil will also be recorded.
Contingency for PS 1: Provide additional maintenance removal of weeds. Treat and replant or reseed if necessary.

2.1.8.5: *Performance Objective:* Create tidal marsh.
Performance Standard 1: At least 75 percent of the aerial cover of the site, excluding tidal channels, will consist of wetland freshwater tidal marsh species by Year Five.
Monitoring Method: A sampling design, based on statistical analysis of appropriate sample size, will be created using parallel north/south transects that will start at an established baseline spanning the southern boundary of the site. At 10-meter regular intervals along each transect, a one-meter plot will be dropped over the existing vegetation and all species within the plot will be recorded along with their representative cover within the plot. Bare soil will also be recorded.
Contingency for PS 1: Replant or reseed areas with exposed substrate.

2.1.9 Monitoring Plan

Responsible Parties

The conservation partner who assumes responsibility for long-term maintenance of the Middle Svensen Island site will be responsible for submitting monitoring reports after each monitoring year until the monitoring required by the mitigation is completed (Year 10). Bradwood has identified several potential nonprofit organizations interested in assuming long-term stewardship of the site.

Schedule and Timetable

2008: Begin construction of Middle Svensen Island site. Seed all areas in summer, plant woody vegetation following winter. Submit as-built plans to DSL and COE.

2009: Year One monitoring (temporary and permanent mitigation areas) in June or July with follow-up report by December 31.

2011: Year Three monitoring (temporary and permanent mitigation areas) in June or July with follow-up report by December 31.

2013: Year Five monitoring (temporary and permanent mitigation areas) in June or July with follow-up report by December 31. Note: this will be the final year for temporary impact monitoring.

2015: Year Seven monitoring in June or July with follow-up report by December 31.

2018: Year 10 monitoring in June or July with follow-up report by December 31.

Assessment Tools and Methods

Monitoring methods will be tied to relevant performance standards as described in Section 2.1.8. In general, the following methods and tools will be used:

Temporary Restoration Areas

A biologist will walk the Pipeline corridor and Terminal restoration areas and record observations on a wetland field datasheet in a representative portion of each wetland impacted by Pipeline construction. Information on vegetation cover (including percent bare ground), soil profile descriptions by horizon, and direct or inferred hydrology observations will be recorded on the form and submitted as part of the monitoring report.

Middle Svensen Island Restoration Site

Methods will be used to describe the performance of wetland vegetation, estuarine/wetland acreage, and hydrology as follows:

For performance standards related to vegetation cover and percent native

A sampling design, based on statistical analysis of appropriate sample size, will be created using parallel north/south transects that will start at an established baseline spanning the southern boundary of the site through wetlands. At 10-meter regular intervals along each transect a one-meter plot will be dropped over the existing vegetation and all species within the plot will be recorded along with their representative cover within the plot. Bare soil will also be recorded.

For performance standards related to wetland acreage

Site will be delineated in Year Five using the methodology outlined in the 1987 Corps Manual. Delineation will subdivide site by wetland type (marsh, scrub-shrub wetland). Acreage will be calculated using a GIS.

For performance standards related to hydrology

Water monitoring gauges will record height of water table throughout the year. Staff gauges in Columbia River will be used to verify mean-high-water elevations.

Maintenance Activities

Any contingencies that must be enacted as a result of monitoring will be funded by an endowment provided to a conservation organization by Bradwood for the purpose of ongoing site maintenance and adaptive site management after 10 to 12 years, provided the sites have met their respective success criteria, and performance standards are shown to be trending toward high functionality and relatively self-sustaining restored state. It is assumed at that time that Bradwood would be considered to have met their regulatory obligations. Monitoring reports

prepared by or on behalf of Bradwood will be shared with the conservation organization so that they can adapt their site management activities and maintenance plan in a matter that will better achieve the performance goals outlined in Section 2.1.8 of this plan. A qualified conservation organization will be asked to review preliminary design plans and collaborate with Bradwood in crafting a site-specific adaptive management plan and stewardship plan prior to their "adoption" of each site.

2.1.10 Site Protection, Maintenance, and Security Instruments

- Site protection for the Svensen Island site will be provided by a conservation easement on the title. Under this conservation easement, allowable land uses of the site will be restricted to preservation and further enhancement.
- Long-term management of the site and responsibility for meeting performance standards will be turned over to a third-party group to be identified and agreed on prior to the start of the mitigation plan implementation.
- Maintenance requirements and responsibilities will be specified in a formal contractual agreement.

2.1.11 Financial Assurances

Bradwood will provide an endowment to a third-party conservation organization for long-term maintenance of the Svensen Island mitigation area. A performance bond or letter of credit will also be executed to assure completion in case of default by key responsible parties.

2.1.12 Wetland Preservation and Maintenance Sites

In order to provide mitigation that is recognized as robust relative to the typical regulatory requirements, Bradwood is proposing preservation and maintenance of two highly valuable existing wetland areas in addition to the tidal wetland restoration proposed on Middle Svensen Island. Both of these areas would qualify as "conservation in lieu" sites under Oregon DSL's CWM requirements because both sites support substantial populations of five ESA-listed salmon ESUs. Under the CWM program, there is no established ratio of conservation area relative to impact area. In addition to the wetland values, these sites have particular value for fish. The preservation of those values is important to the lower Columbia River ecosystem. In addition, additional ecological lift, especially to benefit fish, will be realized on Lower Svensen Island by a few enhancement actions. The sites are described below. The total acreage in the two sites is approximately 231 acres.

A. Svensen Island

The largest of the two proposed conservation sites is Svensen Island, located about 14 river miles downstream from the proposed Terminal location (Figure 1-1). The project has an exclusive option to purchase the majority of the island, and first right of refusal on the remaining area of the island. The island has been protected and separated from the river by a surrounding dike for over 130 years (an 1868 map shows the dike). The area inside the dike has been in agriculture since the dikes were placed. Two cross-dikes divide the island into three distinct parts. The westernmost section of the island (the downstream end, which includes more than half of the island acreage) was flooded when the dike breached at the northwestern tip of the island in December 2003. Since then, daily high tides flood approximately 170 acres inside the dike, and

tidal marsh has become reestablished by natural processes. A high percentage of the flooded area is now occupied by a diverse array of mostly native marsh species. Because the location is either upriver of or at a higher elevation than the area of saltwater intrusion into the channels of the river (depending on the season, flow, and tides), the marsh is a freshwater marsh. A remnant channel through the middle of the flooded segment supports Columbia willow trees and shrubs, but it is not clear whether they will survive the daily inundation.

The goal of wetland preservation at the flooded part of Svensen Island is to protect wetland hydrologic function and wetland plant communities so that the wetlands can continue to provide critical rearing habitat for listed juvenile salmon (see Section 4.0 of this mitigation plan for a thorough discussion of fish and fish habitat values). The land use will be protected by placing a conservation easement on the property title. The values will be maintained under a maintenance/ stewardship agreement with a qualified conservation organization, and their activities on the site will be funded by Bradwood. The primary maintenance action needed is to carry on the control of purple loosestrife and possibly other noxious weeds whose influx would threaten the wetland functions and values being protected. Removal of purple loosestrife would occur primarily during the summer each year, with the goal of preventing seed production. Spreading by influx of seed with the tidal water would be controlled by hand-pulling the young plants.

The activities proposed to gain additional ecological value for fish include:

- Adding LWD at tidal channels as fish habitat features,
- Further restoring fish accessibility by removing two remaining tidegates from existing culverts,
- Further restoring fish habitat value by removing several (up to eight) remaining culverts on former farm roads that block fish escape with receding tides,
- Further restoring marsh and riparian habitat by removing remaining buildings and facilities so that plants can grow (possibly adding soil), and
- Removing remaining fuel tanks that might pose a risk to aquatic organisms.

B. Hunt Creek/Clifton Channel

The second preservation site is the confluence of Hunt Creek with the Columbia River at Clifton Channel adjacent to the proposed Terminal. Hunt Creek provides important spawning and rearing habitat for the lower Columbia River coho salmon ESU, and the confluence area with Clifton Channel is valuable rearing habitat for the same ESUs as the old log pond that will be lost at the Terminal. The goal would be to assure protection of the tidal wetlands and stream habitat associated with Hunt Creek (outside the Terminal, the access road, and the railroad) that would be in the ownership of the Project by placing a conservation easement on the property title. In addition, a maintenance/stewardship agreement with a qualified conservation organization would be established and funded by Bradwood. Part of that maintenance would include controlling nonnative purple loosestrife and possibly other noxious weeds as necessary to preserve the wetland functions. The proposed preservation area is about 57 acres in size and is illustrated in Figure 2-7.

2.2 Washington Wetland Mitigation

2.2.1 Restoration of Temporarily Disturbed Wetlands

During construction of the Pipeline, every practical measure to avoid and minimize wetland impacts will be employed. Many wetlands will be avoided because they are adjacent to a stream that will be crossed via HDD. As the Pipeline trench is backfilled after passing through a wetland, the original contours of the topography will be matched to make sure that wetland hydrology will be maintained. Bentonite trench plugs (low-permeability material) will be placed in the trench surrounding the pipe on each side of a wetland (especially the downslope side) to make sure that the wetland will not drain through the trench. The topsoil from the wetland will have been set aside during trenching and will be placed back in its surface location during backfilling. This will have the effect of repositioning many of the roots and seeds of the original wetland back in place. In addition, the wetland areas will be replanted with a native seed mix. Typically, these methods result in full reestablishment of vegetation in herbaceous wetlands within one or two growing seasons. In addition, where forested wetlands must be cleared for construction of the pipeline, native trees will also be replanted in place. The requirement that no trees can be planted within five feet on either side of the Pipeline centerline will be observed at wetlands and riparian locations. This restriction, and the resulting 10-foot spacing between trees is expected to result in typical forest conditions, because tree spacing in forests is typically 10 feet or more.

2.2.2 Summary of Impacts to Be Compensated

Less than 0.25 acre total of forested wetland would be converted to herbaceous or shrub wetland along the Washington Pipeline segment. The Project's send-out pipeline traverses through about 16 miles of Cowlitz County, Washington. Over that distance, no more than about 4.8 acres of wetlands would be within the active temporary impact area of pipeline construction. Of that, less than two acres is forested wetland. Even though wetlands will be restored in place, there will be areas over the pipeline where no trees will be allowed to grow. That 10-foot-wide area totals less than 0.25 acre. In addition, even where trees can be replanted, there will be a temporal loss of functions that will last several years. The temporal loss in herbaceous wetlands will be small, because the vegetation will typically be fully restored within one or two growing seasons. Therefore, compensation will be provided for temporal impacts over less than two acres of forested wetland and 0.25 acre of conversion of forested wetlands into herbaceous or shrub wetlands.

The ratios for conversion of wetlands from one type to another will vary based on the type and degree of the alteration, but they are generally one-half of the typical ratios for permanent impacts. The typical ratios for impacts to a Category II wetland are 3:1 for creation only and 12:1 for enhancement only. Half of these would be 1.5:1 and 6:1. If creation and enhancement are combined, the ratios drop to 1:1 (creation) and 8:1 (enhancement). Half of these ratios would be 0.5:1 (creation) and 4:1 (enhancement). To compensate for a 0.25 acre conversion of Category II forested wetlands, one combination would be 0.125 acre of creation and one acre of enhancement. Credit may also be given for enhancing the buffers.

2.2.3 Proposed Compensatory Mitigation Site

The site proposed for mitigation is located about three miles north of the pipeline on Delameter Creek, a tributary of the Cowlitz River (Figure 1-1). This site was chosen because pasture wetlands along a stream can be planted to become forested wetlands to mitigate for the conversion of forested wetlands to nonforested wetlands along the Pipeline in Cowlitz County. Delameter Creek, which runs through the southeast corner of the site, is accessible to coho salmon and steelhead. A tributary to Delameter Creek flows from north to south through the site into Delameter Creek.

A. Site Location

The Delameter Creek wetland mitigation site is located in Cowlitz County, within Section 19, Township 9 North, Range 2 West. The 17-acre parcel that contains the site is located near Delameter Road off of SR 411 approximately 4.5 miles west of Castle Rock, Washington (see Figure 1-1). The existing conditions of the mitigation site are shown in Figure 2-8, and site photos are provided in Appendix I.. The site is zoned agriculture.

B. Site Ownership

The land proposed for mitigation is currently owned by the Shulke family. The landowner is willing to place part of the property under a conservation easement that would be administered by a third-party conservation organization.

2.2.4 Existing (Baseline) Conditions of the Mitigation Site

A. Existing Vegetation Communities

The following vegetation communities were observed on-site:

- Upland scrub-shrub - There is a dense community of Himalayan blackberry (FACU) along the edge of wetland B2.
- Riparian forest - The northern- and westernmost portions of the site are dominated by red alder (FAC) with minor components of vine maple (FAC).
- Palustrine forested - Wetland F to the south is dominated by red alder (FAC).
- Palustrine scrub-shrub - Approximately half of Wetland B2 is dominated by Himalayan blackberry (FACU).
- Palustrine emergent - Emergent wetlands are dominated by reed canarygrass (FAC).
- Upland herbaceous grass crop - Between the wetland and the road, the site is upland and has been cultivated for agricultural purposes. Vegetation is pasture grass.

B. Existing Soils

The majority of the site is mapped by the NRCS as Centralia silt loam, 0 to 8 percent slopes, or Centralia silt loam, 8 to 20 percent slopes. Olequa silt loam, 0 to 8 percent slopes and Edgewick silt loam, 0 to 3 percent slopes were also mapped on the northern and southeastern edges of the site, respectively. None of these soil units are listed as hydric by the NRCS.

The soils observed throughout the site, in both wetlands and some adjacent uplands, were silt loam or loam. In the wetland areas, redoximorphic features were common to many and distinct

to prominent. In the upland areas redoximorphic features varied significantly from not present to common and distinct.

C. Existing Hydrology Within Proposed Restoration Area

Wetlands B1, B2, B3, B4, D, and E are depressional wetlands and are supported by precipitation. On the west side of the tributary to Delameter Creek, two small seeps also contribute to Wetland B2. Delameter Creek runs through Wetland B2; however, it is quite incised and is not a contributing water source to the wetland. Wetland F is directly associated with Delameter Creek and one of its tributaries.

D. Existing Wetlands

The NWI map for the site shows one PEMC wetland, less than one acre in size. A field survey to identify baseline conditions delineated slightly more wetland acreage than NWI (about 2.5 acres); the site visit took place on February 8 and 9, 2007. Table 2-17 gives a summary of existing conditions on-site, and a brief description is given below.

Table 2-17. Summary of Existing Conditions

Wetland	Acres	HGM	Cowardin	Cowlitz County Classifications
A	0.07	Depressional	PSSC	None
B1	0.95	Depressional	PEMC/ PSSC	4
B2	0.48	Depressional	PEMC	4
C	0.01	Slope	PEMC	None
D	0.014	Depressional	PEMC	None
E	0.01	Depressional	PEMC	None
F	0.85	Riverine	PEMC/ PFOC	None
Subtotal wetlands	2.384			
Upland	0.031	N/A	Pasture grasses	N/A

Wetland A

Wetland A is on the northern portion of the property. The tributary to Delameter Creek is just to the north and there is a slope to the south of the wetland. The dominant vegetation is scrub-shrub and the dominant plants are red alder, vine maple, and salmonberry (FAC). The herbaceous vegetation is dominated by piggy-back plant (FAC). Soils are well drained loam and sandy loam with many distinct to prominent redoximorphic features. No water was observed within 12 inches bgs due to lack of recent precipitation. The Cowardin classification of Wetland A is palustrine, scrub-shrub, seasonally flooded (PSSC), and the HGM classification is depressional. It is a Category III wetland.

Wetland B1

Wetland B1 is on the east side of the tributary to Delameter Creek. The dominant vegetation is creeping bentgrass (FAC+), soft rush (FACW+), and small-fruited bulrush (OBL). Himalayan blackberry is the subdominant species. The upland area surrounding the wetland is also vegetated with blackberries. There is a break in the topography between the upland to the east

and the wetland. The wetland also follows the tributary to Delameter Creek to the south and discharges into the tributary. The tributary is deeply incised and apparently does not normally flood its banks. Along the tributary Wetland B1 is predominantly covered with blackberries. The soils are loam with common distinct redoximorphic features. The soil was saturated at 10 inches and there was free water in the soil pit at 12 inches. Wetland B is a complex of both PEMC and PSSC Cowardin classes. There are also hummocks throughout the wetland that support upland vegetation (e.g., the blackberries). The PSSC portion is dominated by blackberries. The HGM classification is depressional. Wetland B1 is a Category III wetland.

Wetland B2

Wetland B2 is part of Wetland B1 and joins this wetland from the east. Wetland B2 is in a field previously used for agriculture. It may have been a tributary to Delameter Creek at one time. Soft rush is the dominant species, and the upland area surrounding the wetland is occupied by pasture grasses. Soils are silty clay loam with distinct to prominent redoximorphic features. One inch of standing water was present in Wetland B2. Wetland B2 is a Category IV wetland and is classified as PEMC and depressional under Cowardin and HGM, respectively.

Wetland C

Wetland C is west of the tributary to Delameter Creek and is fed by a seep that flows off the hillside to the west and into the tributary. No soil plot was taken in this wetland; however, soil is likely to be similar to the surrounding areas (silt loam). Dominant vegetation is reed canarygrass and it appears to follow an old road. The ground was saturated to the surface and there was standing water in some areas. The Cowardin classification is PEMC and the HGM classification is slope. It is a Category III wetland.

Wetland D

Wetland D is a very small wetland on the west bank of the tributary to Delameter Creek. The wetland is a depressional wetland, and it discharges into the tributary, which is deeply incised. The dominant vegetation is reed canarygrass. It is classified as PEMC under the Cowardin system. Wetland D is a Category IV wetland.

Wetland E

Wetland E is a very small wetland to the east of the mainstem of Delameter Creek and to the east of its tributary. It is a Category IV wetland dominated by reed canarygrass. The soils are silty clay loam with common distinct redoximorphic features and there was standing water at 12 inches bgs. Wetland E is classified as PEMC and depressional under the Cowardin and HGM classification systems, respectively.

Wetland F

Wetland F is associated with Delameter Creek and continues off-site to the south. Delameter Creek is braided and frequently floods the wetland. Wetland F is a complex of PEMC and

palustrine forested (PFOC) Cowardin classes. Dominant vegetation in the PEMC class is small-fruited bulrush, creeping bentgrass, and lady fern (FAC). Red alder is the dominant vegetation in the PFOC and riparian areas and forms a canopy over the creek. Soils are silty clay loam and loam with common to many distinct redoximorphic features. The wetland is saturated to the surface. It is a riverine wetland under the HGM classification system and is rated as a Category II.

E. Wetland Ratings and Functions

Each wetland was rated using the Washington State Wetland Rating System for Western Washington (Ecology 2004). Ecology recognizes four categories of wetlands: I, II, III, and IV. Ecology Wetland Rating Data Forms are provided in Appendix J.

Category II wetlands are those wetlands that are difficult, though not impossible, to replace, generally have little to no disturbance, and provide high levels of some functions. The primary criteria for Category II wetlands are that they score 51 to 69 out of 100 points on the rating questions related to functions. Category II wetlands also include estuarine wetlands less than one acre, or greater than one acre that are disturbed, and interdunal wetlands greater than one acre. Although Category II wetlands occur more commonly than Category I wetlands, they are deemed to warrant a relatively high level of protection.

Category III wetlands generally provide a moderate level of functions, have been disturbed in some way, and are often less diverse or more isolated from other natural resources. The primary criteria for Category III wetlands are they score 30 to 50 out of 100 points as defined in Ecology's Wetlands Rating System for Western Washington. Interdunal wetlands between 0.1 and one acre in size are also Category III regardless of their score. Category III wetlands are regulated wetlands that do not contain features or levels outlined in Categories I, II, or IV. They occur more frequently, are less difficult to replace, and need a moderate level of protection compared to higher rated wetlands.

Category IV wetlands have the lowest levels of functions (less than 30 points on the rating questions relating to functions). They do not meet the criteria for Category I, II, or III wetlands. These are wetlands that should be replaceable and, in some cases, can be improved from a functions standpoint. These wetlands may provide important functions and values and should be protected to some degree.

The rating and functions for each wetland are listed in Table 2-18. Wetlands B1 and B2 would be modified by the proposed mitigation plan and therefore are described below. The other wetlands will not be directly altered by the proposed mitigation plan; therefore, they are not discussed further.

Table 2-18. Summary of Functions Provided by Existing Wetlands at the Delameter Creek Wetland Mitigation Site

Wetland	Rating	Functions			
		Water Quality	Hydrology	Habitat	Total
A	III	8	8	14	30
B1	III	9	20	14	43
B2	IV	5	14	8	27
C	III	14	4	14	32
D	IV	9	8	11	28
E	IV	3	9	7	19
F	II	20	18	17	55

Wetland B1

Wetland B1 is a Category III wetland and its primary functions are hydrological, providing flood flow alteration. The wetland also provides some habitat functions because it is part of a complex of wetlands and streams. However, vegetation is primarily nonnative and does not provide much diversity. The entire site is used frequently by elk.

Wetland B2

Wetland B2 is a Category IV wetland and provides minimal functions. Like Wetland B1, it provides flood flow alteration, but has low water quality and habitat functions. The entire site is used frequently by elk.

Upland A

Upland A is located between Wetlands B1 and B2. The primary vegetation is pasture grasses. It is relatively flat and is approximately one foot higher in elevation than the surrounding wetlands.

2.2.5 Mitigation Site Plans/Design

The compensatory mitigation would be primarily planting of native tree species in Wetlands B1 and B2 to convert them from emergent and scrub-shrub wetlands to forested wetlands. Forested wetland would also be created in Upland A, the section of upland between Wetlands B1 and B2. This area would be excavated to an elevation similar to that of Wetlands B1 and B2. The site will need to be cleared of blackberries during the growing season prior to any planting occurring on-site. Existing vegetation, including blackberries, will be mowed. Herbicide will be used on the remaining stumps of the blackberries. To complete the mitigation wetland, the side of the wetland that is in the open field (the east side) would have a buffer area planted as forest as well. Forest is an abundant cover type in the vicinity, but open grassy habitat is quite scarce. Also, in this location, the primary functions of the wetland buffer are habitat functions because there is very limited opportunity for water quality or flood flow functions to operate. Therefore, the proposed buffer width to be planted with trees is 50 feet rather than a wider area (110 feet) that might be recommended by guidelines for the type of wetland that will result from the mitigation.

2.2.6 Planting/Landscape Plans

Trees would be planted in Wetlands B1 and B2 and in the upland area. In addition, a buffer on the east side of the wetland would be planted. Table 2-19 lists tree species to be planted in the wetland enhancement and wetland creation areas. All plantings will be bareroot 1.5 to three feet in height and will be planted with spacing of 10 to 12 feet on center. See Figure 2-9 for the planting plan. Planting of bareroot trees and shrubs will occur during the winter dormancy period, between January 1 and March 1. Plants would be planted as soon as possible after delivery to the site. Western red cedar and black cottonwood will be planted on the hummocks and edges of the wetland. Sitka spruce, Pacific willow, Sitka willow, and Oregon ash will be planted in the wetter areas. The site will require watering for at least one growing season. The entire area will need to be fenced to prevent damage by elk before the trees get large enough to be resistant.

Table 2-19. Proposed Planting Plan for Wetland Enhancement and Creation Areas

Species		Total Acres	Number of Trees	Percent Coverage
Sitka spruce	*Picea sitchensis*	0.522	158	30%
Pacific willow	*Salix lucida*	0.261	79	15%
Sitka willow	*Salix sitchensis*	0.087	26	5%
Western red cedar	*Thuja plicata*	0.087	26	5%
Oregon ash	*Fraxinus latifolia*	0.522	158	30%
Black cottonwood	*Populus balsamifera*	0.261	79	15%
Totals		1.74	526	100%

A 50-foot buffer will also be planted. Plants will be bareroot 1.5 to three feet in height and will be planted with spacing of 10 to 12 feet on center. Table 2-20 lists plant species and the number of trees. See Figure 2-9 for the planting plan. The pasture area provides valuable habitat to elk, thus planting a large buffer would eliminate the habitat.

Table 2-20. Proposed Planting Plan for Buffer

Species		Total Acres	Number of Trees	Percent Coverage
Western red cedar	*Thuja plicata*	0.46	140	33%
Black cottonwood	*Populus balsamifera*	0.46	140	33%
Western hemlock	*Tsuga heterophylla*	0.46	140	33%
Vine maple	*Acer circinatum*	0.70	50	Planted in understory
Cascara	*Rhamnus purshiana*	0.70	50	Planted in understory
Totals		1.38	520	100%

The entire wetland buffer restoration area would be fenced to protect the planted vegetation from damage by elk.

2.2.7 Site-Specific Goals, Objectives, and Performance Standards

The long term goal of mitigation at this site is to reestablish functioning forested wetland and riparian habitat to provide natural inputs to the stream and the fish in it, as well as improve other wetland functions, including water quality improvement, buffer functions, and wildlife habitat. The primary performance standard would be to have 3 percent cover of native woody species by Year Three, 7 percent by Year Five, and 40 percent by Year 10.

2.2.8 Monitoring Plan

- Variables to be measured – woody plant cover.
- Sampling methods for each variable – plots along established transects.
- Schedule for sampling – growing seasons three, five, and 10 following planting.
- Timetable for reporting monitoring results to agencies – by December 1 for each year of monitoring.

2.2.9 Site Protection Measures

A conservation easement would be placed on the planted areas.

2.2.10 Maintenance and Contingency Plans

Based on the monitoring, if the performance standard is not being met, additional planting will be done by the following growing season to correct the deficiency.

3.0 WILDLIFE HABITAT MITIGATION

The mitigation for wildlife habitat focuses on Oregon because the Project is addressing the Oregon regulations governing habitat mitigation. No equivalent regulations exist in Washington. The Terminal and about half of the Pipeline would occur in Oregon. Wetland mitigation and fish habitat mitigation are addressed in Section 2.0 and Section 4.0, respectively, of this mitigation plan. Where applicable, the mitigation for specific fish habitat categories is cross-referenced in this section.

Wildlife habitat is addressed in the context of the ODFW's habitat mitigation policy. The purpose of the habitat mitigation policy is to further ODFW's fish and wildlife management policies "through application of consistent goals and standards to mitigate impacts to fish and wildlife habitat caused by land and water development actions" (ODFW, 2006a). OAR 635-415-0025 describes six qualitative habitat categories (Categories 1 through 6), which are based on relative importance to fish and wildlife. The OAR establishes mitigation goals and corresponding implementation standards for each habitat category. Category 6 habitats require no mitigation.

The wetland habitat types described in this section use standard Cowardin wetland classification language to distinguish among different habitat types. Because of the different methodologies used to identify wetland habitat (e.g., dominant vegetation, documented support for federally listed species, etc.), versus those used to delineate wetland boundaries (1987 USACE Manual), the wetland habitat boundaries in this section loosely approximate, but do not necessarily match, the preliminary wetland boundaries delineated using the USACE 1987 Manual methodology. For example, in some cases, delineated wetlands are identified as riparian forest habitat if they lie adjacent to a stream. Therefore, the impact acreages provided for impacts to wetland habitat do not necessarily reflect the extent of impacts to jurisdictional wetlands and waters of the U.S. For the purposes of this project, ODFW defers to the Oregon DSL to ensure that impacts to wetlands are mitigated as prescribed by state regulations.

3.1 Summary of Impacts to Be Mitigated

The initial efforts at mitigation are aimed at avoiding or reducing adverse impacts. For example, the Terminal would be primarily on previously disturbed land used in the past as an industrial site and then for dredge spoils deposition (Figure 3-1). The footprint of the Terminal has been reduced to the minimum size and shape to avoid important wetland habitat to the extent possible. The Pipeline would cross a number of streams using the HDD technique, by which all impacts to the stream and riparian habitat would be avoided (Figure 3-2a-l). In other instances, the Pipeline corridor was altered to avoid important habitats. When the process of avoidance and reduction of impacts was completed, the remaining unavoidable impacts were identified.

Table 3-1 provides a summary of predicted impacts associated with development and operation of the Terminal and Pipeline facilities in Oregon. It is broken down by facility component and habitat category as well as by habitat type. This table includes all habitat types (upland, wetland, and aquatic).

Table 3-1. Estimated Acres of Impacts to Habitats by Project Facility and ODFW Habitat Category

Habitat type	Habitat category	Terminal Facilities						Pipeline		Total Impacts by Habitat Type & Category		Mitigation Location
		Terminal		Power Line		Parking Lot						
		Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	
Upland coniferous forest	2	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	3.3	Peterson Point
	4	0.0	0.0	0.0	3.2	0.0	0.0	16.2	12.1	16.2	15.3	Peterson Point
Upland deciduous forest	2	0.3	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.4	Peterson Point
	4	1.5	0.0	0.0	3.6	0.0	0.0	0.8	0.1	2.3	3.7	Peterson Point
Early seral conifer forest	4	0.0	0.0	0.0	6.8	3.0	5.0	0.1	0.0	3.1	11.8	Peterson Point
Riparian forest	2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	Peterson Point
	4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.5	0.6	0.5	Peterson Point
Riparian scrub-shrub	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Peterson Point
Upland scrub-shrub	4	10.6	2.1	0.2	0.0	0.0	0.0	1.4	0.4	12.2	2.5	Peterson Point
Agriculture/pasture/poplar farm	6	0.0	0.0	0.0	0.0	0.0	0.0	41.9	33.0	41.9	33.0	No Mitigation
Subtotal of Impacts to Upland Habitats		12.6	5.0	0.2	16.9	3.0	5.0	61.0	46.1	76.8	73.0	
Palustrine emergent wetland	4	0.5	0.2	0.0	0.0	0.0	0.0	34.0	28.5	34.5	28.7	Middle Svensen Island
Palustrine scrub-shrub wetland	3	0.3	1.9	0.0	0.0	0.0	0.0	2.3	1.2	2.6	3.1	Middle Svensen Island
	4	0.4	4.4	0.0	0.0	0.0	0.0	2.5	1.6	2.9	6.0	Middle Svensen Island
Palustrine forested wetland	3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.4	0.7	0.4	Middle Svensen Island
	4	0.0	0.0	0.0	0.0	0.0	0.0	12.7	10.9	12.7	10.9	Middle Svensen Island
Estuarine emergent wetland	2	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	Middle Svensen Island
Estuarine scrub-shrub wetland	3	0.3	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.5	Middle Svensen Island

Habitat type	Habitat category	Terminal Facilities						Pipeline		Total Impacts by Habitat Type & Category		Mitigation Location
		Terminal		Power Line		Parking Lot						
		Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	
Subtotal of Wetland Habitat Impacts		1.5	12.8	0.0	0.0	0.0	0.0	52.2	42.6	53.7	55.5	
Streams	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Svensen Island
	4	0.0	0.0	0.0	0.0	0.0	0.0	5.3	2.6	5.3	2.6	Svensen Island
	6	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.9	1.4	0.9	No Mitigation
Nearshore	2	2.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.3	Svensen Island
Subtotal of Aquatic Habitat Impacts		2.9	0.3	0.0	0.0	0.0	0.0	6.7	3.5	9.6	3.8	
Total Impacts to all Habitats		17.0	18.1	0.2	16.9	3.0	5.0	119.9	92.2	140.1	132.3	

The impact mitigation addressed in this section of the mitigation plan is for the upland habitat impacts. That includes permanent impacts on 6.2 acres and temporary impacts on 0.5 acre of Category 2 forest. It also includes permanent impacts on 19.5 acres of Category 4 forest plus 11.8 acres of early seral Category 4 forest and temporary impacts on 19.1 acres of Category 4 forest plus 3.1 acres of early seral Category 4 forest. It also includes permanent impacts on 2.5 acres and temporary impacts on 12.2 acres of Category 4 scrub-shrub habitat. Therefore, a total of 8.3 acres of Category 2 and 31.3 acres of Category 4 forest with permanent impacts requires compensatory mitigation. In addition, temporal losses on 22.2 acres of Category 4 forest require mitigation. The loss of Category 4 scrub-shrub habitat would be compensated for by the regrowth of shrub habitat on the pipeline right of way. Much more than 14.7 acres of Category 4 scrub-shrub habitat would result.

Mitigation for wetland impacts is addressed in Section 2.0, and mitigation for fish habitat impacts is addressed in Section 4.0 of this mitigation plan.

3.2 Proposed Objectives, Mitigation Goals, and Actions

The objectives of the terrestrial wildlife habitat mitigation are to (1) compensate for wildlife habitat impacts per the ODFW wildlife habitat mitigation policy, and (2) preserve and enhance occupied CWTD habitat.

The mitigation goal for Category 2 habitat is no net loss of either habitat quantity or quality, and to provide a net benefit of habitat quantity or quality. The implementation standard recommends or requires avoidance of impacts or mitigation of impacts, if unavoidable, through reliable in-kind, in-proximity habitat mitigation to achieve no net loss of either predevelopment habitat quantity or quality. In addition, a net benefit of habitat quantity or quality must be provided. Progress toward achieving the mitigation goals and standards will be reported on a schedule agreed to in the mitigation plan performance measures. The fish and wildlife mitigation measures will be implemented and completed either prior to or concurrent with the development action. If this cannot be achieved, the ODFW shall recommend against or shall not authorize the proposed development action.

The Category 4 habitat mitigation goal is no net loss of either existing habitat quantity or quality. The implementation standard recommends or requires avoidance of impacts or mitigation of impacts, if unavoidable, through reliable in-kind or out-of-kind, in-proximity or off-proximity habitat mitigation to achieve no net loss in either predevelopment habitat quantity or quality.

In order to achieve the required goals of no net loss of either quantity or quality, the goal is to provide at least 61.9 acres of replacement forest habitat. To provide a net benefit for the 6.2 acres of Category 2 habitat permanently impacted, the mitigation acreage needs to be larger or the habitat category needs to be higher than that of the affected habitat. Since 53.5 acres of impact would occur in Category 4 forested habitat, replacing it with a higher category (e.g., a habitat category that is currently occupied by one or more federally listed species (i.e., CWTD)) and further enhancing that habitat would achieve that need.

The mitigation goal for occupied CWTD habitat is to increase habitat complexity as well as dispersion of forested and grass-dominated habitats with the intent of increasing forage and

cover opportunities for CWTD and other species. In order to achieve this goal, a variety of trees and shrubs will need to be planted to satisfy CWTD forage needs. Some plantings will need to be relatively unpalatable and, thus, allowed to grow and eventually provide desirable hiding and fawning cover.

3.3 Proposed Mitigation Sites

3.3.1 Peterson Point Terrestrial Habitat Mitigation Site

The primary proposed mitigation site for impacts to wildlife habitat is located near the community of Woodson in Columbia County, Oregon, within the Clatskanie River watershed. This property is referred to in this document as "Peterson Point." The legal location is Township 8 North, Range 5 West, Sections 31 and 32. The site is bounded on the north by the Columbia River, on the east by Woodson Slough, on the west by Westport Slough, on the southwest by Kerry Slough, and on the southeast by Kelli Slough.

3.3.2 Middle Svensen Island

See Section 2.1.4.

3.4 Baseline Conditions

3.4.1 Peterson Point Terrestrial Habitat Mitigation Site

This 995-acre bottomland site has been altered substantially by agricultural practices including diking, draining, and cropping (Figure 3-3). Historically, the site consisted of tidal wetlands, riparian forest, and scrub-shrub wetlands. Most recently, much of the site has been managed as a hybrid poplar plantation. However, the current owner has worked with a nonprofit group (Ducks Unlimited) to enhance wildlife habitat values through a combination of activities including blocking drainage ditches, installing flow control structures, and clearing hybrid poplars. The result is a mosaic of hybrid poplar stands, emergent wetlands and pasture/grassland habitats.

Wildlife activity on the site includes a population of 40 to 100 CWTD, and bald eagle, northern harrier, red-tailed hawk, peregrine falcon, a variety of waterfowl, beaver, nutria, tree frog, and bullfrog. Based on the existing habitat conditions, other species that are likely to occur include elk, coyote, raccoon, river otter, woodpecker, a variety of songbirds, heron, swallow (including purple martin), garter snake, and rough-skinned newt. Approximately 40 to 50 CWTD were observed during a site visit by a URS biologist on October 30, 2006. The CWTD population in the Westport Bottomlands area, which extends from Westport Slough east to the confluence of the Clatskanie River and the Columbia River, and includes the Peterson Point site and Wallace Island, is estimated at approximately 120 individuals (Al Clark, pers. comm. 2006). The Oregon Natural Heritage Information Center (ORNHIC) provided information about CWTD observations in the Westport/Wallace Island area. The ORNHIC recorded CWTD numbering 53 to 66 individuals during surveys conducted from 1985 to 1990 in the area (ORNHIC 2006). There were two active bald eagle nest sites in 2006 within a two-mile radius of the site. The nearest active nest is located approximately one mile north of the mitigation site on a slough bordering Whites Island (Isaacs and Anthony 2007). This nest site was first identified in 2005 and successfully fledged one eaglet in 2006 (Isaacs and Anthony 2007). The other active bald eagle nest is located approximately 1.75 miles north of the site on Whites Island. This site was

first active in 2006, when it successfully fledged two eaglets (Isaacs and Anthony 2007). There are no documented peregrine falcon nest sites within a two-mile radius of the Peterson Point site. No other state or federal listed species are documented to occur at the Peterson Point site.

The proposed mitigation parcels are in strategic locations throughout the site and include 114 acres of hybrid poplars (parcels A, B, C, F, and I in Figure 3-3) on relatively higher ground that is drier than many of the other areas at the site in part because of flow control structures and pump stations that regulate the water levels in the adjacent sloughs and ditches. Approximately 91 acres are currently covered with poplars with an average dbh of 10 to 12 inches. The remaining 23 acres consist of poplar saplings with an average dbh of less than five inches. These even-aged stands of nonnative poplars provide limited habitat complexity as there is little or no understory. As a result, the number of wildlife species attracted to this habitat is severely limited. CWTD use these areas for hiding cover and may also seek thermal cover (in summer) and fawning opportunities among the rows of poplars.

In addition, the mitigation site contains 31 acres along the Columbia River and Westport Slough (parcels D, E, G, and H in Figure 3-3) that are currently providing high-quality riparian habitat. CWTD pass through these riparian areas as they access sources of drinking water. Vegetation in these areas consists of native trees including black cottonwood, red alder, and scattered Sitka spruce and Western hemlock.

3.4.2 Middle Svensen Island

See Section 2.1.5.

3.5 Proposed Mitigation Actions

3.5.1 Peterson Point Terrestrial Habitat Mitigation Site

The following mitigation measures are planned for the Peterson Point site:

- Preserve approximately 74.5 acres of occupied CWTD habitat. Approximately 72 acres of the total are hybrid poplar stands and the remainder is mid-successional riparian forest habitat.
- Enhance approximately 68 acres of hybrid poplar stands with underplantings of native trees and shrubs designed to provide good CWTD forage and cover in the short term and native forest in the longer term (Figure 3-4). This enhancement will also improve habitat for a variety of forest-associated species, including songbirds, woodpeckers, raptors, small and medium-sized mammals, amphibians, and reptiles.
- Enhance approximately 2.5 acres of native riparian trees and shrubs along the Columbia River and Westport Slough. This enhancement area currently provides good CWTD cover and a variety of benefits to CWTD and other wildlife and fish. Enhancements will focus on improving forage opportunities, controlling noxious weeds, and filling any gaps in riparian cover.
- Install artificial nest structures for
  - Purple martins,
  - Ospreys,
  - Wood ducks, and
  - Bats.
- Install brush piles/refugia for small mammals, herptofauna, and ground-nesting birds.

3.5.2 Svensen Island

The following habitat enhancements are planned for the Middle Svensen Island property:

Artificial nest/perching structures for

- Purple martin nest structures,
- Osprey nest platforms, and
- Perching poles for raptors.

3.6 Mitigation Work Plan

This section describes how the mitigation plan for impacts to terrestrial wildlife habitats will be accomplished. The plan focuses on conservation/enhancement of three wildlife habitat zones: dry upland conifer-hardwood forest, moist upland conifer-hardwood forest, and riparian forest. These habitat types would compensate for losses to Category 2 and Category 4 forested and scrub-shrub wildlife habitats at the Terminal and over the Pipeline, as well as enhance existing habitats that currently support CWTD. In addition, wildlife habitat enhancements including artificial nest structures will be installed to provide additional nesting opportunities for some species.

The work plan follows an adaptive management approach. That is, initially 50 percent of the terrestrial mitigation site will be planted with native trees and shrubs. In the future, supplemental plantings may be installed on other portions of the mitigation site if the results of annual monitoring suggest that performance standards are not being met.

3.6.1 Planting Plan

Existing Plant Communities

The plant communities currently present within the proposed Peterson Point Terrestrial Habitat Mitigation Site consist of mixed forested riparian associations identified as Westside Riparian-Wetlands and hybrid poplar stands with shrub species typical of early-successional Westside Lowlands Conifer-Hardwood Forest (Johnson and O'Neil 2001). At the site, the Westside Riparian-Wetlands classification is mostly represented by mature riparian forest habitat along Westport Slough and the Columbia River. However, this community was likely present in some of the wetter portions of the site prior to development of agriculture here. The targeted plant communities within the project area are designed to mimic mid-successional riparian and mixed forest communities typical of the Coast Range ecoregion. Because the existing hybrid poplar stands span a spectrum of drier to wetter sites, the mitigation proposes to address the wetter and drier sites with different plant communities that are best adapted to the specific site conditions within each mitigation parcel. These communities would consist of native species planted at quantities and densities that mimic the natural succession of those community types.

Preparation of Planting Area

Prior to planting the upland forest mitigation parcels, existing hybrid poplar stands will be prepared for planting by selectively removing live poplars that will open up approximately 44 percent of the currently closed canopy forest. Trees would be removed using a herringbone pattern to maximize efficiency and protect trees that will not be removed (Figure 3-5). The purpose of removing nearly half of the poplars is to create space for restoration plantings. Following this step, the hybrid poplar stands will contain open areas interspersed with closed

canopy areas. Openings will be planted as described below. Cut trees will either be hauled off the mitigation site for sale or disposal or turned into wood chips for mulch on the site. In areas where windthrow has flattened the poplar stands, removal of the blowdown would likely clear away more than 44 percent of the stand in preparation for planting.

Proposed Vegetation

The proposed vegetation plan includes planting a total of 23 native tree and shrub species. Potential colonizers are present in adjacent areas bordering the site, including black cottonwood, red alder, Oregon ash, Sitka spruce, and red elderberry. Occasional flooding of the wetter areas of the site can be expected to introduce both native and non-native seeds.

Plant communities are expected to develop rapidly. Many of the species were selected for their capability for rapid growth. In addition, the plan specifies a combination of 23 species in order to obtain a moderate level of diversity. Some species can be expected to fall out over time. For example, rapidly colonizing willows may shade out other species. Overall, however, the planted species most adapted to the site conditions are expected to deter the establishment of non-natives from adjacent areas. The mitigation planting provides 35 acres of dry upland conifer-hardwood forest, 35 acres of moist upland conifer-hardwood forest, and 2.5 acres of riparian forest. An additional 22 acres of dry upland conifer hardwood forest, 24 acres of moist upland conifer-hardwood forest, and 29 acres of riparian forest at the site would be preserved as habitat. The conceptual planting plan overview is shown on Figure 3-5.

Upland conifer-hardwood tree species proposed for the mitigation site include:

- Sitka spruce
- western red cedar
- western hemlock
- grand fir
- red alder
- big-leaf maple
- Oregon ash
- black cottonwood
- red osier dogwood
- cascara.

Figure 3-6 provides an example of the proposed dry conifer-hardwood upland forest planting scheme on mitigation Parcel A.

Upland shrub species include:

- vine maple
- red elderberry
- Pacific ninebark
- Indian plum
- thimbleberry.

Figure 3-7 provides an example of the proposed moist conifer-hardwood upland forest planting scheme on mitigation Parcel F.

Riparian species proposed for the mitigation site include:

- Sitka spruce
- Pacific willow
- Hooker's willow
- Oregon ash
- black cottonwood
- red alder
- red osier dogwood
- Pacific ninebark
- Nootka rose.

Figure 3-8 provides an example of the proposed riparian forest planting scheme on mitigation Parcel H.

Plant Communities

Three major plant community types would be planted at the Peterson Point Terrestrial Mitigation Site. These communities include dry upland conifer-hardwood forest, moist upland conifer-hardwood forest, and riparian forest. Nearly all of the plants chosen for these communities occur naturally within the project area, which is an indication of their ability to establish in this type of environment. Conifers (e.g., western red cedar, western hemlock, and Sitka spruce) were selected for their ability to provide year-round cover as well as for their role in late successional forests. The following native shrubs were also selected to provide good browse and cover: Pacific ninebark, red osier dogwood, and red elderberry. Individual plantings will be distributed irregularly to mimic natural propagation patterns.

Descriptions of the proposed plant communities are discussed below.

Dry Upland Conifer-Hardwood Forest (Parcels A, F, and I)

Approximately 35 acres will be developed in three parcels that are currently planted with hybrid poplars. The existing poplar stands would be selectively thinned as described above and then planted with a combination of native trees and shrubs with the long-term goal of creating forested habitat that is dominated by native conifers and shrubs. Then native conifers and other native woody species will be planted across 12 acres within Parcel A, 15 acres within Parcel F, and eight acres within Parcel I. Table 3-2 provides additional information about species and densities that would be planted in the dry conifer-hardwood forest parcels.

Table 3-2. Dry Upland Conifer-Hardwood Forest Planting Plan

Scientific Name	Common Name	Spacing
Trees		
Picea sitchensis	Sitka spruce	6' on center
Tsuga heterophylla	Western hemlock	15' on center
Thuja plicata	Western red cedar	15' on center
Abies grandis	Grand fir	15' on center

Scientific Name	Common Name	Spacing
Alnus rubra	Red alder	10' on center
Acer macrophyllum	Big-leaf maple	10' on center
Shrubs		
Acer circinatum	Vine maple	6' on center
Sambucus racemosa	Red elderberry	4' on center
Oemleria cerasiformis	Indian plum	6' on center
Mahonia nervosa	Dull Oregon grape	1.5' on center

Moist Upland Conifer-Hardwood Forest (Parcels B and C)

Approximately 33 acres of moist upland conifer-hardwood forest will be developed in parcels that are currently planted with hybrid poplars. The hybrid poplars will be selectively thinned as described above, and then native conifers and other native woody species will be planted across 18 acres within Parcel B and 15 acres within Parcel C. Table 3-3 provides additional information about species and densities that would be planted in the moist conifer-hardwood forest parcels.

Table 3-3. Moist Conifer-Hardwood Forest Planting Plan

Scientific Name	Common Name	Spacing
Trees		
Picea sitchensis	Sitka spruce	6' on center
Thuja plicata	Western red cedar	15' on center
Tsuga heterophylla	Western hemlock	15' on center
Populus trichocarpa	Black cottonwood	10' on center
Alnus rubra	Red alder	10' on center
Fraxinus latifolia	Oregon ash	10' on center
Rhamnus purshiana	Cascara	10' on center
Shrubs		
Cornus stolonifera	Red osier dogwood	4' on center
Physocarpus capitatus	Pacific ninebark	8' on center
Sambucus racemosa	Red elderberry	4' on center
Rubus parviflorus	Thimbleberry	4' on center

Riparian Forest (Parcels D, E, G, and H)

Spot plantings of existing riparian forest along Westport Slough and the Columbia River are proposed to fill gaps in canopy coverage and supplement forage opportunities for CWTD. Table 3-4 provides additional information about species and densities that would be planted in the riparian forest parcels. No thinning is proposed prior to riparian plantings.

Table 3-4. Riparian Forest Planting Plan

Scientific Name	Common Name	Spacing
Trees		
Picea sitchensis	Sitka spruce	6' on center
Salix lasiandra	Pacific willow	8' on center
Salix hookeriana	Hooker's willow	2' on center
Fraxinus latifolia	Oregon ash	10' on center
Populus trichocarpa	Black cottonwood	10' on center
Alnus rubra	Red alder	10' on center

Scientific Name	Common Name	Spacing
Shrubs		
Cornus stolonifera	Red osier dogwood	4' on center
Physocarpus capitatus	Pacific ninebark	8' on center
Rosa nutkana	Nootka rose	4' on center

Plant Material

All native plant material (bareroot and potted plants) will be obtained from a local source to ensure the highest success rate for establishment. If possible, plant material will be obtained from seed rather than clones to preserve/enhance the genetic diversity of the wetland restoration areas.

Restoration Timing

Planting of trees and shrubs will occur either after the onset of the fall rainy season (if container plants are used) or in the winter dormant period toward the end of the season (if bareroot material is used). Either container or bareroot plants can be used, depending upon seasonal availability and conditions. The planting of potted plants would be completed in the early fall to maximize the amount of time plants have to establish before the onset of the dry summer months.

Weed Control

Noxious weed control will be an important component of the mitigation plan because weedy species compete with native vegetation for limited water resources and generally provide lower-quality forage for wildlife. Weed control will be conducted annually in the early summer and fall for several years following planting. This will ensure that weed infestations are identified early and controlled before they cause detrimental impacts to the mitigation areas. In general, weeds will be removed mechanically or manually. In some cases, herbicide may be used in conjunction with mechanical and/or manual methods to control noxious weeds.

Browse Control

There is expected to be a high level of deer browsing on planted vegetation; other mammals (e.g., beaver, nutria, rabbits) may also damage restoration plantings. To reduce plant mortality due to herbivory, browse protection will be installed on all bareroot and potted plantings. Plastic-mesh tube-type tree shelters will be installed with all plantings to deter species from browsing the lower portions of the plantings. In instances where the terminal leader of a conifer is exposed above the tree shelter, a protective bud cap of waterproof paper will be installed in the spring to prevent damage to the leader. Bud-capping may be required until trees reach a height of approximately five feet.

3.6.2 Habitat Enhancement Plan

The habitat enhancement plan focuses on enhancing the existing habitats to provide nesting and cover opportunities for a variety of wildlife species. Following is a summary of each proposed habitat enhancement measure, including general information on configuration, placement, and installation. Additional information is contained in Appendix K.

- Purple martin gourds – Peterson Point and Middle Svensen Island
  - Purchase ready-made imitation nesting gourds.
  - Locate in open areas near water and at least 100 feet from the nearest structure or trees.
  - Mount multiple gourds on a single pole.

- Install one multigourd system along the Columbia River and one along Westport Slough.
- Install pole at a height of 12 to 15 feet above the ground or water level.

- Osprey nest platforms – Peterson Point and Middle Svensen Island
  - Build nest platform.
  - Install one nest platform each along the Columbia River and Westport Slough, but not adjacent to purple martin nest structures.
  - Locate nest platform in an open area near or over water.
  - Configure platform such that it is higher than any nearby trees.
  - Avoid placing platforms adjacent to forested habitats.

- Raptor perch poles – Peterson Point and Middle Svensen Island
  - Build raptor perch pole.
  - Place poles in open areas away from structures and tall trees.
  - Orient perch so that the cross pieces point east and west to provide optimum morning and late afternoon light.
  - Perch poles may be placed near osprey nest platforms, but avoid placing them near nest structures for other species.
  - Place no more than one raptor perch pole per one to two acres.

- Wood duck nest boxes – Peterson Point
  - Purchase or build wood duck nest boxes.
  - Locate nest boxes at least 15 feet above ground level within forested habitat.
  - Box should face water source (if no water in sight, should face south or west).
  - Install each box on a PVC pole with a galvanized steel predator guard.
  - Avoid placing nest box on tree, which increases risk of predation.

- Bat houses – Peterson Point
  - Purchase or build bat houses.
  - Locate bat house in an open area facing south-southeast at least 10 feet above ground level and within 1,500 feet of a permanent water source.
  - Position bat houses approximately 30 to 60 feet from the nearest trees.

- Brush piles/refugia – Peterson Point
  - Brush piles may be constructed out of local materials (e.g., downed wood).
  - Brush piles will be 15'W x 15'L x 8'H in size with a design foundation of six- to 10-inch-diameter logs placed parallel to each other one foot apart (old pallets make excellent foundations for a brush pile). Then branches and logs will be placed perpendicularly on top of the foundation. Lastly, smaller debris will be added on top to form a mound.
  - Locate brush piles in open areas with a minimum distance of 300 feet between piles.
  - Install three to four brush piles per acre in appropriate habitat.

3.7 Performance Standards

Performance standards for the upland forest component shall be focused on achieving a shift from even-aged hybrid poplar trees planted in rows at high densities to conditions trending

toward mixed-age stands with fairly open canopies dominated by native trees and shrubs with clusters of native conifers. Performance standards for the riparian forest component shall focus on supplementing existing riparian forest with desirable deer forage species and filling gaps in the forest canopy. Performance standards for successful restoration shall be based on the percentage dominant cover rather than individual plant success. Table 3-5 summarizes the performance standard for each habitat type.

Table 3-5. Performance Standards

Zone	Year 0	Year 1	Year 5
Dry Upland Conifer-Hardwood Forest	All plantings installed	80% survival of native woody species	75% survival of native woody species (including replanting)
	<20% noxious weed cover	<20% noxious weed cover	<20% noxious weed cover
	All habitat structures placed on site	All habitat structures functional	All habitat structures functional
Moist Upland Conifer-Hardwood Forest	All plantings installed	80% survival of native woody species	75% survival of native woody species (including replanting)
	<20% noxious weed cover	<20% noxious weed cover	<20% noxious weed cover
	All habitat structures placed on site	All habitat structures functional	All habitat structures functional
Riparian Forest	All plantings installed	80% survival native woody species	75% survival native woody species
	<20% noxious weed cover	<20% noxious weed cover	<20% noxious weed cover
	All habitat structures placed on site	All habitat structures functional	All habitat structures functional

3.8 Monitoring Plan

Monitoring would be conducted during July or August in years 0, 3, and 5. Specifically, monitoring of the wildlife habitat mitigation sites would include:

- Establishment of transects through each of the mitigation parcels to ensure that each habitat type is adequately represented.
- Establishment of vegetation sampling plots and photo stations along each transect. Thirty-foot-diameter sampling plots would be associated with each photo station. Stations would be identified with steel (rebar) stakes and surveyor's flagging.

- Collection of vegetation data at each sampling plot, including (1) list of dominant species present in each stratum, (2) percentage of surviving native woody species, (3) evidence of herbivory, (4) percentage of noxious weed species (e.g., reed canarygrass, Himalayan blackberry, Scot's broom) present, and (5) recommendations for remedial actions, if necessary.
- Collection of other ecological data, including (1) use and condition of artificial nest boxes/gourds, and (2) wildlife species presence and activity.
- Submittal of annual monitoring reports containing a detailed summary of conditions of each of the mitigation areas would be provided to ODFW and USFWS. In addition to the results of the monitoring, recommendations would be made for maintenance of non-native weedy species and/or corrective actions necessary to meet the performance standards.

3.9 Site Protection, Maintenance, Adaptive Management, and Security Instruments

3.9.1 Site Protection

Protection of the site would be accomplished through deed restrictions (conservation easement), memoranda of understanding, and long-term maintenance by a qualified conservation organization. These properties would be protected in perpetuity from development. A fund would be provided for costs associated with protection. Funding would also be provided by Bradwood for maintenance activities. As discussed above, these would mostly take the form of actions required by adaptive management to ensure that the mitigation sites are moving toward the goals and objectives established here.

3.9.2 Maintenance

Maintenance is divided into four activities: (1) irrigation, (2) browse protection, (3) habitat structures, and (4) weed control.

1. *Irrigation.* During the dry summer months, irrigation may be necessary. Newly established plants typically require one inch of water twice per week for the first year and one inch of water once per week for the second year. Deeper, less-frequent watering promotes establishment of deeper roots during the first year. During the second year, plants are gradually weaned from the irrigation by irrigating less.

2. *Browse protection.* Inspect tube-type tree shelters to ensure that they are anchored correctly. Check/replace bud caps annually.

3. *Habitat structures.* Clean artificial nest boxes/gourds annually to prevent parasite infestations. Boxes/gourds should be maintained outside of the nesting season. Check to see that supporting posts/poles are stable.

4. *Weed control*. Mechanically or manually remove infestations of noxious weeds (e.g., Himalayan blackberry, Scot's broom, reed canarygrass) identified during annual mitigation monitoring. Herbicide application may be used in some areas after consultation with a professional ecologist.

3.9.3 Adaptive Management

To ensure that the mitigation meets the objective and goals outlined in this mitigation plan, many measures will be in place to identify whether success is being achieved and to modify mitigation measures to ensure success of the mitigation. Adaptive management is closely related to the monitoring plan and linked directly to the performance standards. Long-term monitoring will identify the progression of the mitigation toward the performance criteria, and will identify any areas not trending in the desired direction. For any areas not progressing toward the desired conditions, measures outlined in Section 3.11 (Contingency Plan) will be implemented.

If mitigation actions fail, the contingency plan will involve a re-evaluation of the site to identify possible reasons for failure. Native vegetation will be replanted, if necessary, to replace nonsurvivors. Invasive species will be removed if they are determined to be the cause of failure. The monitoring period will be extended accordingly. Additional plant protection measures such as exclusion fencing may be implemented to improve success of the plantings.

3.9.4 Security Instruments

- Site protection for the Peterson Point site will be provided by a conservation easement on the title. Under this conservation easement, allowable land uses of the site will be restricted to preservation and further enhancement.
- Long-term management of the site and responsibility for meeting performance standards will be turned over to a third-party group to be identified and agreed upon prior to the start of the mitigation plan implementation.
- Maintenance requirements and responsibilities will be specified in a formal contractual agreement.

3.10 Financial Assurances

Bradwood Landing will provide an endowment to a third-party conservation organization for long-term maintenance of the Peterson Point mitigation area. A performance bond or letter of credit will also be executed to assure completion in case of default by key responsible parties.

3.11 Contingency Plan

If during the monitoring period, the data collection reveals aerial coverage lower than what was minimally required for that year, appropriate actions must be taken in order to meet the coverage criteria for the following year. If applicable, the monitoring report would indicate the following:

- Areas that have failed to meet minimal coverage criteria.
- Particular species that show a higher mortality, as well as those that are thriving.
- Any factor that may have contributed to plant mortality, such as erosion, inundation, dry down, overexposure to sun, wildlife browse, vandalism, change in site conditions, or other factors.
- Recommendation of species selection during replanting activities.
- Additional browse protection measures such as deer fencing.

Failure to meet the performance standards of success that are based on survival of native woody species will result in weed control, supplemental plantings, additional plant protection methods, or a combination of these efforts designed to meet the mitigation goals. Failure to meet

standards of success for noxious weed cover will result in weed control efforts that best suit the circumstance.

3.12 How the Mitigation Achieves ODFW Mitigation Requirements

The mitigation measures described above meet or exceed those specified by ODFW for Category 2 habitats. Mitigation for unavoidable impacts to Category 2 upland forested habitats would be achieved by creating similar native forest habitats on the Peterson Point site in areas that are currently vegetated with hybrid poplars or non-native pasture grasses. As required by ODFW implementation standards, mitigation would consist of in-kind replacement of lost habitat types in proximity to the impacted area. A net benefit of habitat quantity would be achieved by preserving 74.5 acres of currently occupied CWTD habitat and creating 70.5 acres of native forest habitat (as detailed in Section 3.5, above). Mitigation for impacts to wetland and stream habitats would occur on the Middle and Lower Svensen Island properties as discussed in Sections 2 and 4 of this document.

The mitigation measures described above meet or exceed those specified by ODFW for Category 4 habitats. Mitigation for unavoidable impacts to Category 4 upland habitats would be achieved by a combination of in-kind and out-of-kind replacement of lost habitat types in proximity to the impact area (as detailed in Section 3.5) to achieve no net loss of either predevelopment habitat quantity or quality. Mitigation for impacts to Category 4 wetland and stream habitats would occur on the Middle and Lower Svensen Island properties as discussed in Sections 2 and 4 of this document.

3.13 How the Mitigation Compensates for Impacts to CWTD Habitat or Habitat Use

The Columbia River Distinct Population Segment ("DPS") of the CWTD is listed as endangered under the ESA. The USFWS has identified essential habitat for this ungulate within the entire Julia Butler Hansen National Wildlife Refuge ("JBHNWR") as well as a portion of the Oregon mainland between the communities of Westport, Woodson, and Clatskanie (USFWS 1983). There is no legal definition of essential habitat. This document provides recommendations on measures to avoid, minimize, and mitigate potential impacts to CWTD and their habitat associated with construction, operation, and maintenance of the pipeline.

The CWTD are present in low-lying mainland areas and islands in the Columbia River upper estuary and along the river corridor. This DPS is most closely associated with riparian forest and scrub-shrub wetlands (Verts and Carraway, 1998), but may inhabit a wide variety of habitats, including commercial poplar plantations and pastures (Al Clark, pers. comm. 2006). This species is nonmigratory. The peak of breeding activity is generally around mid-November, and peak of fawning occurs about mid-June (USFWS 1983). The CWTD diet consists of browse, forbs, and grasses. Forbs are most popular during spring, summer, and early fall, while browse is most common in summer, fall, and winter; grasses are eaten at any time of year when other forage is unavailable (USFWS 1983). Healthy population densities recorded between 1974 and 1980 ranged from 20 to 27 deer/km^2 (Verts and Carraway 1998). Densities as high as 62 deer/km^2 were recorded between 1984 and 1990, when overpopulation occurred on the JBHNWR's mainland (USFWS, 1998).

The proposed pipeline would cross essential habitat used by the Westport/Wallace Island subpopulation. Additional extant populations of CWTD near the proposed pipeline are monitored by the USFWS. Estimated deer numbers at each of these locations from 2005 data are provided in Table 3-6.

Table 3-6. Current Population Estimates of Columbian White-Tailed Deer Along the Lower Columbia River

Location	Population[1]
Julia Butler Hansen National Wildlife Refuge	
Washington Mainland	100
Tenasilahee Island	100
Wallace Island	25
Other Sites	
Crims Island	25
Puget Island	125
Westport Bottomlands	120
Clatskanie Flats	25
Fisher Island and Willow Grove	25
Lord Island and Diblee Flats	20

[1] Survey conducted fall 2005 (Al Clark, pers. comm., Oct. 31, 2006).

Lands classified by USFWS as "*[e]ssential for the survival and recovery of the Columbian white-tailed deer*" (USFWS 1983) that would potentially be affected by the Project occur between the communities of Westport and Clatskanie. The term "essential habitat" has no legal definition; however, it is often used to identify areas of important habitat prior to legal designation of critical habitat. No critical habitat has been established for the CWTD. The legal locations of lands identified as essential habitat are:

- Clatsop County, OR, Township 8 North, Range 6 West, Section 36.
- Clatsop County, OR, Township 8 North, Range 5 West, Section 31.
- Columbia County, OR, Township 8 North, Range 4 West, Sections 30, 31.

To achieve the objective of securing the CWTD, protecting its habitat, and ultimately delisting the Columbia River DPS of the CWTD, the USFWS has identified the following recovery measures:

- Annually assess viability of each extant subpopulation of CWTD.
- Ensure viability of extant populations.
- Establish necessary new populations of CWTD on existing habitat.
- Encourage public support for CWTD restoration program.

Washington Department of Fish and Wildlife management recommendations (WDFW 2004) for this species include the following:

- Avoid further degradation of riparian habitats in areas where CWTD occur or may occur.
- Plant native trees and shrubs to reestablish cover and browse in extensive clearings.

- Manage habitat so that cover is available within 820 feet of foraging areas.
- Manage coyote population to increase fawn survival rates.

Following is a summary of the potential avoidance and minimization measures and compensatory mitigation that Bradwood proposes to use for the project.

Avoidance and minimization measures:

- *Avoid disturbance during fawning period*. Schedule ground disturbing activities in suitable CWTD habitat, such as construction and maintenance, outside of the CWTD fawning season when possible. The fawning season normally occurs from late May through early to mid-July. Maintenance vegetation control would be conducted between mid-July and October.

Compensatory mitigation measures:

- *Enhance and protect potentially suitable habitat*. Bradwood has coordinated with the resource agencies to identify areas of potentially suitable habitat for CWTD as near the Project as feasible. Habitat enhancement of these areas would primarily include planting of appropriate native riparian trees and shrubs in riparian habitat that either has no forest because of past land use practices or is occupied by hybrid poplars and has limited habitat value. In addition, removal/control of noxious weeds may be beneficial for development of high-quality habitat for CWTD. Potential mitigation sites were discussed with USFWS during a July 11, 2006 meeting at the JBHNWR. These sites are all located within the Clatskanie Delta in areas where CWTD currently occur.

These actions would help further the specific goals of the recovery plan for the CWTD in the following ways:

- *Protecting suitable habitat for CWTD on the Peterson Point site*. Patches of habitat were identified that provide near optimal interspersion of cover habitat and foraging habitat.
- Enhancing marginally suitable habitat on the Peterson Point site by replacing non-native vegetation with native species suited to the site, including additional browse species.

4.0 FISH HABITAT MITIGATION

4.1 Introduction

The Project proposes a comprehensive mitigation package that addresses priority limiting factors for ESUs that range through the Columbia River System. The mitigation measures would restore habitat in the Columbia River estuary at locations that would benefit the species at critical points in their life cycle.

4.1.1 Estuary Rearing Benefits to Salmon

The Columbia River estuary is used as a migration corridor by all juvenile anadromous salmonids as they move from fresh to salt water. In addition, subyearling juvenile Chinook, coho, and chum salmon utilize suitable Columbia River estuary habitat for rearing during the period they are making physiological adaptations to a marine environment. In addition, sub-adult and adult coastal cutthroat and bull trout utilize the Columbia River estuary as foraging habitat. Historically, the estuary consisted of swamps and marshes that formed a continuous matrix of habitats (Lott 2004). These habitats supported an abundant prey base for juvenile salmon (Healy 1980, 1982, Levings et al. 1995). Habitat complexity in the Columbia River estuary has changed considerably, largely due to diking and filling of emergent and forested wetlands, and flow regulation. Loss of these habitats has reduced available rearing habitat for salmon with subyearling life histories, and may be in part responsible for changes in salmonid life history (Bottom et al. 2005).

The lower Columbia River estuary has been identified as a critical area for restoration (Johnson et al. 2003; Bottom et al. 2005). Restoring diverse, complex, and interconnected wetland habitat would increase productivity and availability of shallow-water habitat, and expand transition areas for juvenile salmon (Lott 2004).

Additionally, it is believed that improvements to estuarine habitat would result in significant population increases (Kareiva et al. 2001; Bottom et al. 2005).

Restoration priorities and practices for the lower Columbia River estuary have been identified by NOAA, and include the need to “enhance, restore, and create tidal wetlands and other key habitats to aid rebuilding of ESA-listed salmon populations and native species” (Johnson et al. 2003). Guidelines indicate that projects should (1) be founded on the best available ecological restoration science, implemented in an ecosystem context, and developed with the intent to restore relevant ecological processes, and (2) incorporate adaptive management practices with testable hypotheses to track ecological responses to a given restoration effort. The Project has designed a mitigation plan that incorporates these guidelines and principles to achieve a significant net benefit to salmonids.

4.1.2 Watershed Context and Need

The Columbia River watershed is one of the largest in the world, covering approximately 225,000 square miles in seven U.S. states and two Canadian provinces. Thirteen species of salmonids are federally listed as threatened or endangered within this watershed. Juvenile salmon occur in the estuary all year, as different species, size classes, and life history types

continually move downstream and enter tidal waters from upstream (Bottom et al. 2005). Reconnection of isolated high-quality fish habitats is a high priority to restoration strategies for the watershed and for fisheries restoration projects generally (Roni et al. 2002). Restoring the tidal estuarine habitat of the lower Columbia River is a priority in many conservation plans for the area including the subbasin plan (2004), and recovery plans for the salmon species (ESUs) of the lower Columbia River (NMFS 2006).

4.1.3 Relationship to Other Plans

NMFS Regional Recovery Plan

The restoration of tidal channel, estuarine marsh, and other tidal habitats is a high priority to the federal recovery plan for the lower Columbia River listed ESUs. The recovery plan designates primary populations which are of "high significance" to the viability of the ESU. These populations are targeted to reach a high to very high viability level. Contributing populations (populations where some restoration would be needed to assure population persistence) are also designated. Stabilizing populations are also designated, those that "would be maintained at current levels" with likely low viability.

There are 23 historical steelhead populations in the Lower Columbia River Steelhead DPS. Another four or five populations are identified as part of the Upper Willamette River Steelhead DPS. Steelhead utilize the entire Lower Columbia River as migration habitat and tributary streams as spawning and rearing habitat. Steelhead populations in tributaries of the Columbia River downstream from the Cowlitz River in Washington and Willamette River in Oregon are not considered part of the Lower Columbia River Steelhead DPS or a listed steelhead DPS. Listed steelhead populations present in the project action area are limited to the Cowlitz River watershed. NMFS identifies "major factors limiting recovery" of all steelhead in the lower Columbia River and Willamette River DPSs as including "lost/degraded floodplain connectivity and lowland stream habitat." (NMFS 2005).

NMFS states that a critical threat to the listed salmon and steelhead is the lack of "floodplain function and the availability of floodplain habitats." This also affects steelhead in the Cowlitz River watershed. Restoration of these habitats, "including tidal swamp and marsh habitat in the tidal freshwater portion of the Lower Columbia" is necessary for recovery of listed ESUs, particularly those that produce subyearling smolts, such as the Lower Columbia River Chinook and Coho ESUs and the Columbia River Chum ESU.

Subbasin Plan

The subbasin plan for the lower Columbia River estuary and surrounding watersheds is an exhaustive review of the baseline situation, the limiting factors, and possible strategies for recovery for all listed salmonids along with a number of other species of concern.

The plan emphasizes the importance of estuaries on salmonid survival, both as smolts and as oceangoing adults. "Estuaries provide juvenile salmonids an opportunity to achieve the critical growth necessary to survive in the ocean," they state, citing studies by Wissmar and Simenstead (1988). Studies conducted by Emmett and Schiewe (1997) show that favorable estuarine conditions translate into higher salmonid survival. This paradigm was summarized by Kareiva et

al. in 2001: that improvement of salmonid survival and growth during the estuarine and early ocean stage greatly increases the chance of successful return and spawning.

Subyearling salmonids moving through the estuary require a spectrum of salinities, depths, and water velocities to find locations where they can feed and adjust physiologically to the requirements of life in saltwater. The best habitat places high-energy areas with ample food and refuge habitat in close proximity to each other. Complexes of tidal marsh, tidal creeks, and channels, and associated dendritic channel networks provide refuge from predators as well as high insect prey density. Overhanging banks and vegetation, along with sinuous banks, provide the perfect habitat for salmonid rearing in the estuary. The connectedness of the habitat is vitally important to its quality for salmonids (Roegner et al. 2004).

Studies have shown that the estuary is just as important to species that move through it rapidly as those that spend weeks or months in the estuarine area. Radio-tagged coho in the Frasier River as well as salmonids in the Columbia River estuary have been shown to utilize peripheral marsh and forested wetland habitat during their rapid movement through the estuarine area (Fresh et al. 2004).

The primary limiting factor in the current state of the Columbia River estuary is the amount of "high-energy areas with ample food availability and sufficient refuge habitat." Loss of connections between the various habitat types limits the ability of juvenile salmonids to effectively move between the habitats and to grow and adapt to saltwater conditions. Anthropogenic factors have greatly changed the Columbia estuarine situation, with hydrosystem construction and operation limiting flows; channel confinement, especially in the form of diking, cutting connections between mainstem and floodplain; and floodplain development and water withdrawal limiting habitat availability.

Studies of changes in estuarine cover since the arrival of European-Americans in the Columbia River estuary have focused on channel confinement through diking. This practice has been widespread, with virtually all floodplains being diked and isolated from the flow of the river during the past 100 years. Reports note that "dikes prevent overbank flow and affect the connectivity of the river and the floodplain." It is estimated that the historical estuary had at least 75% more tidal swamps/marshes than the current estuary simply because tidal and flood waters could reach many floodplain areas that are now diked or otherwise disconnected from the main channel (USACE 2001). Restoring access to "suitable low-tide refuge near marsh habitat is an important factor in production and survival of salmonid juveniles in the Columbia River Estuary" concludes the subbasin plan (Lower Columbia Fish Recovery Board 2004), pointing to dike removal, reconnection of tidal channels, and functioning tidegates as possible solutions.

4.2 Summary of Impacts to Be Mitigated

Direct habitat loss:

- Log pond and other tidal wetlands at the Terminal site, totaling 12.65 acres.
- River area occupied by pilings, totaling about 0.37 acre.
- Riparian habitat at the Terminal, totaling about 40 acres (permanent Terminal impact area).

These areas are also designated as part of the Critical Habitat for Snake River sockeye, spring-summer Chinook, and fall Chinook.

Temporary disturbance of habitat:

- Turning basin dredging would affect about 45 acres of bottom habitat in 20- to 40-feet-deep water.
- Hunt Creek bridge replacement would affect a few hundred square feet total.
- Return water from upland dredge disposal would add some turbidity locally; however, after all control measures are applied, the amount should be minor and far below lethal levels.
- In-water dredge disposal return water would add some turbidity locally; however, after all control measures are applied, the amount should be minor and far below lethal levels.
- Maintenance dredging and disposal would have similar impacts as the original dredging, but to a lower degree and for less time, because much less material would be moved from generally deeper water and the impacts would last much less time.
- Potential fracture-out of HDD drill mud could put clay particles in the water. The effects of that sediment would vary with the volume of mud versus the volume of water and with the fish in the location. It could range from inconsequentially small to a moderate impact.

4.3 Proposed Mitigation Sites, Locations, Opportunities

4.3.1 Lower Svensen Island

The Svensen Island site is located about 14 river miles downstream from the Terminal location (Figure 1-1). The Project has an exclusive option to purchase the majority of the island. The island has been protected and separated from the river by a surrounding dike for over 130 years (an 1868 map shows the dike). The area inside the dike has been in agriculture since the dikes were placed. Two cross-dikes divide the island into three distinct parts. The westernmost section of the island (the downstream end, which includes more than half of the island acreage) was flooded when the dike breached at the northwestern tip of the island in December 2003. Since then, twice daily high tides flood about 170 acres inside the dike, and tidal marsh has reestablished itself. A high percentage of the flooded area is now occupied by a diverse array of marsh species, mostly native, and is a fish and wildlife haven. Since the location is upriver of the area of saltwater intrusion into the river, the marsh is a freshwater marsh. A remnant channel through the middle of the flooded segment has Columbia willow trees and shrubs (see Appendix L for lower Svensen site photographs).

There is substantial opportunity for additional restoration of the site to benefit juvenile salmon in the form of removing remnant culverts and other farming features that might present hazards to fish, further restoring fish accessibility by removing tidegate lids, and further development of fish habitat by restoring LWD features to redeveloping tidal channels.

The site has been secured by an exclusive option to purchase.

4.3.2 Middle Svensen Island

The Middle Svensen Island mitigation site is located in Clatsop County, within Section 14, Township 8 North and Range 8 West. The latitude and longitude coordinates are 46.1786°N, 123.6461°W (NAD83/WGS84). The site is accessed from U.S. Highway 30 by Svensen Island

Road, about four miles west of Knappa, Oregon. The mitigation site location is shown on Figure 1-1. The existing conditions of the mitigation site are shown on Figure 2-2.

The Middle Svensen Island site meets all the criteria to be suitable for replacing estuarine habitat in Oregon. The site is located 14 river miles west of the Terminal impact site within the portion of the Columbia River designated as estuarine by the DSL. Salinity and tidal influence are similar at both the impact and mitigation sites, and both are within the lower Columbia River watershed. The restored site would be accessible to all of the ESA-listed salmon affected by construction of the Terminal.

The Middle Svensen Island site is adjacent to the proposed enhancement/preservation site at Lower Svensen Island. In fact, it is expected that the two sites will be joined hydrologically by either placement of a culvert through the dike or perhaps by dike breaching, resulting in a substantial increase in fish-accessible tidal wetland habitat.

The existing wetland and habitat conditions on Middle Svensen Island are described in Section 2.1.5 of this mitigation plan. They are not repeated here because the site currently provides no fish habitat.

Mitigation Work Plan Elements

The overall objective is to convert the site back to tidal wetland habitat accessible to fish, especially juvenile salmonids. This would be accomplished by opening tidegates and removing a portion of the dike to allow the Columbia River to flood the site at high tide. In addition, the site will be enhanced through the planting of a high marsh shrub area and riparian shrubs and trees around the tidal inundation area to provide habitat diversity. Areas inundated during low tides will be created to provide a full range of habitat to offset losses from the filling of the log pond and other tidal wetlands at the Terminal impact site.

There are four components of the fisheries habitat mitigation, described below. The area of existing wetland that will be restored to tidal influence and the area of existing upland that will be restored to tidal wetland can be seen on Figures 2-5a and 2-5b. Cross-sections are depicted in Figures 2-6a and 2-6b. The area of low-tide open-water habitat creation, large wood features, areas where shrubs and trees will be planted, wildlife habitat features, as well as the area expected to develop tidal marsh habitat can also be seen on Figures 2-5a and 2-5b.

Low-Tide Open-Water Habitat Creation

This plan proposes to excavate permanent, low-tide open-water habitat that will be directly connected to the Columbia River. These habitat features would provide habitat functions similar to those lost by filling in Wetland 1 (historic log pond) at the impact site, but over a wider range of tides. The new dike breach and at least two of the culverts that will have the tidegates removed will be connected to the low-tide habitat. That will allow the habitat features to function as fish habitat during low tides as low as 0 feet (for the culvert locations) and perhaps lower, depending on the natural scouring at the dike breach.

By providing this habitat at the tide levels projected, the low-tide habitat lost at the Terminal will be more than compensated for, because the slopes required on the low-tide habitat edges will

make a larger area be below the elevation of the lowest accessible tide at the log pond at the Terminal.

Large Wood Features in Low-Tide Open-Water Habitat
Large wood pieces will be placed strategically and anchored in tidal channels to provide specific value to juvenile salmon. Six such features are proposed, as shown on Figure 2-5a and 2-5b. These features will compensate for features lost at the log pond on the Terminal site. Their location at ideal tide elevations should make them more valuable than those being lost.

Restore Tidal Influence to Existing Wetlands
Existing Wetland A will be restored from degraded, nontidal hay pasture to tidal wetland. Restoration will be achieved through removal of three tidegates, breaching of the north dike to the Columbia River, installation of a culvert connecting Middle Svensen Island to Lower Svensen Island, and excavation of a tidal channel network to achieve a tidal plane elevation that supports a tidal marsh plant community. Drainage ditches will be filled to become part of the surrounding contiguous tidal marsh or will be modified to become part of the tidal channel network.

Upon restoration, the site will become one large tidal marsh wetland area with shrub and tree plantings on patches of higher ground where the dike is wider or has had dredge spoils placed on it. Therefore, it will include both low marsh and high marsh.

The total acreage of wetland that will be restored to tidal marsh (both high and low marsh) is about 62 acres. In order to compensate for permanent filling of less than 14 acres of wetland at the Terminal, a 3:1 ratio for conversion of palustrine to tidal wetland would require that about 42 acres be counted for wetland mitigation. The remaining area would be available to count for other fish and habitat impacts and to account for impacts at the mitigation site that will be necessary to protect the residences on the island and accomplish the restoration of tidal habitat. All 62 acres of tidal marsh will be accessible to juvenile salmon during high tides.

Tidal Wetland Restoration
Part of the site is not currently wetland (based on a January 2007 delineation) but was historically wetland prior to the construction of dikes around the site. The upland area is made up of spoil piles from historical ditch excavation and maintenance that are generally above 7 feet elevation and the inner slopes of the dikes. The upland areas total about three acres on Middle Svensen Island. This entire area will be restored to tidal marsh via the actions described above (breaching of the dike, etc.).

The total acreage of upland that will be restored to tidal marsh (primarily high marsh) is three acres, all of which will be accessible to juvenile salmon on the highest tides.

4.3.3 Hunt Creek/Clifton Channel

The tidal wetland at the confluence of Hunt Creek with the Columbia River at Clifton Channel adjacent to the Terminal is a site proposed for preservation of important habitat. Hunt Creek is important spawning and rearing habitat for the Lower Columbia River coho salmon ESU, and the confluence area with Clifton Channel is valuable rearing habitat for the same ESU. The goal

would be to assure protection of the tidal wetlands and stream habitat associated with Hunt Creek outside the Terminal, the access road, and the railroad that would be in the ownership of the Project by placing a conservation easement on the title. In addition, a maintenance/stewardship agreement with a qualified conservation organization would be established and funded by the Project. Part of that maintenance would include controlling purple loosestrife and possibly other noxious weeds as necessary to preserve the wetland functions.

4.4 Baseline Conditions

4.4.1 Lower Svensen Island

The Lower Svensen Island mitigation site was surveyed by a URS Fisheries biologist on October 24, 2006. The site was evaluated at both low and high tide. Photographs were taken to document site characteristics at both tides. The site consists of woody scrub-shrub, tidal island, mud flat, emergent vegetation, and open-water habitat. It is surrounded by a dike on all sides and bisected by a large west-to-east remnant channel, visible on aerial photographs (Figure 2-4). The Columbia River mainstem borders the site to the north and flows from east to west. The eastern boundary of the mitigation site is marked by a north-south dike that separates the mitigation site from the remainder of the island (mostly pastureland). The southern boundary of the site contains two old houses, a bridge to the mainland, and remnant farm buildings. The western boundary is marked by the dike. A breach in the dike exists in the northwest corner where a tidegate once existed. The breach has resulted in a waterway that now connects the site to the Columbia River, causing the site to be inundated with water at high tide.

The dikes can be seen in maps dated in the late 1860s. The site has been used since that time as farmland for both crops and raising cattle. Since the dike breached in December 2003, the site has changed to tidal marshland providing habitat to wildlife, vegetation, and Columbia River salmonids.

Tide Gates
There are no tidegates on the northern, western, or eastern dikes. Historically, one tidal gate existed in the northwest corner of the site; however, it was destroyed as the dike breach expanded after December 24, 2003. The breach was not repaired and subsequent scour and erosion has resulted in a channel that now connects the site to the Columbia River. The existence of this channel now permits inundation of the site at high tide. There are three remaining tidegates on the southern dike within the Lower Svensen property boundary (out of seven remaining tidegates on the island). Two of the tidegates on the property are located at “the mouth” of the east-west channel that bisects the property. One of these culverts lost its tidegate soon after the dike breach and functions as an open culvert.

Culverts
There are seven culverts within the property that were used to direct water beneath farm roads, cattle crossings, and cattle feeding stations, and to aid in access to various parts of the site.

Other Structures
There are two abandoned single-family residences present on the southern portion of the site with connecting dirt roads and associated farm buildings. All of these structures are subject to

flooding at high tide. The dirt roads are no longer usable during low tides, as the site has become saturated. Various items such as feeding stations and oil/gas barrels are scattered throughout the site.

Waterways and Channels

In addition to the main channel bisecting the site, many smaller remnant channels exist, mostly based on drainage ditches. New channels stemming from the main channel also appear to be forming. At low tide, the eastern portion of the site is saturated, but only certain areas contain standing water. A culvert in the northeastern part of the site prevents water from draining properly, and may cause fish stranding at low tide. Removal of the culvert would alleviate this problem. At low tide, open water is present in the main channel from the breach to about the middle of the site. The smaller dendritic channels do not contain enough water at low tide to sustain fish; however, they do provide habitat and access to additional food resources and habitat during higher tides. Two areas remain that contain permanent water. The first is known as "the lake" by the longtime landowners, and is presumably the old channel. The second is located in the southeast part of the site. There is little to no LWD on the site, nor tall trees (conifers). The site did not have timber stands at least back to the early 1900s, according to residents whose families have lived there since that time.

Fish Access and Habitat

Tidal marshes are the most productive fish habitats in an estuary. Marsh vegetation may produce an average annual standing crop of five tons per hectare. The resulting plant detritus sustains a rich invertebrate fauna. Some of the small crustaceans and aquatic insects are an important food source for juvenile salmon. Most of the larger tidal marshes include dendritic channels that provide excellent fish habitat. Large numbers of juvenile Chinook and chum salmon are present within tidal channels of the marsh areas, and other species, such as starry flounder, likely use these areas as well. Chinook fry may take up month-long residence periods in certain marsh areas. During that time, those juvenile fish would almost double in size and quadruple their weight as they feed on the abundant invertebrate life found in the tidal marshes. The protected and turbid water of the marsh also offers a certain amount of protection against predators. At present, fish have access to the site through the channel at the northwestern breach location and at the culvert that lost its tidegate. The site serves as a protected area for salmon rearing and may serve as a refuge from storm flows.

Other Wildlife

Wildlife seen during the site visit included numerous shorebirds and waterfowl, in addition to raptors. People who have been working on-site over the last two years report seeing hundreds of red-legged frogs and thousands of Pacific chorus frogs during the spring and early summer. This may indicate that common predators, such as bass and bullfrogs, are not prevalent on the site.

4.4.2 Middle Svensen Island

The Middle Svensen Island site currently provides no habitat for fish, due to its isolation from the river and the lower part of the island by dikes and tidegates. It has seasonally saturated wetlands that have no surface water interconnection with the Columbia River except through tidegates on drainage ditches that preclude fish passage (Figure 2-3).

4.5 Proposed Mitigation Actions

4.5.1 Lower Svensen Island

The activities proposed to gain additional ecological value for fish include:

- Adding LWD at tidal channels as fish habitat features.
- Further restoring fish accessibility by removing two remaining tidegates from existing culverts.
- Further restoring fish habitat value by removing several (up to seven) remaining culverts on former farm roads that block fish escape with receding tides.
- Further restoring marsh and riparian habitat by removing remaining buildings and facilities so that plants can grow (possibly adding soil).
- Removing remaining fuel tanks that might pose a risk to aquatic organisms.

Creating Fish Access to the Floodplain System

One of the most significant improvements that could be made to the Svensen Island system for salmonids is to provide better access to the low-velocity rearing habitat in the tidal areas on the lower portion of the island. The mudflats and vegetated islands in between Svensen Island and the mainland are excellent habitat, especially for juvenile salmonids. Providing connectivity between these habitats and tidal areas on the island would greatly improve habitat for salmonids. Habitat improvements would also benefit prey species of salmonids, and other species protected under essential fish habitat regulations.

Two tidegates would have lids removed to allow inflow and fish passage at more locations. One existing culvert already is missing its tidegate. Thus all the existing culverts would permit free inflow and outflow and fish passage during both incoming and outgoing tides. These measures would improve access to tidal habitats and help prevent stranding during outgoing tides. The resulting flows would increase the development and function of tidal channels important to rearing salmon.

In addition to opening tidegates, existing failed culverts would be removed from the site. The culverts are located in areas where flow-through channels once existed. Removing blocked culverts would improve connectivity within the floodplain and would prevent juvenile salmon from being trapped during low tides and becoming easy prey to birds.

The removal of remaining buildings and facilities on the site will allow marsh vegetation to grow in areas now occupied by them. If determined to be advantageous and if excess soil material is available from Middle Svensen Island, some areas may be covered with soil to facilitate plant growth. Among the facilities to be removed will be fuel tanks that may contain residual fuel and pose a risk to aquatic organisms.

Vegetation Maintenance

The quality of the habitat at Svensen Island is largely dependent on the plant community growing on and near the floodplain. Dikes have been heavily colonized by invasive weed species, particularly purple loosestrife and reed canarygrass. Control of these species is part of the wetland maintenance plan and commitment for the site. Maintenance of

native-plant-dominated communities would allow the structure and function of salmonid habitat throughout the site to continue developing.

Large Woody Debris Placement
Historically, there was an abundance of logs in the lower Columbia River and presumably on the island. There is a need for LWD throughout the Svensen Island system to improve habitat structure and provide refugia for salmonids. Without large trees on-site, inputs of LWD would not occur naturally, and logs would have to be brought from elsewhere. LWD would be placed along the developing tidal channels to provide favorable to fish foraging sites and more complex microhabitats. Various locations are planned; however, installation is likely to be field-fitted based on conditions at the time of construction, given that the site continues to evolve, with the potential for placement of additional wood as adaptive management, if monitoring of fish use indicates the need.

Channel Creation
The breaching of the dike at Svensen Island has led to daily inundation of the floodplain on the lower section of the island. Scour of the loose sediments on the floodplain is causing the formation of channels that distribute incoming water and collect outgoing water. These channels are very important as fish habitat, especially for juvenile Chinook that use these areas for migration and feeding. Because of the success of natural processes in creating these channels, it is not proposed that they be enhanced or extended through artificial means, with the exception of connecting a channel between the lower and middle parts of the island through the existing cross-dike (either breach or large culvert). Less disturbance of the island would still allow for the creation of the channel structure important to fisheries habitat without major sediment or other impacts associated with digging new channels or channel extensions. However, minor modifications may be possible if needed to help the development of tidal channels in a dendritic pattern.

4.5.2 Middle Svensen Island

The Middle Svensen Island site would provide full restoration of fish access and habitat features. Therefore, every increment of fish value would be above current status.

Proposed mitigation actions on Middle Svensen Island include:

- Removing three tidegates on the south side of the island.
- Breaching the northern dike near the cross-dike between Middle and Lower Svensen Island (the above actions will flood about 65 acres at normal high tide).
- Providing a large culvert connection or dike breach through the cross-dike to facilitate marsh vegetation seed transport from Lower to Middle Svensen Island to speed marsh establishment.
- Filling or reconfiguring existing drainage ditches.
- Excavating new low-tide dendritic channels and nick-points to initiate self-excavated channels in strategic locations.
- Placing excavated material along selected dike areas to facilitate growth of shrubs and trees to be planted.
- Adding anchored LWD at tidal channels as microhabitat features.

- Controlling invasive weeds.
- Protecting two existing homesites by placing fill around one house and raising the eastern cross-dike.

4.6 Expected Mitigation Value

4.6.1 Svensen Island

The expected fisheries mitigation value for Svensen Island can be calculated in two ways: (1) the amount of habitat gained at the site and (2) the total number of salmonids likely to use the habitat.

The amount of habitat on Lower Svensen Island was calculated using aerial photographs and GIS. Emergent, woody scrub-shrub, tidal island, mudflats, open-water, and dike habitats were identified and delineated using aerial photographs. The extent of these habitats was ground-truthed during a field visit. The acreage of each habitat was then calculated using GIS. This analysis indicates that the Lower Svensen Island mitigation site would provide about 170 acres of habitat directly usable by juvenile salmon at high tides. Our preliminary estimates rely on the results of two different study locations to estimate salmonid use of the Svensen Island mitigation site (Bottom et al. 2003; McConnell and Blahm 1983). These studies produced beach seine data from a variety of locations throughout the saline and freshwater habitats of the lower Columbia River. In addition, after a preliminary design has been completed, we will run Ecosytem Diagnosis and Treatment ("EDT") modeling on the proposed design pre- and post-project to better quantify the expected benefits from restoration actions. This modeling will also allow us to model certain design changes to predict if benefits to fish are detectable from those changes.

Because Svensen Island is located in the freshwater portion of the estuary, average fish densities from beach seine data collected in the freshwater portion of the estuary are used to estimate maximum densities of rearing juvenile salmonids utilizing Lower Svensen Island aquatic habitat. Maximum densities of rearing subyearling Chinook, coho, and chum salmon utilizing nearshore habitat in the Columbia River estuary occur between May and June for Chinook, and in May for coho and chum. During these periods, approximately 30,000 Chinook, 11,000 coho, and 1,000 chum salmon may rear in the 170 acres of usable habitat on Svensen Island during high tide.

4.6.2 Middle Svensen Island

The calculations of habitat availability for Middle Svensen Island estimate approximately 65 acres of usable fish habitat. Using the same calculation approach as used above for Lower Svensen Island, one would estimate that more than 11,000 Chinook, more than 4,000 coho, and about 400 chum salmon would be expected to use the restored habitat at Middle Svensen Island. It may take two or three seasons before the habitat develops to the point of being valuable, and somewhat longer to be fully functional. Similar to the Lower Svensen Island site, after a preliminary design has been completed, we will run EDT modeling on the proposed design pre- and post-project to better quantify the expected benefits from restoration actions. This modeling will also allow us to model certain design changes to predict if benefits to fish are detectable from those changes, such as the benefits of connecting Lower and Middle Svensen Island through a culvert or dike breach.

4.7 Site-Specific Goals, Objectives, and Performance Standards

4.7.1 Lower Svensen Island

The goal of mitigation at Lower Svensen Island is to protect and further restore fisheries values by protecting wetland hydrologic function and wetland plant communities and by further modification of existing conditions to increase fish accessibility, habitat, and functions.

The objective is to support through minimal intervention the ongoing naturalization process initiated by the dike breach in 2003. Additional modification of the hydrologic regime, the channel structure at the island, the vegetative community, and habitat features using woody debris are proposed.

Performance standards at the site are focused on the effective functioning of the site for fisheries and the maintenance of a wetland community supportive of fish cover and forage needs. The principal performance standard would be the requirement that fish be able to effectively enter the island floodplain areas during rising tides and effectively leave again on outgoing tides. Once the actions of removing tidegates or culverts or buildings or tanks is complete, those standards will be met and require no further monitoring.

For vegetation cover, the main objective is to control purple loosestrife. An appropriate performance standard would be that the site have no more than 20 percent cover by purple loosestrife in monitoring year one (the same year as monitoring year one for Middle Svensen Island) and no more than 10 percent cover by purple loosestrife in monitoring year five.

For the area where the buildings are removed, establishment of marsh vegetation by year three would be the objective. The standard would be 50 percent cover by marsh vegetation other than purple loosestrife.

4.7.2 Middle Svensen Island

The primary goal at the Middle Svensen Island mitigation site is to restore a functioning wetland community to mitigate for losses at the Terminal site. This wetland community would also have the function of supporting fish rearing in tidally influenced wetlands at the site.

The objective is to create a self-sustaining wetland with hydrology that closely resembles natural patterns. The wetland vegetative community would consist of native species and exclude invasive exotics. Wetland performance standards are given in Section 2.1.8 of this mitigation plan.

For fisheries at the site, the objective of providing high-quality rearing habitat that can be used by salmonids and their prey species is compatible with the wetland goals and objectives.

Performance standards for fisheries at the Middle Svensen Island site are again linked to adequate fish access and egress at the site. So long as the tidally influenced portions of the site can be accessed by salmonids and other fish, the performance standard is being met.

4.8 Monitoring Plan

Fisheries monitoring at both sites would be done semiannually for the first five years of the Project. After that, unless required by adaptive management, the monitoring would be done once a year until Year 10. At both sites, the quality and extent of the fisheries habitats would be surveyed and results recorded. Depth measurements would be made at various locations, both at high and low tides, to capture the extent of tidal functioning. Fish would be observed directly to establish patterns of access and utilization of the mitigation sites.

4.9 Adaptive Management

The science of restoration is relatively new. The mitigation project at Middle Svensen Island is being done on a new mitigation site, with relatively little history to guide managers. In such a situation, adaptive management is needed. Aiming at goals and objectives, the exact management needed would be determined by the situations confronted. Keeping the mitigation sites accessible to fish, growing appropriate vegetation, and establishing a proper hydrologic regime may take a number of course corrections. Working from the monitoring reports, management can be adjusted to ensure that the objectives would be met despite obstacles that may crop up. Monitoring of LWD function will allow adjustments, such as adding additional LWD if needed.

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