PORT OF TACOMA UMBRELLA WETLAND AND HABITAT CONSERVATION BANK PROSPECTUS

June 9, 2014
Pierce County, Washington

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INTRODUCTION

The Port of Tacoma (Port) is an approximately 2,400-acre commercial port located predominately within the City of Tacoma on Commencement Bay in South Puget Sound. The Port was created by Pierce County citizens in 1918 and is now one of the largest container ports in North America and one of the top 50 in the world. Considered an "economic engine" for the region, the Port creates more than 43,000 jobs in Pierce County and 113,000 statewide. In order to meet the Port's Mission and Core Values, we are continuously maintaining, upgrading, rehabilitating and redeveloping facilities and properties to meet the future needs of the Port, customers and the citizens of Pierce County.

Port projects often directly or indirectly impact aquatic environments or sensitive areas. These impacts are avoided and minimized to the extent possible, but often require compensatory mitigation to replace habitat area, functions and values when unavoidable impacts occur. In order to meet our regulatory obligations to local, state and federal natural resource agencies and protect the resources of our tribal partners, the Port is left with four options for compensatory mitigation: concurrent mitigation; advanced mitigation; mitigation banks; or in-lieu fees. While all of these methods of compensatory mitigation have their advantages and disadvantages, establishing a mitigation bank appears to be the best option at this time for the Port.

To meet the future compensatory mitigation requirements, the Port of Tacoma proposes the establishment of a Wetland and Habitat Conservation Umbrella Mitigation Bank. The proposed Umbrella Bank will initially include two sites: the Upper Clear Creek Mitigation Site and the Lower Wapato Creek Combined Mitigation Site. Once certified by the Interagency Review Team (IRT), the proposed Umbrella Mitigation Bank will provide compensatory mitigation for unavoidable habitat impacts that cannot be avoided, minimized, or compensated on site. Credits from the Umbrella Bank will potentially be used by the Port of Tacoma, Port tenants, business partners and government agencies to mitigate for aquatic and wetland impacts as well as impacts to Endangered Species Act (ESA), Essential Fish Habitat (EFH) and other state and federally protected species and habitat. While the two proposed mitigation sites are designed to have a range of overlapping and watershed scale mitigation values, it is anticipated that the Port will be proposing expansions to the proposed mitigation sites and/or additional locations for inclusion in the Umbrella Mitigation Bank with approval by the IRT. These additional mitigation sites are conceptually identified in this prospectus, but additional site-specific details will be identified at a later date.

UMBRELLA BANK GOALS AND OBJECTIVES

The Port intends to offset future aquatic, wetland and critical area impacts by creating credits through the establishment of a Wetland and Habitat Conservation Umbrella Mitigation Bank. Port development projects will follow mitigation sequencing, whereby impacts are avoided and minimized to the maximum extent practicable. In the event that unavoidable impacts to wetlands or other critical areas occur, on-site mitigation may not be possible or ecologically beneficial, especially given the industrial nature of the Service Area and limited opportunities for wetland restoration or creation on Port property. As well, small mitigation projects implemented piecemeal on relatively small, isolated land parcels may not work to restore degraded watershed functions, a primary goal of mitigation. Creating mitigation bank credits presents a means to meet the overall objective of providing high quality, successful, long-term mitigation for unavoidable impacts to aquatic resources by:

1. Employing a watershed approach, thereby obtaining greater ecological benefits than would otherwise be achieved through on-site mitigation options that are impracticable or of low ecological value.
2. Utilizing scale efficiencies by combining the required mitigation for impacts from individual smaller projects within the designated Service Area into collective mitigation at a larger site with greater ecological value, achieving both ecologic and economic economies of scale.
3. Enabling the Port to efficiently meet regulatory requirements by streamlining the permitting and compensatory mitigation process.
4. Reducing or eliminating temporal functional loss.
5. Ensuring a high degree of success through monitoring and long-term management.

This prospectus serves to initiate agency and public involvement under state and federal mitigation rules for the proposed umbrella mitigation banking agreement. It provides a summary of existing conditions, regulations related to this effort, the rationale for site selection, and the proposed umbrella mitigation banking agreement structure.

UMBRELLA SITES

The Port has 19 mitigation sites, or phases, and preservation areas totally approximately 152 acres (Figure 1). Nine additional sites have been identified as potential umbrella bank sites. Two of these potential sites, Upper Clear Creek and Lower Wapato Combined Habitat Project Site, are in development and are discussed further in this document. Other potential mitigation areas discussed in this prospectus include mitigation on non-port owned property and project specific mitigation. The Port has discussed potentially partnering up with other government agencies to perform mitigation on City of Tacoma (Metro Parks) and Washington Department of Natural Resources property along Ruston Way, in Tacoma. Project specific mitigation would occur on properties with derelict or outdate structures that would not be restricted from future redevelopment. Removing these structures before the area is redeveloped will benefit fish and wildlife species by removing overwater or bed coverage and/or potential hazardous substances like creosote. Mitigation credits from these types of projects will be used for Port redevelopment.

None of the parcels proposed as umbrella bank mitigation sites currently or historically have supported agricultural practices that would qualify them as agricultural lands of long-term commercial significance (ALLCS). Examining aerial photographs from the 1930's until present shows that no agricultural crops have been grown on the Upper Clear Creek Mitigation Site with the exception of pasture grasses. Productivity and commercial capacity of the site is limited due to hydrologic regime and active floodplain environment. The property is currently zoned single family dwelling (0320141001) and floodway (0320141086). The Lower Wapato Combined Mitigation Site also appeared to support limited pasture land in the past, but has been used as a legal upland dredge disposal site since the 1960's. This parcel (0320013145) is currently zoned as vacant industrial land. Water rights have not been applied for or secured at either site and are not anticipated to be needed.

Upper Clear Creek Mitigation Site

The Port of Tacoma is planning a habitat improvement project on approximately 41 acres of land in the Clear Creek drainage, located between the cities of Puyallup and Tacoma on the southwest side of the Puyallup River valley (Figure 1). The site is referred to as the Upper Clear Creek Mitigation Site (UCCMS) and consists of a 14-acre Environmental Protection Agency (EPA) settlement site (to provide mitigation in support of a Consent Decree in United States v. Port of Tacoma, et al., No. 11-cv-05253 [W.D. Wa.]) and an approximate 27-acre mitigation bank site the Port is proposing to include in the Umbrella Mitigation Bank.

Figure 1. Port of Tacoma Mitigation Sites

0 1,000 2,000 3,000 4,000
Feet

Notes: The locations of all features shown are approximate. This drawing is for information purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute any warranty.

Port of Tacoma

Reference: Parcel data obtained from Pierce County. Aerial imaery obtained from i-cubed.
All other features digitized from Port of Tacoma Port Wide Habitat Mitigation report (Herrera 2013).

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The UCCMS is located in unincorporated Pierce County along Clear Creek, approximately 0.7 river miles (RM) upstream of the stream's confluence with the lower Puyallup River. The project will include habitat improvements to the Clear Creek channel, which is a perennial, fish-bearing stream and the floodplain of Clear Creek and the Puyallup River on the southwest side of the Puyallup River valley.

Natural floodplain conditions will be restored by realigning Clear Creek channels through re-established and rehabilitated Category I riverine wetlands within the floodplain of Clear Creek and the lower Puyallup River. Removal of substantial fill and excavation of stream channels will improve Clear Creek wetland connectivity, improve fish habitat conditions by providing in- and off-channel foraging and refuge habitats, and increase floodwater storage capacity in the Clear Creek basin. In addition, mitigation includes enhancing wetland and riparian buffers by establishing forested conditions. Re-establishment, rehabilitation, and enhancement measures will involve eradication of invasive vegetation and planting a diversity of native plant species.

Site Description

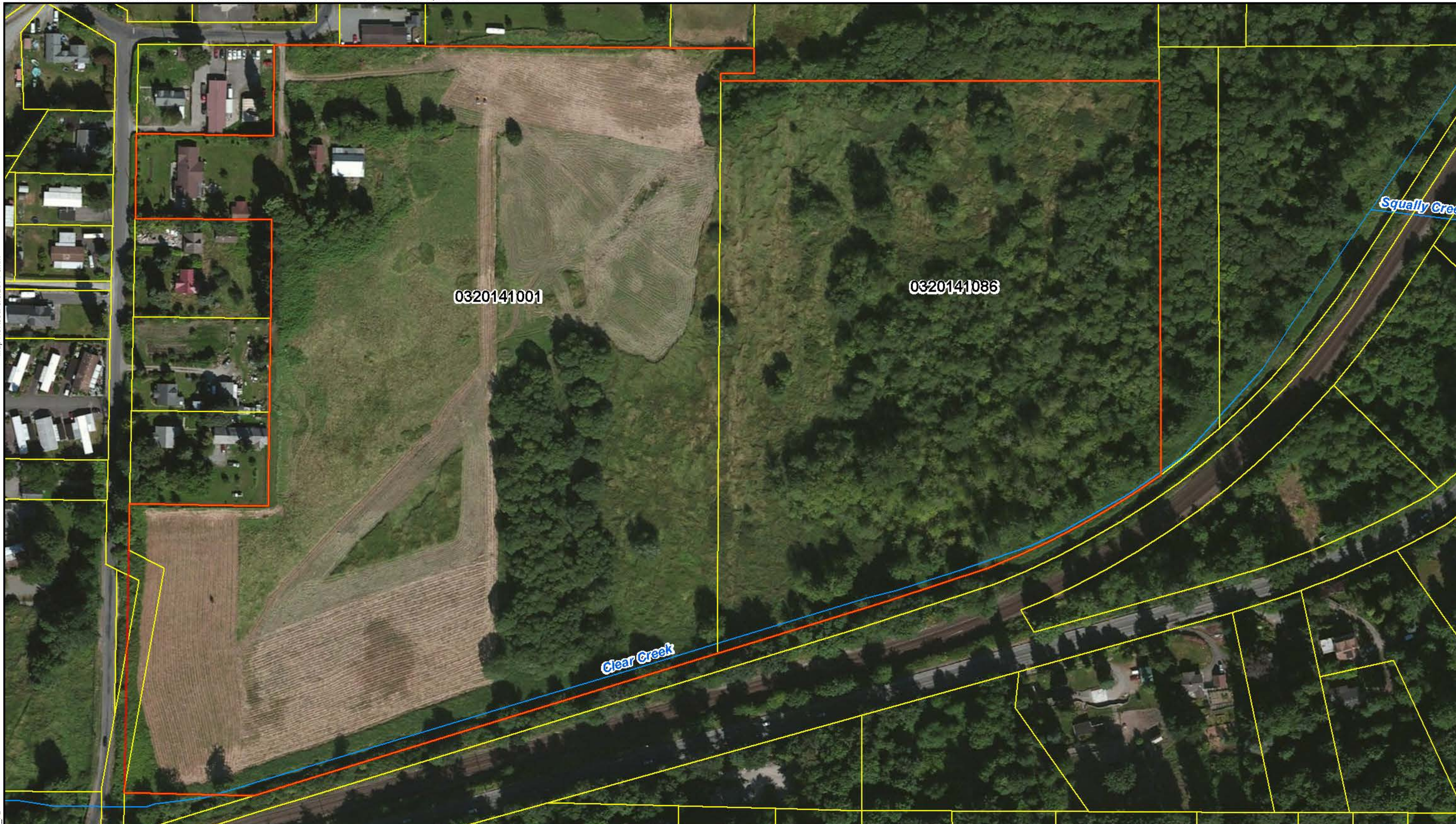
The mitigation bank site is located in unincorporated Pierce County on the southwest side of the Puyallup River valley along Clear Creek, approximately 0.7 RM upstream of the confluence with the lower Puyallup River. The site includes a portion of Clear Creek and adjacent floodplain habitat east of the stream that is also within the floodplain of the Puyallup River.

The mitigation bank site is owned by the Port, and consists of parcels 0320141001 and 0320141086 with respective street addresses of 3714 Gay Road East and 4014 Gay Road East, Tacoma, Washington (Figure 2). The site lies southwest of the intersection of Gratzer Road East and River Road East (State Route [SR] 167). The mitigation bank portion of the site is located in Sections 13 and 14 of Township 20 North, Range 3 East, Willamette Meridian.

Site Selection

In accordance with joint regulatory agency guidance (Washington State Department of Ecology (Ecology) 2012a; requirement 1.b., p. 5), the mitigation site was selected using a watershed approach. In addition, the following demonstrated use of a watershed approach in consistent with 33 CFR 33.4(c) and Ecology's *Selecting Wetland Mitigation Sites Using a Watershed Approach* (Hruby et al., 2009). This approach takes into consideration long-term sustainability of proposed restoration actions, and suitability for replacing potential lost aquatic resource functions resulting from future projects by the Port.

The mitigation site is located in the lower portion of the Puyallup Watershed (HUC 17110014) within approximately 3.5 miles of potential future Port development sites in the vicinity of Commencement Bay. The site is located in a freshwater environment that provides opportunities to improve watershed conditions and replace lost aquatic resource functions by re-establishing and rehabilitating riverine scrub-shrub and forested wetlands, and enhancing fish and wildlife habitat. In addition, the site provides opportunities for enhancing herbaceous uplands to forested riparian and wetland buffers.



Map Revised: 5/9/2014 smm

Figure 2. Upper Clear Creek Mitigation Site

0 100 200 300 400
Feet

Upper Clear Creek Mitigation Site

Tax Parcels

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Port of Tacoma

The UCCMS is identified in the *Clear/Clarks Creek Basin Plan* (Pierce County, 2006). Pierce County identifies the Clear Creek Stream Corridor Restoration as a high-priority capital improvement project (CIP) that involves restoring a 3,000-foot reach between Pioneer Way East and Gay Road East. Pierce County recognizes the Port's mitigation bank project as a component of this CIP. The project addresses riparian and aquatic habitat degradation. In support of improving water quality conditions, acquisition of the mitigation site by the Port is consistent with a programmatic recommendation of Pierce County that prioritizes acquisition and protection of riparian corridors through purchase or conservation easements.

The mitigation bank site provides opportunities to restore critical riverine watershed processes that have been highly altered by past land uses. The *Clear/Clarks Creek Basin Plan* characterizes the lower Clear Creek aquatic and riparian habitat as highly disturbed by agricultural practices, flood control practices, and residential landscaping, which have resulted in a channelized, ditch-like stream conditions that limits in-stream habitat complexity and the riparian community. The removal of meander bends has eliminated fish refuge areas and disconnected the stream from the floodplain (Pierce County, 2006). Pierce County identified Clear Creek from Pioneer Way to Gay Road East encompassing the UCCMS reach as a riparian/aquatic habitat problem area due to the straightened channel reach and reduced riparian buffer. In addition, land use practices have resulted in removal of large areas of native riparian vegetation. Most of the ditched stream channel is lined with invasive species such as Himalayan blackberry and reed canarygrass.

According to Pierce County (2006), historical photographs and site plans for developments constructed prior to wetland regulations provide evidence that considerable wetland areas have been lost or altered in the Clear/Clarks Creek Basin due to urban development and agricultural land uses. To promote agriculture and other development, wetlands adjacent to streams in the Puyallup River valley including Clear Creek were lost by filling, dewatering with drainage tile, and channelizing of streams during the early 1900s. Altered wetlands in the valley, where the mitigation bank site is located, provide optimum physical conditions for wetland restoration. In particular, the wetlands at and surrounding the mitigation site were historically large and complex with a potential to support a variety of habitat types due to their location at the confluence of Squally Creek and Clear Creek.

On the UCCMS, there are several signs of habitat disturbance and alteration of riverine wetland processes as a result of past agricultural land use. Clear Creek was placed in a channelized ditch along the southwest edge of the valley to allow for development of agricultural fields. As a result, an earthen sidecast berm was created on the east side of the stream that limits floodplain connectivity to adjacent wetlands during periods of high flow. The ditched stream has been maintained by Drainage District #10. In addition, an east-west cross ditch was created to promote site drainage with discharge to Clear Creek through a culvert beneath the earthen berm. Natural floodplain vegetation communities were cleared, and the land was filled and graded to support crops and pasture. In the time since agriculture practices were abandoned, large portions of the fields have reverted to emergent wetlands dominated by invasive reed canarygrass.

As a result of the flood protection provided by Puyallup River levees, additional land use development has encroached on the floodplain in the vicinity of the mitigation bank site including residences and roadways.

A mitigation bank is suitable at the UCCMS based on Ecology (Hruby et al., 2009) guidance for the following reasons:

- Site alterations mentioned above will be addressed.
- Mitigation activities will restore riverine wetland functions, which is the appropriate hydrogeomorphic (HGM) class where the site is located.
- Clear Creek is the appropriate source of water to the mitigation site based on the riverine wetland HGM class.
- Clear Creek provides an adequate supply of water to maintain wetlands with no long-term hydrologic control or maintenance needs.
- Adequate water supply and site flooding will support development and maintenance of hydric soils.
- Site design includes aggressive measures to eradicate reed canarygrass and other invasive species.

Landscape and Site Constraints

Based on Ecology (Hruby et al., 2009) guidance, the mitigation bank site has a variety of landscape and site constraints related to improving water quality, hydrology, and habitat functions (wildlife and plant species richness). Table 1 presents these constraints and how they will be addressed at the mitigation bank site in support of improving watershed conditions.

SALMON HABITAT LIMITING FACTORS

Several habitat factors in the Clear Creek subbasin of the Puyallup River basin are identified as limiting naturally producing self-sustaining runs of salmonids (Kerwin, 1999). In accordance with joint regulatory agency guidance (Ecology, 2012a; requirement 1.e., p. 6), Table 1 presents these habitat limiting factors and how they will be addressed by the mitigation bank project.

TABLE 1. CLEAR CREEK SALMON HABITAT LIMITING FACTORS

Limiting Factor	How Limiting Factor will be Addressed
Fish Passage	Not applicable. No fish passage barriers exist on the mitigation bank site.
Floodplain Connectivity	The mitigation bank project will restore floodplain connectivity by removing the sidecast berm adjacent to Clear Creek which will increase floodplain connectivity with the channel. In addition, several channels are proposed in the floodplain to improve connectivity.
Bank Stability	The mitigation bank project will reconstruct stable banks adjacent to proposed floodplain channels. The banks will be stabilized by means of large woody debris, seeding, and planting native vegetation.
Large Woody Debris	The mitigation bank project will install over 90 large woody debris structures in proposed channels and throughout the floodplain.
Pools	The mitigation bank project will install large woody debris structures within the proposed channels with the intent of forming scour pools.
Side Channel Habitat	The mitigation bank project will maintain the existing Clear Creek channel as a side channel. In addition, the project will provide off-channel habitats including two ponds and associated outlet channels

Limiting Factor	How Limiting Factor will be Addressed
Substrate Fines	Not applicable. The low-gradient floodplain nature of the Clear Creek reach where the mitigation bank site is located is not conducive to supporting gravels and associated spawning habitat. Therefore, substrate fines are not a limiting factor on the mitigation bank site.
Riparian	The mitigation bank site will improve riparian conditions by planting native shrub and forested vegetation communities.
Water Quality	The mitigation bank project will improve water quality conditions by increasing the frequency of overbank flooding and surface water contact time with the floodplain vegetation thereby promoting pollutant removal. In addition, the project will improve water temperature and dissolved oxygen conditions by providing additional shading of Clear Creek.
Water Quantity	Not applicable. The mitigation bank project does not involve measures to increase water quantities in Clear Creek.

Existing Conditions

In accordance with joint regulatory agency guidance (Ecology, 2012a; requirement 1.c., p. 5), this section presents baseline conditions for the mitigation bank site (which also apply to the EPA settlement site). Historical land uses in the Clear Creek basin have primarily included agriculture and low-density residential uses. The lower Puyallup River floodplain, which includes the lower Clear Creek basin, attracted farmers with its nutrient rich soils and flat uniform land ideal for farming. As a result, Clear Creek and several other streams in the Puyallup River valley were diverted from their original locations in the early 20th century to provide additional agriculture acreage. Clear Creek was diverted into an excavated ditch along the western boundary of the mitigation bank site adjacent to the railroad tracks.

The UCCMS property was historically used for agriculture land. Typical impacts to an area used for agriculture include annual plowing or tilling, soil compaction, water diversion or drainage, and removal of or disturbance to shrub and forested vegetation.

Existing baseline conditions of the mitigation bank site are assessed and characterized in the following reports:

- Clear Creek and wetlands on the mitigation bank site were delineated by Grette Associates. The *Upper Clear Creek Mitigation Site Revised Wetland Delineation and Analysis Report* presents the results of the delineation including site characteristics, historic information, habitat conditions, methods, vegetation, hydrology, hydric soils, stream typing, wetland categorization, buffers, and functions (Grette, 2012).
- Information on existing fish and wildlife species and habitat conservation areas regulated by Pierce County are presented in the *Habitat Assessment—Upper Clear Creek Mitigation Site* (Herrera, 2013b).
- Information on threatened and endangered species, critical habitat, and essential fish habitat are presented in the *Biological Evaluation—Upper Clear Creek Mitigation Site* (Herrera, 2013c).

- Information on mitigation bank site water depths and flow velocities based on computer modeling are presented in the *Hydrologic and Hydraulic Analysis – Upper Clear Creek Habitat Site* (Herrera, 2012).
- Information on groundwater and Clear Creek stage monitoring are presented in the *Hydrologic Monitoring Report—Upper Clear Creek Mitigation Site* (Herrera, 2013a).
- Information on subsurface soil conditions are presented in the *Subsurface Exploration Data Report – Upper Clear Creek Habitat Restoration* (Aspect, 2012).
- Information on cultural resources are presented in the *Preliminary Cultural Resources Assessment of the Upper Clear Creek Mitigation Property Habitat Restoration* report (NWAA/SWCA, 2012).

The following sections summarize key results of these reports pertaining to aquatic resources and buffers on the mitigation bank site.

The UCCMS mitigation bank site is approximately 41 acres and consists of Clear Creek, wetlands, upland pasture, and one residence (Figure 3). Clear Creek flows along the western property boundary and comprises approximately 0.75 acres on the UCCMS. An adjacent upland sidecast berm on the UCCMS is approximately 1.60 acres. Approximately 29 acres of the UCCMS contains existing wetlands that are degraded and/or not fully functioning. Approximately 9.67 acres consist of mown, upland pasture that abuts emergent wetland on the northeast portion of the UCCMS. A residence is located on the northeast portion of the UCCMS and is approximately 0.68 acres consisting of a house, wood shed, well house, concrete pads, driveway, walkways, and associated landscaping.

Surrounding off-site land use conditions include Gay Road East to the north, rural residential development to the north and east, Burlington Northern Santa Fe (BNSF) rail tracks to the west, and forested wetlands to the south and east. The railroad embankment represents the left (west) bank of Clear Creek.

WETLAND CONDITIONS

Grette Associates (2012) conducted wetland delineations on the UCCMS in June 2011 and March 2012. One wetland was delineated (Wetland A), and the flagged boundary was surveyed (Figure 3). The wetland covers approximately 29 acres of the UCCMS and extends off site for a total area of approximately 43.1 acres.

The wetland covers much of the southern and western portions of the site, with uplands to the north and east. On the UCCMS, Wetland A consists of approximately 17 acres of degraded emergent wetland and 12 acres of forested wetland. Wetland A, including off-site portions, was rated as a Category wetland using Ecology's *Washington State Wetlands Rating System for Western Washington – Revised* (Hruby, 2004). The wetland contains both slope and riverine hydrogeomorphic classes, and was rated as riverine in accordance with the rating system. The United States Fish and Wildlife Service (USFWS) classifications of the wetland include palustrine emergent (PEM) and palustrine forested (PFO) vegetation communities (Cowardin et al., 1979).

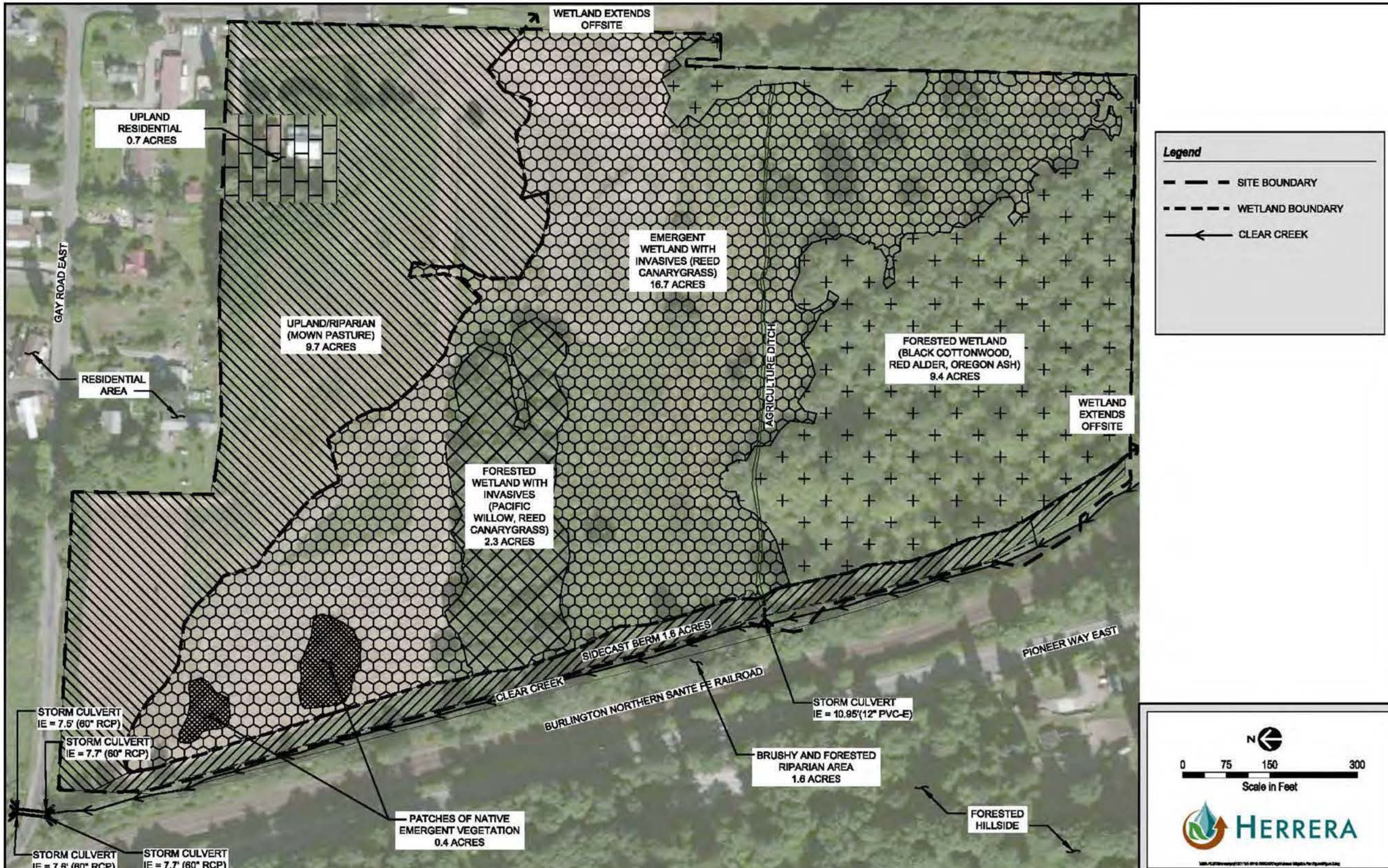

Figure 3. Upper Clear Creek Existing Conditions

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Path: Figure3_CC_EC

Reference: Imagery, data and other features obtained from Port of Tacoma Upper Clear Creek Mitigation Site Draft Advance Mitigation Site (Herrera 2013).

WETLAND VEGETATION

Emergent portions of Wetland A on the mitigation bank site are dominated by infestations of invasive reed canarygrass (*Phalaris arundinacea*). The primary distinction between wetland and upland plant communities along the delineated boundary is a marked increase in thistle (*Cirsium* sp.) and a decrease in slough sedge (*Carex obnupta*) and reed canarygrass. Forested areas are dominated by black cottonwood (*Populus balsamifera*), red alder (*Alnus rubra*), mature Pacific willow (*Salix lasiandra* ssp. *lucida*), red osier dogwood (*Cornus sericea*), slough sedge (*Carex obnupta*), skunk cabbage (*Lysichiton americanum*), stinging nettle (*Urtica dioica*), and small-fruited bulrush (*Scirpus microcarpus)*.

WETLAND HYDROLOGY

Wetland hydrology is driven primarily by a seasonal high groundwater table associated with water levels within Clear Creek. According to USFWS classifications, water regimes in Wetland A include seasonally flooded and saturated (Cowardin et al., 1979). Occasional overbank flooding from Clear Creek contributes surface water to Wetland A, but only during high flows. Hydrologic modeling conducted by Herrera (2012) demonstrates that overbank flooding occurs during a peak flow that corresponds to at least once every 2 years (i.e., 2-year recurrence peak flow). According to the Pierce County (2013a) *Region 5 Hazard Mitigation Plan*, all of Wetland A is inundated during extreme flood events, such as the 1996 flood. Several small depressions were noted throughout the wetland in both the emergent and forested areas. These depressions contained evidence of seasonal flooding and/or ponding, including algal mats and water stained leaves.

A culvert is located beneath the sidecast berm adjacent to Clear Creek. During high flows in Clear Creek, water enters Wetland A through a ditch that connects to the culvert and runs in the east-west direction through the mitigation bank site. Water in the ditch typically overtops the banks of the ditch, and floods the wetland in combination with a high groundwater table. During periods of lower flows, surface water from the wetland drains back into Clear Creek through this culvert.

WETLAND SOILS

Soils within Wetland A are mapped as Sultan silt loam (42A), Snohomish silty clay loam (39A), and Puyallup fine sandy loam (31A) according to the *Soil Survey of Pierce County* (Zulauf, 1979). Typical soil profiles within wetland areas on the site consist of up to 4 inches of dark brown (7.5YR 3/2) silt loam on the surface over a layer of 4 to 16 inches plus of 60 to 70 percent dark gray (10YR 4/1) silt loam with 30 to 40 percent strong brown (7.5YR 5/6) redoxymorphic concentrations. Soil profiles within wetland areas met the F3 hydric soil indicator (depleted matrix) as described in *Field indicators of Hydric Soils in the United States Version 6.0* (USDA NRCS, 2010).

To assist with the Port's planning and design of the UCCMS, Aspect Consulting conducted a geotechnical survey in November 2011 (Aspect, 2012). According to the survey, there are deposits of what appear to be imported soils throughout the site that range from 0.5 to 8.5 feet below the surface and typically consist of a brown to gray clayey silt. In addition, deposits of historic surface soils were identified throughout the site at depths ranging from 2.5 to 8.0 feet below the existing surface and typically consisted of dark brown peat. The survey also identified a fine-grain sediment deposit typically associated with a low energy fluvial depositional environment. This layer consisted of gray silt with scattered interbeds of organic silt and fine sand that ranged from 2.5 to 15 feet below the existing grade.

WETLAND FUNCTIONS

Water Quality, hydrologic, and habitat functions of Wetland A were assessed by Grette (2012) to determine the Category rating using Ecology's *Washington State Wetlands Rating System for Western Washington – Revised* (Hruby, 2004). Supplemental qualitative ratings (high, medium, low) are presented in Table 2, which were determined based on Ecology (2008) guidance.

TABLE 2. WETLAND A FUNCTION SCORES AND RATINGS

Water Quality Functions Qualitative Rating[a]		Hydrologic Functions Qualitative Rating[a]		Habitat Functions Qualitative Rating[a]		Total Score	2004 Ecology Rating Category[b]
Potential	**Opportunity**	**Potential**	**Opportunity**	**Potential**	**Opportunity**		
Moderate	Yes	High	Yes	Moderate	Moderate	76	I

Notes:

[a] Qualitative ratings based on Ecology (2008) guidance.

[b] Wetland category based on the 2004 Ecology rating system (Hruby, 2004).

Wetland A has a moderate rating for potential to improve water quality attributable to several factors including presence of depressions capable of trapping sediments, and dense trees and shrubs capable of resisting water velocities and promoting sediment deposition. Wetland A has opportunity to improve water quality because the upper basin of Clear Creek occurs within an urban growth area that could contribute pollutants to the wetland. In addition, the basin and immediate areas surrounding Wetland A contain tilled fields, pastures, cleared forests and residences that may contribute to pollutant loading. Wetland A also has an opportunity to improve water quality because according to Washington State's Water Quality Assessment [303(d) List], Clear Creek is Category 5 water for high fecal coliform, and a Category 2 water for low dissolved oxygen (Ecology, 2013).

Wetland A has a high rating for potential to reduce flooding and erosion (hydrologic functions) due to an average wetland width that is more than 20 times the width of Clear Creek, and the large areas of forest and shrub cover capable of slowing flows. It has opportunity to provide hydrologic functions due to the absence of downcutting in Clear Creek adjacent to the wetland, the fact that portions of the upstream basin are within an urban growth area, the absence of dams on Clear Creek, and the fact that roads and residences are located downstream that could be damaged by flooding. Finally, Wetland A has an opportunity to provide hydrologic functions because the subbasin downgradient of the UCCMS has flooding problems (Pierce County, 2013a), and the UCCMS has been identified as important for flood storage and conveyance in the *Clear/Clarks Creek Basin Plan* (Pierce County, 2006).

Wetland A has a moderate rating for potential to provide habitat functions due to several factors that create niches for fish and wildlife, including plant community diversity (emergent wetland and forested wetland with underlying shrub and herbaceous strata), several hydroperiods (seasonally flooded, occasionally flooded, and saturated), high native plant richness, moderate interspersion of habitats, and several types of habitat features (large wood, standing snags, undercut banks, and thin-stemmed plants in seasonally flooded areas). In addition, Wetland A has a moderate rating for habitat functions because it provides habitat for threatened species (Chinook salmon and steelhead) that reside in Clear Creek, represents a priority area according to Washington Department of Fish and Wildlife (WDFW), and is near or adjacent to several WDFW-listed priority habitats (biodiversity areas and corridors, riparian, and instream). Wetland A has a moderate rating for opportunity to provide habitat functions due to lack of adjacent, accessible, and undisturbed habitats, and because high-intensity land uses surround Wetland A.

STREAM AND RIPARIAN CONDITIONS

Clear Creek is currently confined within a straight channel that runs along the BNSF Railway near the toe of the hillside bordering the west side of the site. Clear Creek is classified as a Type F2 stream according to Pierce County Code (PCC) Chapter 18E.40.060 based on fish-bearing status and adjacency to a landslide hazard area. Clear Creek is a Type 3 water according to the Washington Department of Natural Resources (WDNR) interim water typing system (Washington Administrative Code [WAC] 222.16.031) based on moderate to slight fish, wildlife or human use.

Throughout the UCCMS, Clear Creek predominantly serves as a migration corridor for salmonids enroute to spawn in upper reaches (below the fish passage barrier at RM 1.9), as well as in tributaries streams including Swan, Squally and Canyon creeks. There are also suitable (and improving) refuge, foraging and juvenile rearing habitats on the UCCMS. There is a lack of spawning habitat on the UCCMS, primarily due to the low gradients that do not maintain suitable gravel substrates in the stream.

Aquatic habitats in Clear Creek throughout the UCCMS consist of glide habitats characterized by a low-gradient (between 0 and 1 percent) channel with fine silt substrate, and occasional beds of sand (Herrera, 2013b). Wetted widths average 20 feet. Typical channel depths range between 1 and 2 feet, with a thalweg depth of 2.5 to 3 feet. Downed wood is nearly absent from the stream channel. Only 11 pieces were observed during stream surveys, primarily small to medium sizes (less than 12 inches in diameter).

Clear Creek and its riparian zone on the UCCMS contain a mixture of intact and degraded habitat conditions. Reed canarygrass generally dominates the right (east) bank of the narrow riparian corridor, which lacks mature woody vegetation, which if restored, could provide shade, bank stability, and large woody material. The dominant vegetation on the left (west) bank is native trees and shrubs, extending in some areas over half of the wetted stream channel.

BUFFER CONDITIONS

Upland buffers only occur on the northeast portion of the mitigation bank site, which extend along the entire northern boundary of the UCCMS. Upland buffers do not occur elsewhere on the site because the remainder of the site consists of Clear Creek along the western edge and wetland extend off site to the east and south. According to PCC Chapter 18E.30.060, buffers are required adjacent to wetland edges. Where wetlands extend off site, there is no opportunity to provide a buffer on the UCCMS. The upland buffer gently slopes downward to the wetland boundary. The on-site upland buffer consists of pasture that is regularly mown. Typical herbaceous vegetation consists of meadow foxtail (*Alopecurus pratensis*), velvet grass (*Holcus lanatus*), and field horsetail (*Equisetum arvense*). According to subsurface soil explorations, the upland buffer consists of approximately 1-foot depth of sandy silt topsoil over approximately 5 feet of silty fill material (Aspect, 2012).

A residence is located within the upland buffer on the UCCMS including a portion of the mitigation bank site. The residence consists of a house, wood shed, well house, concrete pads, driveway, walkways, and associated landscaping.

FISH AND WILDLIFE USE

Several salmonid species are identified in Clear Creek up to RM 1.9, where a diversion dam serves as a barrier for anadromous fish passage (Table 3) (Pierce County, 2006; WDFW, 2013). Reticulate sculpin (*Cottus perplexus*), river lamprey (*Lampetra ayresii*), and Pacific lamprey (*Lampetra tridentata*) may also occur in Clear Creek. In accordance with joint regulatory agency guidance (Ecology, 2012a; requirement 1.e., p. 6), fisheries enhancement activities at the mitigation bank site will benefit the same fish stocks that potentially could be impacted by future Port projects within the service area.

TABLE 3. SALMONID UTILIZATION OF CLEAR CREEK

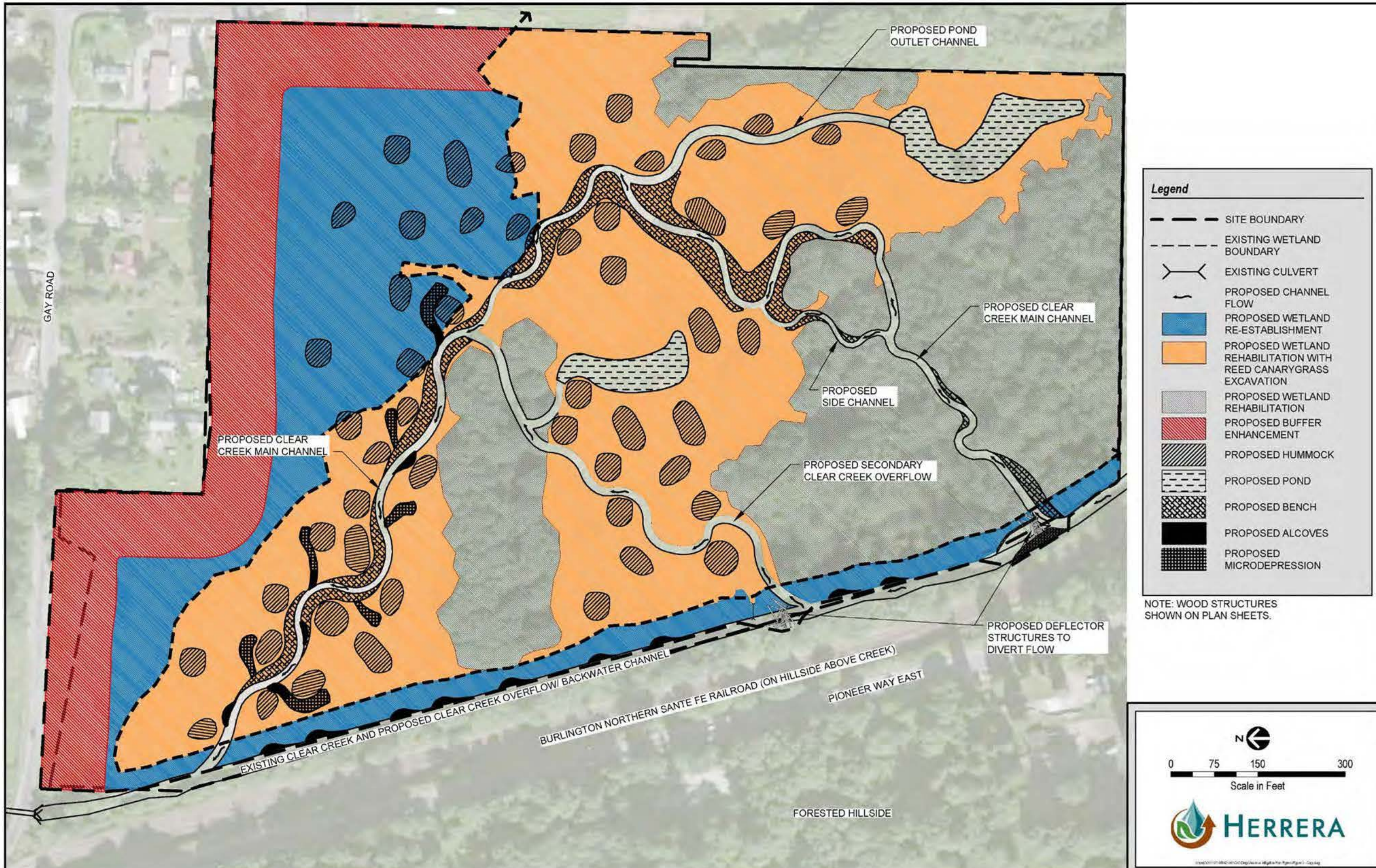
Common Name	Scientific Name	Presence
Winter Steelhead Trout	*Oncorhynchus mykiss*	Presence Presumed
Coho	*Oncorhynchus kisutch*	Known Spawning
Fall Chum	*Oncorhynchus keta*	Documented Present
Pink	*Oncorhynchus gorbuscha*	Documented Present
Fall Chinook	*Oncorhynchus tshawytscha*	Documented Present
Cutthroat Trout	*Oncorhynchus clarki*	Documented Present
Bull Trout	*Salvelinus confluentes*	Documented Present

Several species of wildlife were observed using the mitigation bank site during site reconnaissance, including song birds, raptors and small mammals (Grette, 2012). Song birds observed at the site include common yellowthroat (*Geothlypis trichas*), marsh wren (*Cistothorus palustris*), song sparrow (*Melospiza melodia*), Steller's jay (*Cyanocitta stelleri*), barn swallow (*Hirundo rustica*) and tree swallow (*Tachycineta bicolor*). Red-tailed hawk (*Buteo jamaicensis*) was also observed at the site. Signs of small mammals were observed indicating use of the site by raccoon (*Procyon lotor*) and coyote (*Canis latrans*). In addition, great blue heron (*Ardea herodias*) were observed flying over and near the property. A great blue heron rookery occurs directly south of the future mitigation bank site (WDFW, 2013).

Conceptual Site Design

Site Plan

This section presents the proposed site plan for the UCCMS, which focuses on design elements that pertain to the mitigation bank site. However, many of the design elements are common to both the mitigation bank site and the EPA settlement site. Figure 4 shows the preliminary design for the overall UCCMS. The portions of this design occurring on the mitigation bank site are shown on Figure 5.



Map Revised: 3/28/2014

Figure 4. Upper Clear Creek Mitigation Site Preliminary Plan

Notes: The locations of all features are approximate. This drawing is for informational purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of Tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute and warranty.

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Path: Figure4_CC_PrelimPlan

Reference: Imagery, data and other features obtained from Port of Tacoma Upper Clear Creek Mitigation Site Draft Advance Mitigation Site (Herrera 2013).

Map Revised: 3/28/2014

Figure 5. Upper Clear Creek Mitigation Bank

Notes: The locations of all features are approximate. This drawing is for informational purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of Tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute and warranty.

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Path: Figure5_UCC_WMB

Reference: Imagery, data and other features obtained from Port of Tacoma Upper Clear Creek Mitigation Site Draft Advance Mitigation Site (Herrera 2013).

The proposed design will remove the entire sidecast berm on the site and realign a meandering Clear Creek through the UCCMS, while retaining the existing channel to serve as an overflow conveyance feature during high flows as well as a backwater habitat for fish during high and low flows. A secondary overflow/backwater channel between the existing and realigned mainstem channel will provide further fish habitat complexity and support wetland rehabilitation measures by supporting a range of wetland hydroperiods. In addition, the design includes creation of diverse microtopography and habitat features including channel benches, ponds, alcoves, microdepressions (i.e., swales), hummocks, large wood structures, standing snags, and planting of a diverse array of native wetland and upland plant communities within the restored stream channel and floodplain terraces. Additional design details are presented in the basis of design plans (Herrera, 2013d).

CHANNEL FLOW DIVERSION, BACKWATER CONDITIONS, AND IMPROVEMENTS

Two flow deflector structures constructed of large woody debris (LWD) will be installed in the existing channel to function as partial blockages to divert flows to floodplain channels (Figure 4). The upstream deflector structure will divert most of the base flow into the new main floodplain channel while maintaining some flow in the existing channel. Most of the remaining base flow will be diverted into the secondary floodplain channel at the downstream deflector structure. The structures are designed to provide robust flow splitting that mimics a stable beaver dam complex. These two structures are each designed as a complex assortment of LWD that will create a rough flow path at low flow, but less impedance to flow for higher flow events, thereby optimizing the flood conveyance capacity through the existing channel, new channels and adjacent floodplain area.

Stream flow and surface water depth will be monitored during construction of the deflector structure at three locations: 1) 100 feet upstream of the proposed structure within the existing Clear Creek channel, 2) 100 feet downstream of the diversion within the proposed floodplain channel, and 3) at the downstream limit of the deflector structure within the existing Clear Creek channel. The intent of this monitoring is to inform the construction contractor and the design engineer of the appropriate elevations of the structures to assure that the targeted flow splits are achieved.

In addition to flow that will pass through the large wood channel deflector structures, existing backwater effects indicate that surface water will be maintained in the existing channel year round to support fish habitat (Herrera, 2012). Based on downstream survey, a hydraulic control is located approximately 300 feet downstream of Gay Road East within the Clear Creek channel that is a result of a flat downstream channel segment with bedforms that control low flow water surface elevations. The backwater caused by this streambed control extends into approximately the lower half of the project site under low flow conditions. In addition, groundwater flow to the existing channel under existing and proposed conditions from the adjacent hillside and hyporheic flow from the floodplain would provide sources of water for the channel, preventing stagnation.

The existing Clear Creek channel is degraded because its dimensions do not resemble natural meandering and low-lying bank conditions. Throughout the UCCMS, Clear Creek characteristics include a generally straight alignment, trapezoidal dimension and high banks. The left (west) bank is contiguous with the adjacent railroad embankment and the right bank is elevated due to past side casting of dredged material from the channel. However, the existing channel provides some high quality habitat functions for fish including dense, native shrub and tree canopy cover along most of the left bank. Therefore, with proposed improvements, the existing Clear Creek channel will be maintained to provide additional year-round habitat for fish; functioning as a low-flow, high-flow and backwater channel.

Several habitat improvements are proposed along the right bank of the existing Clear Creek channel including:

- Removal of the sidecast berm along the upper banks
- Construction of several alcoves of varying dimensions that mimic a naturally meandering bank
- Installation of several large wood bank roughening structures
- Re-vegetation of the right bank with native emergent, shrub, and tree plantings

FLOODPLAIN CHANNEL AND BENCH DESIGN

The proposed design includes several floodplain channels: a main channel, short segment of side channel off the main channel, secondary overflow/backwater channel and two pond outlet channels (Figure 4). The network of multiple channels is intended to maximize fish habitat potential on the site, rehabilitate wetlands, provide habitat complexity and mimic historic conditions.

The alignments of the channels contain meanders that resemble naturally occurring streams that function to provide additional channel length and habitat area for fish. The alignment of the outlet channel from the southeast pond and the downstream segment of main channel generally resemble the inferred historical channel alignment based on historical aerial photograph analysis presented in the *Revised Wetland Delineation and Analysis Report – Upper Clear Creek Mitigation Site* (Grette, 2012). However, the alignment has been adjusted to provide buffer area between the stream channel and surrounding properties. The main channel inlet location (i.e., deflection point from existing ditched channel) was driven largely by the southern property boundary. The alignment of the main channel and side channel through the existing forested wetland was chosen based on naturally occurring depressions and avoidance of existing mature trees. The alignment of the secondary overflow/ backwater channel was chosen to avoid impact to existing forested wetlands and to improve riverine wetland functions.

Hydraulic modeling was conducted to determine the optimal dimensions of the floodplain channels and adjacent bench habitats, and the results are presented in the *Hydrologic and Hydraulic Analysis – Upper Clear Creek Habitat Site* (Herrera, 2012). During modeling of various channel dimensions, the channel width was modified to provide more flow depth complexity including a deeper main channel and shallower floodplain bench habitat with diverse inundation levels at various seasonal base flow rates. The width of the floodplain channels range between approximately 8 and 10 feet to maintain sediment conveyance and sustain channel geometries with flow depths of approximately 1 to 2.5 feet deep under low-flow conditions. The benches are approximately a ½ foot lower in elevation than the surrounding wetland floodplain grades with the intent of becoming inundated during the average annual flow rate, but only partially inundated during summer low base flow conditions. The width and locations of the shallower benches is varied through the site with maximum widths ranging between 10 and 50 feet. On average, maximum bench width is approximately 20 feet.

The intent of the project is not to establish a reinforced or permanent channel, but rather to provide a relatively stable geometry over the short term to medium term to allow the floodplain vegetation to establish, and allow the floodplain to morph naturally over time at the project site. The proposed channel dimensions are designed to maintain flow velocities of 0.5 to 1.0 feet per second and shear stress of 0.03 to 0.1 pounds per square foot. The desirable flow velocity and shear stress ranges were carefully considered to provide an initial channel geometry that is relatively stable. With expansion of the channel into the floodplain, it is inevitable that the channel will lengthen and the gradient will be reduced.

Alcove Design

Alcoves will be constructed along the right bank of the existing Clear Creek channel on the mitigation bank site. The alcoves will resemble an enlargement of the channel. Large wood bank roughening structures will be constructed adjacent to the alcoves, which will function to help prevent the alcove from silting in. The depth and side slopes of the alcoves will be similar to the existing Clear Creek channel.

Floodplain Pond Design

Two floodplain ponds are proposed on the mitigation bank site. The ponds were designed on the southern portion of the site to provide more variability in hydraulic depth and habitat complexity (e.g., amphibian and fish habitat) given the shallow nature of the floodplain and channels. The ponds are anticipated to collect surface water during large flood events. Each pond has an outlet channel that connects to downstream active flow channels. The outlet channels will prevent fish stranding during periods of low flow and provide access to the ponds for fish rearing.

The ponds were designed to mimic oxbow lakes, which were historically common in the Puyallup River floodplain. The pond shapes designed for the project site are variable in form, characteristic of the remnant oxbow ponds observed in the Puyallup River floodplain (Herrera, 2013d). The outer dimensions are also based on how the ponds fit in the context of the site and surrounding hummocks, channels and existing native vegetation to be preserved.

The design dimensions of the ponds include a maximum bottom width of approximately 20 to 65 feet, top width of approximately 50 to 90 feet, depth of approximately 5 to 6 feet, and length of approximately 200 to 300 feet. The side slopes of the ponds range from approximately 1.5:1H to 7.5:1V (horizontal distance to vertical distance). The outer edges of the pond are designed to support a fringe zone of emergent vegetation for amphibian breeding habitat.

Sediment Transport and Erosion/Accretion

Sediment will be managed by natural processes encouraged as part of the proposed holistic design for this project. The floodplain channels will not be fixed in one place over time. The channels will be susceptible to bank erosion and formation of meanders and bars over time, moderating and managing the transport of sediment through the site.

The site is designed to accommodate sediment accretion. Sediment deposition (with corresponding scour) will form desired micro-topographic features over time. Deposition will occur in both the channel and floodplain. Sediment delivery to the site appears to be metered from the off-site upstream alluvial fans at the valley edge, depositing sediment at the confluences of the upstream tributaries with Clear Creek, and sequestration of sediment forced by the constriction of the railway. As such, deposition of sediments on site will be variable and it is unlikely that large volumes of sediment will be deposited at one time. What sediment does deposit should not be of sufficient quantities to stress proposed vegetative communities or initiate large-scale colonization of invasive species. The design includes features such as varying bed topography, large wood structures, and benches that will encourage deposition in multiple areas, but these are targeted processes and the vegetative communities planned in these areas are adaptable to such disturbances.

Sediment deposition is expected on streamside benches and in the broad wetland floodplain amongst hummocks. In these areas, planned vegetation includes tree and shrub species that are adapted to floodplain conditions and gradual accumulations of sediment (e.g., black cottonwood, alder, willows, etc.).

Furthermore, native vegetation cover across the site will be monitored and maintained for a minimum of 10 years with the objective of establishing dense cover of native species and controlling cover of invasive vegetation. Sediment accretion patterns and depths will be used to inform replanting decisions (e.g., species and density), if necessary, during maintenance and contingency actions. Toward the end of the monitoring period, shade expected from native cover will prevent reed canarygrass growth in areas of accumulated sediment.

HUMMOCK DESIGN

Hummocks of varying size are proposed throughout the mitigation bank site within wetland rehabilitation and wetland re-establishment areas (Figure 5). Hummocks play an important role in natural floodplain wetlands throughout the Puget Sound Lowlands by providing habitat complexity. The varied elevation ranges created by the hummocks provide habitat for different species of fauna, from macroinvertebrates and amphibians to birds and small mammals. In addition, the elevation differences create a range of hydrologic conditions across the hummock, providing for a diverse range of vegetation. The functions of hummocks are integral to the overall function of the floodplain wetland ecosystem.

The hummock design is related to the quantity of conifer trees that each hummock can support. The design includes two hummock shapes (round and oblong) of three different sizes (small, medium and large). The hummocks support varying quantities of conifer trees based on the size of the hummock, assuming trees spaced 10 feet on center. The design also assumes no conifers would be planted on the outer 10 feet of each hummock, as this zone could be too wet for conifers (particularly on the southern portion of the site where wetter conditions are modeled).

The hummocks were sized to adequately anchor large wood structures. Most of the hummocks will have between one and three wood structures corresponding to the size of the hummock. Each structure consists of two crossing logs with root wads attached. The wood structures will be embedded on the southern side (facing into the direction of flow). Wood structure design details are presented in the Basis of Design plans (Herrera, 2013d).

Over time, natural channel migration and erosion processes are anticipated to change the dimensions and alignment of the proposed hummocks. However, to allow for establishment of planned vegetation communities and in-stream habitat, some of the hummocks will be strategically positioned along the channels and within the floodplain to minimize short-circuiting of channel length due to avulsion.

The hummocks are designed to be a maximum height of 2.5 feet above the surrounding wetland floodplain elevations. After removing approximately 12 inches of soils containing reed canarygrass, the hummocks will be approximately 1.5 feet above existing grades on the mitigation bank site. Each hummock has approximate 3:1 side slopes up to a height of 2 feet. The tops of the hummocks are gently sloped and crowned to a maximum height of 2.5 feet. The height of the hummocks will prevent flooding of the top surfaces during the 6-month recurrence flow. Depending on the location of the hummocks on the site, the upper surfaces may be too dry to develop wetland indicators (e.g., hydrophytic vegetation, wetland hydrology and hydric soils). Should that occur these upland hummock patches will still function as part of a wetland mosaic coniferous benches and, as such, will be considered as jurisdictional wetland (USACE, 2010).

LARGE WOOD STRUCTURE DESIGN

Several large wood structures are proposed across the mitigation bank site including in-channel and floodplain structures. Wood structure design details are presented in the Basis of Design plans (Herrera, 2013d). In-channel deflector structures will be installed in the existing channel to divert flows into the new floodplain channels as presented above. In-stream meander roughening structures, channel roughening structures, and bank roughening structures are intended to provide habitat complexity. Each of these structures contains root wads within the channel exposed to flow. Over time, scour around these structures is anticipated to form pools thereby enhancing in-stream rearing and refuge habitat for juveniles and adult fish. The design profile of the main floodplain channel was modified to improve hydraulic complexity and provide variability in the flow depths by installing large wood-grade control structures (i.e., high spots) to the base of the channel. These structures also support flooding within adjacent benches and floodplain wetlands.

Structures within the floodplain will include wetland roughening structures and hummock roughening structures. These structures will provide floodplain roughening to increase hydraulic residence, and support hydraulic complexity and the natural formation of topographic complexity. Final location and orientation of hummocks and associated large wood structures will occur in the field during construction, as directed by the Port's project engineer and scientist.

RE-VEGETATION DESIGN

Re-vegetation with native plants is planned for several areas of the mitigation bank site including areas of proposed wetland re-establishment, wetland rehabilitation, and forested riparian and wetland buffer enhancement. The existing emergent wetland plant community is dominated by a near monoculture of invasive reed canarygrass where wetland rehabilitation is proposed. In addition, reed canarygrass is prevalent in the understory of the Pacific willow-dominated forested wetland community in the center of the site where wetland rehabilitation is proposed. The primary re-vegetation approach involves eradication of reed canarygrass and planting of dense native species.

Planting plans, details, and a plant schedule for the UCCMS are presented in the Basis of Design plans (Herrera, 2013d).

REED CANARYGRASS ERADICATION

Extensive portions of the wetland floodplain on the UCCMS are dominated by invasive reed canarygrass. In accordance with the Washington State *Integrated Pest Management Plan for Freshwater Emergent Noxious and Quarantine Listed Weeds* (WSDA, 2013), the approach to eradicating reed canarygrass at the UCCMS involves mechanical, cultural and chemical control methods.

The primary method of eradication will be mechanical control involving lowering the ground surface to remove soil containing the bulk root mass of reed canarygrass. The removed soil containing reed canarygrass roots will be disposed off site. The ideal depth for removal of the bulk mass of roots is 18 inches. However, in most areas, a depth of 12 inches is proposed for removal, which was determined based on hydraulic modeling analyses to maintain higher elevation wetland zones that will not be inundated year-round (Herrera, 2012). Excavation to a depth of 18 inches in all areas dominated by reed canarygrass would result in excessive flooding conditions during high base flow events and a reduction in variability of flooding conditions across the site, which limits support of diverse wetland vegetation communities. However, removal of 18 inches is planned wherever possible such as along the proposed channels, adjacent lower elevation bench habitats, ponds, and areas currently not inundated for most of the year based on well data.

In advance of construction and excavation activities, starting in 2013 and extending through the spring of 2014, the Port is controlling reed canarygrass by implementing a combination of mechanical and chemical controls. This method involves treatments of mowing followed by glyphosate herbicide application. After mowing, reed canarygrass shoots are allowed to grow to low height followed by herbicide application. Herbicide is being applied in mid-summer (just prior to summertime dormancy) and in the late fall (just prior to frost and wintertime dieback) as recommended by the Nature Conservancy (2004) and WSDA (2013). Where monocultures of reed canarygrass occur, herbicide is being applied with a boom sprayer so that large areas can be treated in a short period of time. Where reed canarygrass occurs in the understory or in close proximity to native vegetation designated for preservation, special care is taken to avoid application of herbicide on native vegetation including use of backpack sprayers that can more accurately target. Additional measures planned to prevent recolonization of reed canarygrass after construction include spot treatments of mowing and herbicide applications. Weed matting and mulching may also be considered.

Finally, the Port is implementing control by seeding the site with native grasses following mechanical control methods. In addition, the site will be planted with native emergent, shrubs, and trees to provide soil cover and shaded conditions that limit the growth of reed canarygrass.

FLOODPLAIN WETLAND PLANT COMMUNITIES

The intent of the proposed planting plan in floodplain wetland areas of the mitigation bank site is to establish a diversity of emergent, scrub-shrub and forested native plant communities. Wetland rehabilitation and re-establishment areas will have a mix of hydrologic and microtopographic conditions, including channel benches, hummocks and pond side-slopes. To compliment these different habitats and provide vegetative diversity and structure, a variety of native species were selected that will thrive in the assorted conditions that span the site.

Benches will be located adjacent to selected reaches of the stream channel that are approximately 0.5 feet lower than the surrounding floodplain. These benches are anticipated to be inundated during the average annual flow, but only partially inundated during summer base flows (Herrera, 2012). Native emergent and scrub-shrub vegetation adapted to seasonal inundation and slow flowing water will be planted on these benches. This vegetation will help stabilize the benches, while also promoting sediment retention and providing important habitat for fish and macroinvertebrate species.

Similarly, emergent vegetation adapted to shallow inundation (less than 3 feet of depth) is proposed for planting within a narrow zone (5 to 20 feet wide) around the edges of the ponds. Scrub-shrub vegetation is proposed adjacent to the emergent pond edges to provide overhanging vegetation to support thermal regulation, fish refuge from predators, sources of macroinvertebrate prey, and detritus.

The surrounding floodplain wetlands will contain a mix of native forested and scrub-shrub vegetation communities. The species planted in these areas will be adapted to extended periods of shallow inundation and groundwater. Species such as willows, red alder, and black cottonwood will be able to withstand varying degrees of sediment accretion, which is expected to occur in various areas of the site during flood events. Furthermore, a mix of conifer tree and deciduous shrub species adapted to drier conditions will be planted on the tops of the hummocks scattered throughout the floodplain wetland. These species will add structural and species diversity to the wetland, supporting habitat for a wider range of fauna.

Over time, as vegetation on the site matures, forested and scrub-shrub wetlands are the anticipated dominant vegetation communities according to the USFWS classification system (Cowardin et al., 1979) based on the percentage of cover represented by the uppermost canopy layer. Forested wetland communities are anticipated to have a minimum of three strata consisting of emergent, shrub, and tree species; whereas scrub-shrub wetland communities will have a minimum of two strata consisting of emergent and shrub species.

FORESTED BUFFER PLANT COMMUNITY

The forested riparian buffer to be planted on the mitigation bank site will serve to protect the stream and floodplain wetland, while also providing upland habitat to a variety of species. Existing structures within the buffer will be removed and the buffer will be planted with a mix of native coniferous and deciduous trees, and shrubs that are typical of functioning riparian and wetland buffers throughout the Puget Sound Lowlands. This densely planted vegetation will screen the floodplain from surrounding land uses, trap and filter sediment from stormwater runoff, and provide habitat to various birds, mammals and insects.

SOIL PREPARATION, SEEDING, FERTILIZING, PLANTING AND IRRIGATION

Soil Preparation

Upon achieving final grade and prior to seeding and stabilization, the contractor and the Port's representative will assess the graded areas for excessive soil compaction. Areas that exhibit excessive soil compaction will be cross-ripped or tilled using a bulldozer or tractor fitted with ripping tines or a tiller. Care will be taken to ensure cross ripping maintains the dimensions of graded depressions. Light ripping may be necessary over hummocks to ensure adequate lofting of soils and optimum conditions for planting trees and shrubs.

Seeding

To prevent soil erosion and support native revegetation efforts, disturbed areas will be seeded with certified weed free, native grass mixes. Different seed mixes will be applied to wetland and upland areas (Table 4). In addition to native species, sterile wheatgrass seed will be applied to disturbed areas to prevent soil erosion. The quick germination rate of wheatgrass quickly stabilizes soil, and the sterile nature prevents additional germination and growth during the following year allowing native grass species to thrive.

To support maximum germination rates, seeding will occur during two windows including between September 1 and October 1, and between March 1 and May 15. In general, seeding will occur in the fall and, as necessary, overseeding will occur in the spring. If adequate soil moisture is present, seeding may occur outside of these seeding windows during the growing season (May 16 to August 31). For example, if excessively wet soil conditions are present during construction, localized areas may be seeded as grading and structure installation is completed, and temporary access (spur roads, wetland mats) are removed. If seeding occurs outside of the seeding windows in absence of adequate soil moisture, supplemental irrigation or temporary cover techniques will be implemented.

TABLE 4. COMPOSITION OF SEED MIXES FOR THE UPPER CLEAR CREEK MITIGATION SITE

Scientific Name	Common Name
Wetland Seed Mix	
Beckmannia syzigachne	American sloughgrass
Deschampsia caespitosa	Tufted hairgrass
Elymus glaucus	Blue wildrye
Festuca rubra	Red fescue
Glyceria occidentalis	Western mannagrass
Triticum aestivum X	Sterile wheatgrass (Regreen)

Scientific Name	Common Name
Upland Seed Mix	
Bromus carinatus	California brome
Elymus glaucus	Blue wildrye
Festuca rubra	Red fescue
Triticum aestivum X	Sterile wheatgrass (Regreen)

Seeding will be accomplished by hydroseeding, drill seeding, or hand seeding, and will be applied at the rates and composition specified on the project plans (Herrera, 2013d). If hydroseeding is conducted, a two-pass method will be implemented with the first pass intended to maximize seed contact with the soil surface, and the second pass intended to cover the seed with mulch. The first pass will consist of seed, water, organic fertilizer, tackifier, and a small amount of hydromulch to be used as a tracer. The second pass will consist of tackifier and hydromulch. In areas that are drill seeded or hand seeded, organic fertilizer may be applied separately and a thin layer (approximate 1-inch depth) of wood-strand mulch will be applied after seeding to protect the seed and prevent soil erosion.

Fertilizing

Disturbed areas requiring seeding will be fertilized with a slow release natural organic fertilizer. The fertilizer will support seed germination and growth of plants from seed (grasses), and bare root, live stake, and container stock. Fertilizer rates will be provided in the contract specifications.

Planting

Planting will include native trees, shrubs, groundcovers, ferns, and emergent species (Table 5) proposed within emergent, scrub-shrub, and forested zones as indicated on the project plans (Herrera, 2013d). Standard spacing will apply to planted vegetation including 10 to 12 feet on center for trees, 5 feet on center for shrubs, and 1.5 or 2.5 feet on center for groundcover, ferns, and emergent species. Containerized plant stock will be planted immediately before or during the dormant period from October through March, following earthwork and seeding (may occur after year 1 or 2). All bare root emergent species will be installed between March 1 and March 31. The timing of installation will also depend on flooding and soil surface saturation levels. For example, live stake and emergent planting may occur after March to avoid flooded conditions. No plant installation will occur during freezing conditions or the summer dry season.

TABLE 5. COMPOSITION OF NATIVE PLANTS FOR THE UPPER CLEAR CREEK MITIGATION SITE

Stratum	Scientific Name	Common Name
Tree	*Acer macrophyllum*	Big-leaf maple
	Alnus rubra	Red alder
	Crataegus douglasii	Black hawthorn
	Fraxinus latifolia	Oregon ash
	Populus balsamifera	Black cottonwood
	Populus tremuloides	Quaking aspen
	Picea sitchensis	Sitka spruce
	Pinus monticola	Western white pine
	Pseudotsuga menziesii	Douglas fir
	Rhamnus purshiana	Cascara
	Salix lasiandra	Pacific willow
	Thuja plicata	Western red cedar
	Tsuga heterophylla	Western hemlock
Shrub	*Acer circinatum*	Vine maple
	Amelanchier alnifolia	Serviceberry
	Cornus sericea	Red-twig dogwood
	Corylus cornuta	Beaked hazelnut
	Holodiscus discolor	Oceanspray
	Lonicera involucrata	Black twinberry
	Malus fusca	Crabapple
	Oemleria cerasiformis	Indian plum
	Physocarpus capitatus	Pacific ninebark
	Ribes divaricatum	Spreading gooseberry
	Rosa pisocarpa	Peafruit rose
	Rubus parviflorus	Thimbleberry
	Rubus spectabilis	Salmonberry
	Sambucus racemosa	Red elderberry
	Salix geyeriana	Geyer's willow
	Salix hookeriana	Hooker's willow
	Salix sitchensis	Sitka willow
	Symphoricarpos albus	Snowberry
	Vibernum edule	Highbush cranberry

Stratum	Scientific Name	Common Name
Groundcover / Fern	*Athyrium filix-femina*	Lady Fern
	Polystichum munitum	Sword fern
	Rubus ursinus	Pacific blackberry
Emergent	*Carex obnupta*	Slough sedge
	Carex stipata	Saw-beak sedge
	Carex utriculata	Beaked sedge
	Juncus tenuis	Slender rush
	Scirpus acutus	Hardstem bulrush
	Scirpus microcarpus	Small-fruited bulrush
	Sparganium emersum	Narrow-leaf bur-reed

Irrigation

To prevent plants from drying out, plants will be irrigated during the first summer following planting (years 1 and 2). This will be particularly important for plants on the upper elevations of hummocks and within the buffer areas. Irrigation may consist of a temporary system, and could include an above ground system or a water truck. Irrigation will occur approximately once every 2 to 3 days during the summer and early fall, depending on the outside temperatures, recent precipitation and surface saturation levels.

CONSTRUCTION TIMING AND SEQUENCING

Construction grading is expected to start during summer 2014. The in-water work associated with the existing Clear Creek channel will occur during the approved in-water fish protection work window (anticipated to be July 16 through August 31), which includes construction of flow deflector structures, alcoves, bank roughening structures, and removal of soil berms to connect the existing channel to the new floodplain channels.

Earthwork and planting at the UCCMS will be sequenced over two construction years due to the size of the project and the short, summer construction season so these activities occur when the site is not flooded or excessively wet. The first year (year 1) will focus efforts on the downstream, northern half of the site, including floodplain excavation of soils containing reed canarygrass (shoots, seed, and roots), construction of elevated hummocks, installation of large wood structures, and construction of channels. Construction may include constructing a portion of the floodplain channel network on the south half of the site. Temporary Erosion and Sediment Control (TESC) measures will be implemented to minimize and prevent release of turbid water into Clear Creek in accordance with the Stormwater Management Manual for Western Washington (Ecology, 2012b).

Year 2 will focus efforts on the upstream/south half of the site, including many of the same activities occurring in year 1. Year 2 activities will include construction of ponds, removal of the existing sidecast berm, connection of the new floodplain channels to the existing channel at the upstream end of the site, and construction of alcoves and installation of large wood structures along the right bank of the existing channel. Upon completion of each phase or portion of earthwork, the site will be stabilized (e.g., seeding, temporary cover). In addition, year 2 activities will include demolition of residential structures (house, shed, well house, barn, concrete pads, and associated driveways and walkways) on the northeast portion of the UCCMS where buffer enhancement is proposed.

Construction sequencing will ultimately be determined by the contractor. Given the wet soil conditions, the project will require complete stabilization following earthwork activities each year. A north-to-south construction sequencing will be required to control and manage water during construction. The following provides the most likely earthwork sequencing for years 1 and 2.

Year 1 (Northern Portion of UCCMS)

1. Install primary access roads and secondary spur access roads. The primary access roads will be constructed parallel to one side of the new floodplain channel alignments. The secondary spur roads will provide access to wetland mats where localized excavation will take place (i.e., local excavation zones). Length and spacing of spur roads will be dependent on the excavator weight, reach and size of wetland mats.
2. Place wetland mats in a local excavation zone. The size of the local excavation zone will be based on the number of wetland mats and reach of the excavator used (dependent on the excavator weight and size of mats). Several zones are anticipated.
3. Excavate surface soils (approximately 1 foot depth) containing reed canarygrass.
4. Haul and stage reed canarygrass soils on site for dewatering and decanting, followed by off-site haul and disposal.
5. Excavate and grade upland soils where wetland re-establishment is proposed.
6. Construct hummocks using soils excavated from the wetland re-establishment area.
7. Construct large wood structures in the floodplain.
8. Grade final contours in local excavation zone.
9. Relocate wetland mats to the next local excavation zone.
10. Remove spur access roads when no longer necessary as local excavation zones are moved.
11. Repeat steps 3 through 10 until all of the following are complete: floodplain excavation, reed canarygrass removal, hummock construction, and construction of large wood structures in the floodplain.
12. Remove spur access roads from both the upstream and downstream ends of the work area, and excavate floodplain channels and benches to final grade.
13. Install large wood structures in floodplain channels.
14. Install maintenance bridges over floodplain channels.
15. Remove primary access road.
16. Remove sidecast berm to connect downstream extent of floodplain channel to existing channel.
17. Seed and install plants.

Year 2 (Southern Portion of UCCMS)

1. Install primary access roads and secondary spur access roads for year 2 construction of the south portion of the site. The primary access roads will be constructed parallel to one side of the new floodplain channel alignments. The secondary spur roads will provide access out to wetland mats.
2. Repeat steps 2 through 11 (from year 1). In addition, floodplain activities for year 2 include excavation and grading of floodplain ponds, and filling of an agricultural ditch.
3. Stage all logs required for the existing channel on the existing sidecast berm.
4. Remove spur access roads from the upstream end and excavate floodplain channels and benches to final grade.
5. Install large wood structures in floodplain channels.
6. Install maintenance bridges over floodplain channels on southern portion of site and install temporary bridge over the new floodplain channel at the downstream (northern) end of the existing sidecast berm to provide temporary access on sidecast berm.
7. Remove primary access road.
8. Remove a portion of the existing sidecast berm to divert water into the upstream main floodplain channel followed by installation of large wood flow deflector structure in existing channel.
9. Construct alcoves and bank roughening structures along right bank of existing channel between the two large wood flow deflector structures followed by removal of additional sidecast berm and stabilization with seeding after final grading is achieved.
10. Remove a portion of the existing sidecast berm at the downstream, secondary floodplain channel location, followed by installation of large wood flow deflector structure in existing channel.
11. Construct alcoves and bank roughening structures along the right bank of existing channel north of the secondary floodplain channel inlet/large wood flow deflector structure.
12. Remove remaining portions of existing sidecast berm followed by stabilization with seeding.
13. Remove temporary access bridge over downstream end of the existing sidecast berm.
14. Demolish house, barn, woodshed, well house, concrete pads, and associated driveways and walkways.
15. Seeding and plant installation.

WETLAND MITIGATION ACTIVITIES

Three types of wetland mitigation activities are proposed at the mitigation bank site including wetland re-establishment, wetland rehabilitation, and forested riparian buffer enhancement (shown on Figure 5). Wetland re-establishment and rehabilitation are forms of restoration, and are defined below according to Ecology (2006).

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purposes of tracking net gains in wetland acres, restoration is divided into:

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former wetland. Re-establishment results in rebuilding a former wetland and results in a gain in wetland acres and functions. Activities could include removing fill, plugging ditches or breaking drain tiles.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions and processes to a degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres. Activities could involve breaching a dike to reconnect wetlands to a floodplain or returning tidal influence to a wetland.

Wetland re-establishment is proposed in the northeast portion of the site and where the sidecast berm is located along the right bank of the existing Clear Creek channel. Wetland re-establishment will be achieved by removing invasive vegetation and fill to an elevation similar to the existing adjacent wetland. Then, habitat features will be installed (e.g., hummocks, large wood structures) and the site will be planted with native vegetation.

Wetland rehabilitation is proposed on most of the site. The primary actions in support of wetland rehabilitation involve returning riverine functions to the site by removing the sidecast berm adjacent to the existing Clear Creek channel and realigning several new channels through the site. In addition, rehabilitation actions include constructing riverine floodplain ponds and outlet channels, reed canarygrass eradication, filling an agricultural ditch, and constructing habitat features.

To protect the restored functions of Category I re-established and rehabilitated wetlands, an 110-foot-wide enhanced forested upland buffer is proposed on the northern and eastern sides of the site where existing uplands occur. Enhancement measures involve planting this upland area with native shrubs and trees that over time will develop into a forested community. According to PCC 18E.30.060, the standard buffer width for a Category I wetland is 150 feet; however, the width can be reduced to 110 feet if measures are taken to minimize the impact of surrounding land uses. To prevent disturbance from humans and pets, impact minimization measures proposed for the mitigation bank site include planting the buffer with dense native vegetation and installing new fencing or maintaining existing fencing at the outer limits of the buffer.

In accordance with joint regulatory agency guidance (Ecology, 2012a; requirements 1.d. and 1.e, pp. 5 and 6), the mitigation bank site will provide the following approximate mitigation areas and quantities. These areas are shown on Figure 5.

- 4.17 acres of wetland re-establishment including hummocks
- 22.06 acres of wetland rehabilitation including:
    - 11.92 acres of eradicated reed canarygrass and replacement with restored scrub-shrub and forested floodplain wetland including hummocks
    - 8.20 acres of rehabilitated forested wetlands by restoring riverine wetland hydroperiod

- 0.81 acres of emergent and scrub-shrub benches adjacent to the realigned Clear Creek channel
- 0.67 acres of floodplain ponds
- 0.39 acres and 1,200 linear feet of floodplain channels including the realigned Clear Creek main channel and pond outlet channels
- 0.07 acres of alcoves on the right bank of the existing Clear Creek channel
- 0.82 acres of forested riparian buffer enhancement

LOWER WAPATO COMBINED HABITAT PROJECT

Site Description

The Port of Tacoma is planning to use nearly 20 acres of its land that has been filled with dredge material for decades to restore an intertidal estuary complex of tidally influenced meandering channels, mudflats, marsh, forested wetland and riparian complex near the mouth of Wapato Creek and Commencement Bay, hereafter referred to as the Lower Wapato Combined Habitat Project (LWCHP). The Port of Tacoma proposes to create mitigation bank credits for future unavoidable wetland and/or stream impacts by Port development projects. The proposed mitigation project is to relocate and remeander Wapato Creek, restoring the Creek's historic location to the extent possible given other site constraints. By meandering the Creek through the site and creating a more gradual bank slope, the proposed design reestablishes tidal wetlands and floodplain connectivity, and expands and improves tidal rearing and foraging opportunities for juvenile salmonids, including threatened juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*O. mykiss*), as well as chum salmon (*O. keta*) and Coho salmon (*O. kisutch*), and habitat for shorebird assemblages. The proposed project will also correct an existing partial fish passage barrier, allowing for greater use of upstream habitats by anadromous salmonids, including federally listed steelhead trout, as well as chum and Coho salmon.

Site Selection

Commencement Bay and the Puget Sound Nearshore have received development pressure since the late 19th century. In this approximately 150 years, the natural shoreline has been highly impacted and altered. According to the US Army Corps of Engineers (USACE) (1993) habitat conversion, simplification, and destruction has significantly changed the configuration and extent of the estuarine habitats in Commencement Bay. It is estimated that only 180 acres of the original 2,100 acres of historic intertidal mudflats remain. An estimated 98.7 percent of the original 3,900 acres of emergent marsh and wetland have been lost. These important salmonid habitats have been replaced by hundreds of acres of subtidal and shallow subtidal open water.

Three events highlighted the damage to salmonid habitat in Commencement Bay; the Commencement Bay Nearshore/Tideflats Record of Decision (1989), the listings of Puget Sound Chinook (1999) and steelhead trout (2007) under the Endangered Species Act. These events and their associated research, studies and reports helped to identify limited habitat features, impacted watershed processes, and high priority areas for restoration and protection. These efforts identified extensive loss of floodplain connectivity to off-channel rearing habitat, lack of habitat diversity for salinity adaptation (osmoregulation), and extensive loss of estuarine habitat for foraging and rearing as the largest obstacles to reestablishing healthy sustainable salmon runs (Commencement Bay Natural Resource Trustees et al., 1997; Kerwin, 1999; and Pierce County, 2008).

Guidance for the establishment of mitigation sites by regulatory agencies emphasizes the importance of mitigation site selection. The location chosen should possess the physical, chemical, and biological characteristics necessary to accomplish the goals and objectives of the mitigation site (USEPA, 1995). Mitigation site location, to the extent possible, should occur in the same geographical location (Water Resource Inventory Area [WRIA]) as the impacts unless a watershed restoration plan identifies other priority habitats or ecological processes that should be targeted. Overall, the site selected should be ecological suitable and self-sustaining.

LWCHP site is an ideal location for a mitigation bank site. The nearly 20-acre site is located within WRIA 10, and will provide high ecological functions by providing habitat identified and prioritized by resource agencies (Commencement Bay Natural Resource Trustees, et al., 1997) and conservation groups (Kerwin, 1999; Pierce County, 2008). This mitigation bank site will provide multiple environmental habitats and functions lacking in Commencement Bay and the lower Puyallup River Watershed including wetland mitigation, fish and wildlife enhancement, flood control, buffers between industrial and residential land and public access opportunities.

Historically, Wapato Creek supported runs of chum, Chinook, and Coho salmon and cutthroat and steelhead trout. This mitigation bank project follows the goals and objectives set by NOAA NRDA Trustees, Puget Sound Chinook Salmon Recovery Plan and Pierce County's Salmon Habitat Protection and Restoration Strategy. This project will provide habitat types that are very limited in WRIA 10, increase habitat function relative to existing conditions, and provide habitat that directly supports juvenile salmonids and indirectly benefits other species. Specific functional objectives for this project include increasing acreage of tidally influenced habitat available to juvenile salmonids, providing mudflat, freshwater and intertidal marsh/wetlands, providing an osmoregulatory adaptation/transition zone, and increase export of salmonid prey.

Existing Conditions

The environmental baseline conditions within the action area are degraded. The baseline conditions that salmonids presently face in the Wapato Creek basin of the Puyallup Watershed are a result of considerable human alterations to the environment. These alterations have included significant and pervasive land use changes throughout the watershed, altering the landscape from its original old-growth forested condition. In the late 1800s and early 1900s, the basin was cleared of its original, old-growth forest and areas of the basin were subsequently used primarily for scattered residential and agricultural purposes.

The reduction in large woody material in the stream channels due to timber harvest and associated loss of recruitment has reduced available cover, habitat heterogeneity, and channel stability. Increased summer temperatures have likely resulted from a reduction in shade following clearing of riparian vegetation, water withdrawals, and, possibly, increasing summer air temperatures due to climate change. Timber harvest, expanding road networks, and urbanization have increased both the frequency and magnitude of discharges during storm events in the upper reaches; however, a diversion structure intercepts much of the high flow and diverts it to the Puyallup River (WSDOT, 2006).

Wetland Conditions

The Watershed Company (2012) and Grette Associates (2008) conducted wetland investigations on the LWCHP site. Grette delineated six areas and The Watershed Company eight areas that meet wetland characteristics (Figure 6). The wetland covers approximately 1.26 acres of the LWCHP.

The wetlands on the LWCHP site are the result of intentional and predicted differential settlement of legally placed dredge fill. Wetland F, a created and maintained ditch, consists of approximately 1 acre of degraded palustrine wetland. The delineated wetlands were all rated as Category IV, except for Wetland F, which is a Category III using Ecology's *Washington State Wetlands Rating System for Western Washington – Revised* (Hruby, 2004). All LWCHP wetlands were found to be non-jurisdictional by the USACE and are regularly mowed and maintained by Port of Tacoma maintenance staff.

Wetland Vegetation

The depressional wetlands located at the LWCHP site are dominated by emergent and invasive vegetation. Wetlands A, C and E are dominated by reed canarygrass (*Phalaris arundinacea*) and rettop (*Agrostis gigantean*). Rush species, mainly Baltic rush (*Juncus balticus*) and soft rush (*Juncus effuses)* generally dominate Wetlands B and F. Wetland D has large areas of bare ground and hard hack (*Spiraea doughlasii*). The uplands adjacent to the wetlands are mainly covered in Scotch broom (*Cytisus scoparius*), Common velvet-grass (*Holcus lanatus*), and Colnial bentgrass (*Agrostis tenuis*). A history of on-going vegetation is evident by the large areas of sparse vegetation from mowing and spraying of herbicides.

Wetland Hydrology

The wetlands at the LWCHP site appear to receive most of their water from direct precipitation and surface water runoff from the adjacent upland areas. Standing water was observed in Wetlands A, E and F. No water was found in Wetlands B and D during the wetland delineation, yet primary indicators of wetland hydrology were observed. There is no surface water connection between the wetlands and Wapato Creek.

Previous hydrological studies indicate groundwater levels are highest on the eastern side of the study area (ranging from approximately 12 to 18 feet mean lower low water [MLLW]) and lower in the center of the study area, just east of Wapato Creek (ranging from approximately 10 to 12.5 feet MLLW). Groundwater exhibits significant seasonal fluctuations, but very little fluctuation with tidal variation in Wapato Creek (no more than 0.15 feet in any location). No salinity was recorded in groundwater samples.

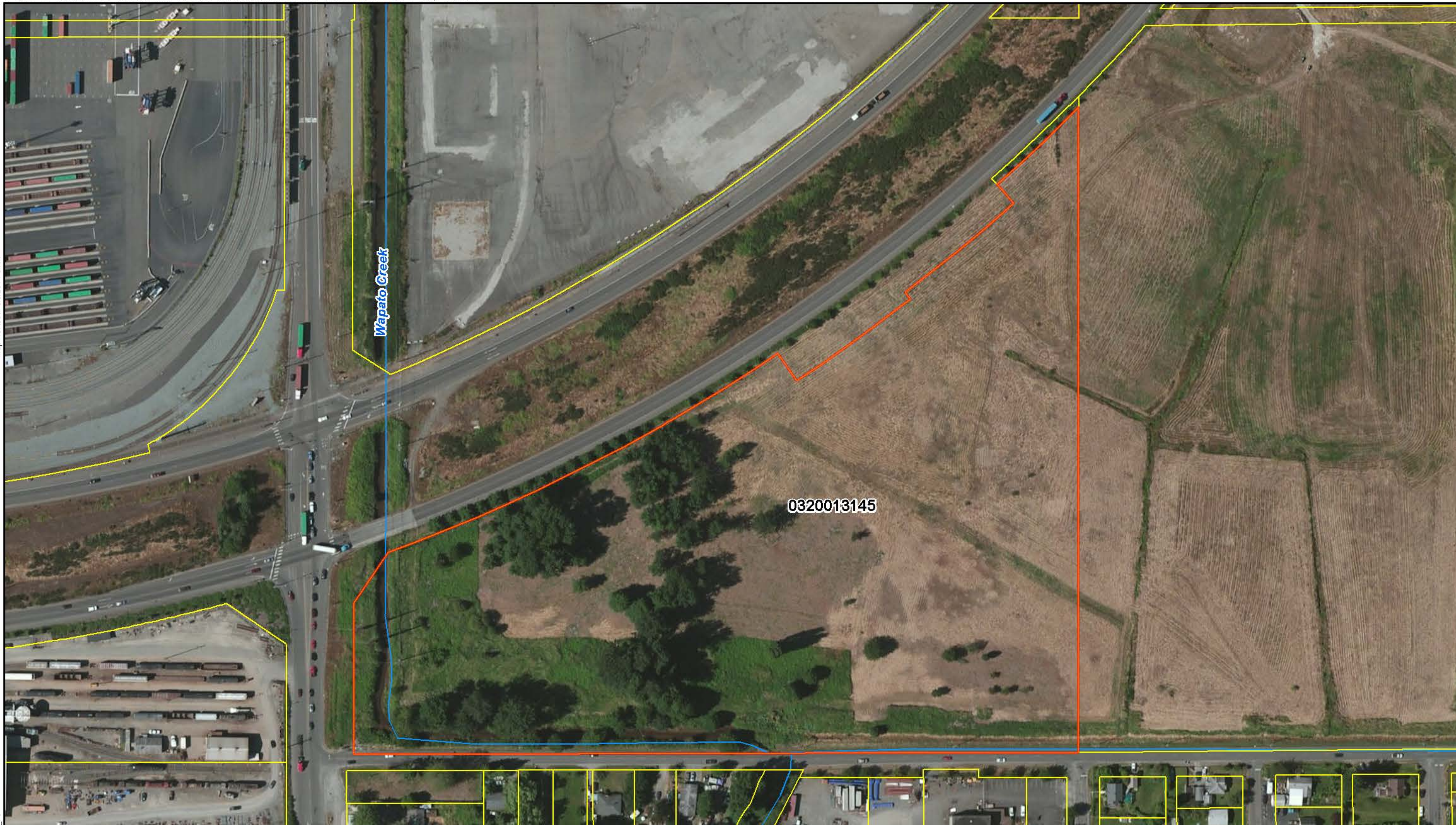

Figure 6. Lower Wapato Combined Habitat Project

0 100 200 300 400
Feet

Lower Wapato Combined Habitat Project

Tax Parcels

Reference: Parcel data obtained from Pierce County. Aerial imaery obtained from i-cubed.
All other features digitized from Port of Tacoma Port Wide Habitat Mitigation report (Herrera 2013).

Notes: The locations of all features shown are approximate. This drawing is for information purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute any warranty.

Port of Tacoma

Map Revised: 5/9/2014 smm

Office: TACO Path: Prospectus_F6

Wetland Soil

Soils within the LWCHP site and associated wetland are mapped as fill according to the United States Department of Agriculture, Natural Resources Conservation Service web soil survey (USDA/NRCS 2014). The bulk of the fill was hydraulically placed dredge spoils that occurred over the period from the mid-1960s to 2008. This fill ranges in thickness, but is an average of approximately 6 to 8 feet thick. It is underlain by native tideflat sediments consisting of alluvial sand and silt deposits (GeoEngineers Geotechnical site investigation, 2010).

Soil test pits were examined to depths up to the point of resistance, which averaged between 6 and 16 inches. Soil profiles consisted of a dark grayish-brown (10YR4/2) loamy sand with strong brown (7.5YR 4/6), numerous, small, distinct mottles. Soil profiles within wetland areas met the F3 hydric soil indicator (depleted matrix) as described in *Field Indicators of Hydric Soils in the United States Version 6.0* (USDA/NRCS, 2010).

Wetland Functions

Water quality, hydrologic and habitat functions of Wetlands A through F were assessed by Grette (2008) to determine the Category rating using Ecology's *Washington State Wetlands Rating System for Western Washington – Revised* (Hruby 2004). Supplemental qualitative ratings (high, medium, low) are presented in Table 6, which were determined based on Ecology (2008) guidance.

TABLE 6. WETLAND FUNCTION SCORES AND RATINGS

Wetland ID	Water Quality Functions Rating[a]		Hydrologic Functions Rating[a]		Habitat Functions Rating[a]		Total Score	2004 Ecology Rating Category[b]
	Score	Opportunity	Score	Opportunity	Score	Opportunity		
A	7	Low	6	Low	11	Low	24	IV
B	5	Low	7	Low	10	Low	22	IV
C	8	Low	5	Low	10	Low	23	IV
D	10	Low	7	Low	10	Low	27	IV
E	8	Low	7	Low	7	Low	22	IV
F	18	Low	8	Low	10	Low	36	III

Notes:

a Qualitative ratings based on Ecology (2008) guidance.

b Wetland category based on the 2004 Ecology rating system (Hruby, 2004).

The wetlands found at the LWCHP site have a low rating for potential to improve water quality. The depressional wetlands are isolated from Wapato Creek, limiting the amount of water that passes through them. The wetlands only receive water from direct precipitation and limited surface water runoff from the adjacent upland areas.

The potential for the isolated wetlands to reduce flooding and erosion is also low at the LWCHP site. Because of the site location and the lack of connection between the wetlands and Wapato Creek, it is very unlikely to provide any flood storage capacity in its current configuration. The potential to reduce erosion is also low due to the fact the wetland area does not receive fine material.

The wetlands have a low rating for potential to provide habitat functions due to the degraded nature of the site and the isolation of the wetlands. The existing depressional wetlands at the LWCHP site are inaccessible to fish in Wapato Creek or Commencement Bay. Wetland habitat functions for wildlife are also low because of several factors, including the presence of invasive species and a monoculture plant community (lack of diversity), limited hydroperiods, and simplicity of habitat features (lack of large wood, standing snags and undercut banks).

Stream and Riparian Conditions

Historically, the proposed mitigation bank area was a tidally influenced wetland or mudflats. The wetland was converted to agricultural use in the first half of the 20th Century (GeoEngineers, 2010). Between 1964 and 1968, the site was legally filled with dredge material from the expansion of the Blair and Hylebos Waterways, and the Wapato Creek channel was rerouted to its present location and configuration (GeoEngineers, 2010).

Much of the Wapato Creek channel length, including in the project area, has been straightened and otherwise channelized such that off-channel habitat no longer exists at a functional level. Adequate habitat refugia have not been identified in the Wapato Creek basin since no relatively large areas of undisturbed habitat are present. Development in the basin has been broadly distributed and pervasive.

Few pool and riffle sequences are present along the existing, channelized project reach; however, significant pools are not anticipated in this type of tidal environment. The pools present tend to be shallow and lacking in cover. The flattening gradient approaching the mouth of the creek (reduced energy) and the bed load carried by the creek tend to inhibit the formation of deeper pools, particularly in the relative absence of woody structures or other partial obstructions to cause scour.

Streambed substrate adjacent to and within the project area consist primarily of small gravel with sandy fines at the upstream end near 12th Street East and becoming even sandier and siltier proceeding downstream. The lower banks are armored with rock at the culvert outfall at 12th Street East. Given the intertidal area and finer substrate materials, suitable spawning habitat is not expected and are not “not properly functioning” on that basis.

The dominant existing riparian vegetation in the area consists of reed canarygrass (*Phalaris arundinacea*), Himalayan blackberry (*Rubus armeniacus*), Douglas hawthorn (*Crataegus douglasii*), a few small willows and black cottonwood (*Populus balsamifera*). Salt-tolerant vegetation occurs at the low bank elevation, including saltgrass (*Distichlis spicata*) and seaside arrowgrass (*Triglochin maritima*). The presence of salt-tolerant vegetation in the low bank elevation (approximately 9 feet above MLLW) and salt- sensitive vegetation (reed canarygrass) at higher bank elevations (beginning at approximately 12 feet above MLLW), is consistent with the measured halocline, in which the denser saltwater is situated below the freshwater originating from upstream. Only a relatively minor amount of woody structure presently exists along the lower, tidally influenced reaches of Wapato Creek, including the project area and vicinity.

Buffer Conditions

Currently, upland buffers are lacking on most of the proposed mitigation site. A limited buffer is located along Wapato Creek, parallel to 12th Street East. Buffers do not occur elsewhere on the site because the remainder of the site has historically been used for agriculture and dredge material disposal. The LWCHP site has been regularly maintained with mowing and the application of herbicides.

Typical herbaceous vegetation within the buffers consists of reed canarygrass (*Phalaris arundinacea*), rettop (*Agrostis gigantean*), rush species, hard hack (*Spiraea doughlasii*), Scotch broom (*Cytisus scoparius*), Common velvet-grass (*Holcus lanatus*), and Colonial bentgrass (*Agrostis tenuis*). Outside of the stream corridor, black cottonwood (*Populus balsamifera*), poplar, a couple of Pacific madrone (*Arbutus menziesii*), upland grasses, weeds (such as morning glory and poison hemlock), and thistles are present.

Fish and Wildlife Use

Numerous fish species utilize Wapato Creek, including federally threatened steelhead trout, chum and Coho salmon and cutthroat trout (Kerwin, 1999; WDFW, 2012; see Table 7). Federally threatened Puget Sound Chinook salmon are not identified to occur in Wapato Creek based on a WDFW Priority Habitats and Species Report (May 5, 2012) or WDFW's SalmonScape database, but anecdotal information states that they may occur infrequently in small numbers. Given the estuarine tidal nature of the project area and lack of fish passage barriers downstream from the project site, juvenile Chinook salmon could potentially access the project site on the rising tide. Current conditions at the site offer limited features characteristic of preferred juvenile Chinook salmon or other juvenile salmonids rearing in estuarine channels (e.g., low diversity in channel form or vegetation, limited overhead cover, and limited floodplain connectivity). Juvenile Chinook salmon have been documented to utilize shallow water areas in the Blair Waterway beginning in late February and extending into early summer, with the highest densities occurring between May 1 and June 30 (Duker et al., 1989; Grette, 2004). Juvenile Chinook occur throughout the Blair Waterway, with high densities occurring at the mouth of the waterway and in the shallower shoreline areas throughout the waterway (Duker et al., 1989, see Figure 7). Sampling in the Blair Waterway captured approximately 660 juvenile Chinook salmon from 229 beach seine sets (Grette, 2004).

TABLE 7. SALMONID UTILIZATION OF WAPATO CREEK

Common Name	Scientific Name	Presence
Winter Steelhead Trout	*Oncorhynchus mykiss*	Documented Present
Coho	*Oncorhynchus kisutch*	Documented Present
Fall Chum	*Oncorhynchus keta*	Documented Present

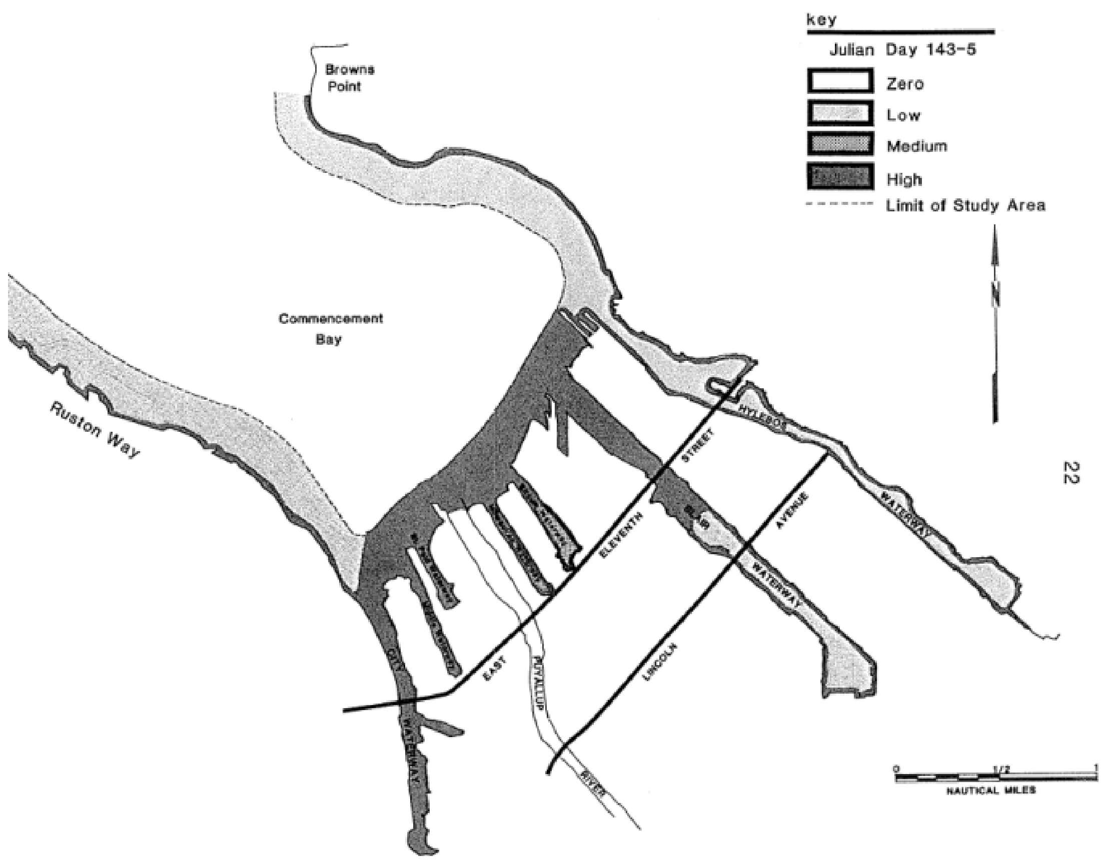

FIGURE 7. JUVENILE CHINOOK SALMON UTILIZATION

Several species of wildlife have been observed during site reconnaissance efforts and wetland reviews, including song birds, raptors and small mammals (The Watershed Company, 2012 and Grette Associates, 2008). Songbirds observed at the site include common yellowthroat (*Geothlypis trichas*), marsh wren (*Cistothorus palustris*), song sparrow (*Melospiza melodia*), Steller's jay (*Cyanocitta stelleri*), barn swallow (*Hirundo rustica*), and tree swallow (*Tachycineta bicolor*). American crow, glaucous-winged Gulls and red-tailed hawks (*Buteo jamaicensis*) were also observed at the site. Signs of small mammals were observed indicating use of the site by raccoon (*Procyon lotor*) and coyote (*Canis latrans*).

CONCEPTUAL SITE DESIGN

Site Plan

The conceptual site design intends to restore the existing ditched and confined portion of Wapato Creek to a more natural, pre-developed state with a complex and dynamic stream and associated wetland and upland habitats in a tidally influenced area of Wapato Creek. There are two potential elements to the proposed Lower Wapato project: 1) relocation of Wapato Creek from a ditch into a longer, sinuous stream channel (net gain of 1,097 linear feet of stream channel) and enhanced mud flat/shallow stream channel area (2.40 acres – 2.15 created through excavation of uplands, 0.1 acres created by partial fill of old channel, and 0.15 acres of enhanced existing habitat) with a variety of associated estuarine/wetland habitats (5.15 acres of palustrine forested wetlands and 2.23 acres of estuarine emergent wetland), and a forested upland buffer (7.22 acres) to provide an increase in the quantity and quality of fish and wildlife habitat and flood control capacity. The stream would include large woody material, pool/riffle sequences and suitable substrate. The wetland would include a variety of habitat types, as well as downed wood and snags; and 2) the optional replacement of twin 45-foot-long, 50-inch-diameter culverts carrying Wapato Creek under 12th Street East with a single, 80 foot-long, 19-foot-wide bottomless culvert.

Stream Relocation and Extension and Wetland Restoration

The proposed design will relocate, re-meander and extend the upper tidal reach of Wapato Creek, in the process restoring the Creek's historic location and function to the extent possible given other site constraints. The length of the relocated channel section will be approximately 1,926 feet compared to 829 feet for the existing, to-be-bypassed section. The existing channel is straight and ditch-like adjacent to existing roadways (Figures 8 and 9). Of the 829 feet of bypassed channel, 709 feet will be filled along 12th Street East to accommodate future widening of 12th Street East, with the rest remaining as a blind tidal channel to be partially filled to create mudflat habitat. By meandering the Creek through the site and creating a more gradual bank slope, the proposed design restores historic floodplain connectivity and creates 2.23 acres of estuarine emergent wetlands, 5.15 acres of palustrine forested wetlands, and 2.40 acres of enhanced stream channel and mudflat.

The restoration area will create significant diversity in elevation and wetland vegetation to maximize hydrologic, water quality, and habitat functions as described by Hruby (2006) and described in greater detail below.

Culvert Replacement (Optional)

The proposed LWCHP has been designed to accommodate the anticipated widening of 12th Street East to a typical three-lane road footprint that includes sidewalks and bike lanes. This standard road design increases the culvert length at the downstream end of the project by approximately 35 feet (existing: 45 feet, proposed: 80 feet). However, from an aquatic habitat perspective, the proposed culvert design more than compensates for that additional length compared to the existing condition. Wapato Creek currently passes under 12th Street East in two concrete culverts, both 50 inches in diameter with a plunge of approximately 18 inches to the base flow water surface elevation. The culverts contain no substrate and are a partial barrier to fish movement depending on the species, life stage, stream flows and tides. With an outlet invert elevation of 12.2 feet (MLLW Port of Tacoma

Datum), the existing culverts are near the upper limits of tidal fluctuation. The proposed bottomless culvert is 19 feet wide, with a gravel/cobble streambed. The proposed replacement culvert will remove the barrier and create un-impeded fish movement.

Map Revised: 3/28/2014

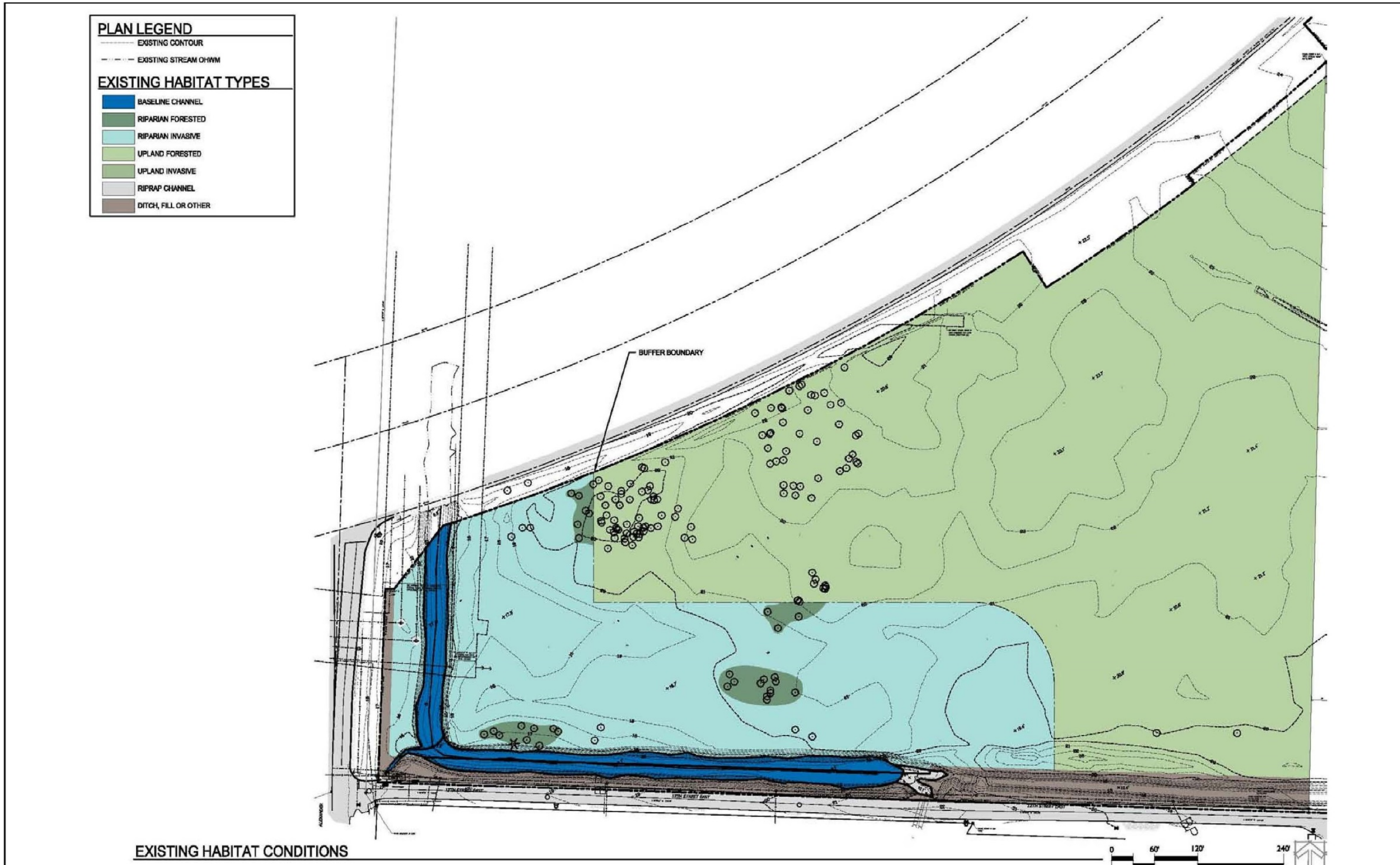

Figure 8. Lower Wapato Existing Conditions

Notes: The locations of all features are approximate. This drawing is for informational purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of Tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute and warranty.

Path: Figure8_LW_EC

Reference: Data and other features obtained from Port of Tacoma Lower Wapato Combined habitat Project Draft Advance Mitigation Site (The Watershed Company 2013).

Map Revised: 3/28/2014

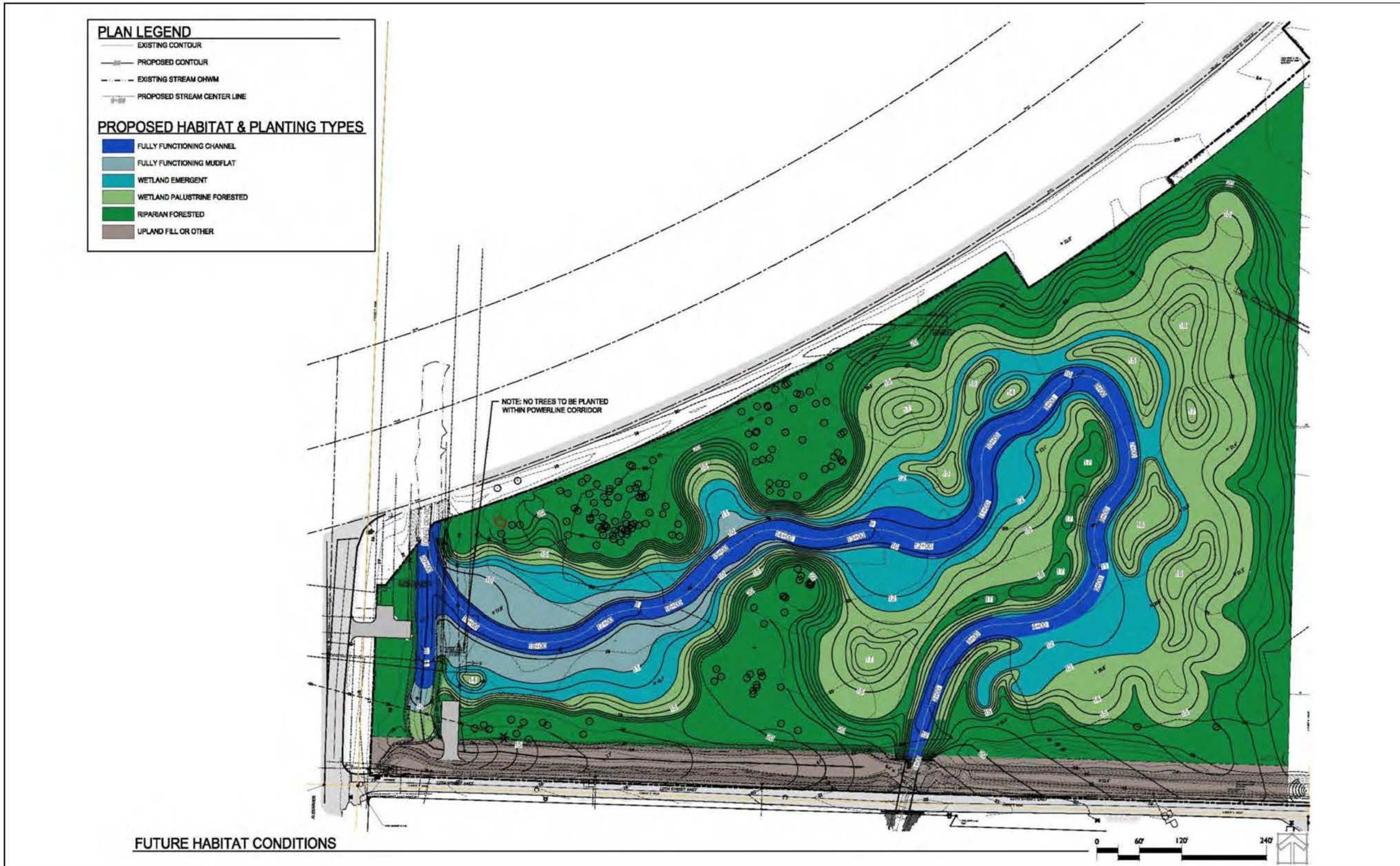

Figure 9. Lower Wapato Combined Mitigation Site
Preliminary Plan

Notes: The locations of all features are approximate. This drawing is for informational purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of Tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute and warranty.

Port of Tacoma

Reference: Data and other features obtained from Port of Tacoma Lower Wapato Combined habitat Project Draft Advance Mitigation Site (The Watershed Company 2013).

Path: Figure9_LW_PrelimPlan

CHANNEL FLOW DIVERSION, BACKWATER CONDITIONS AND IMPROVEMENTS

The conceptual design includes several types of channel flow diversion structures. Proposed structures will be placed in the constructed channel to protect stream banks, divert flow within the channel and provide habitat. These structures include fallen trees, bank logs, reventment logs and rootwads. The largest large woody material structure will be located downstream from the 12th Street culvert and will be designed to protect the bank and deflect flows into the created channel. Other channel flow diversion structures will be located throughout the LWCHP site.

The restoration area will create a broad wetland area relative to the stream channel with diverse microtopography that will slow and disperse water passing through and over the wetland. Tidal conditions should backup brackish water throughout the site. The proposed site design should also be able to attenuate high flow and flooding in Wapato Creek by providing storage and filtering area within the created wetland complex.

Several habitat improvements are proposed at the LWCHP site including:

- Excavation and creation of a new sinuous, tidally influenced stream channel
- Construction of several hummocks of varying size and vegetation composition
- Installation of five different types of large woody material structures
- Re-vegetation of upland buffers and wetlands with a diverse mixture of native grasses, emergent, shrubs and trees.

FLOODPLAIN CHANNEL AND BENCH DESIGN

The designed floodplain channel, bench and wetland elevations are based on known tidal elevations at the project site. These tidal elevations provide predictable frequency and durations of inundation at different elevations, providing confidence that wetland conditions will be achieved. Based on stream flow monitoring conducted over the course of a year (GeoEngineers, 2010) and on-site observations of existing vegetative characteristics, the approximate expected habitat continuum was determined according to proposed elevations. The proposed restoration area incorporates each of the habitat types or vegetation zones as shown in Figure 10.

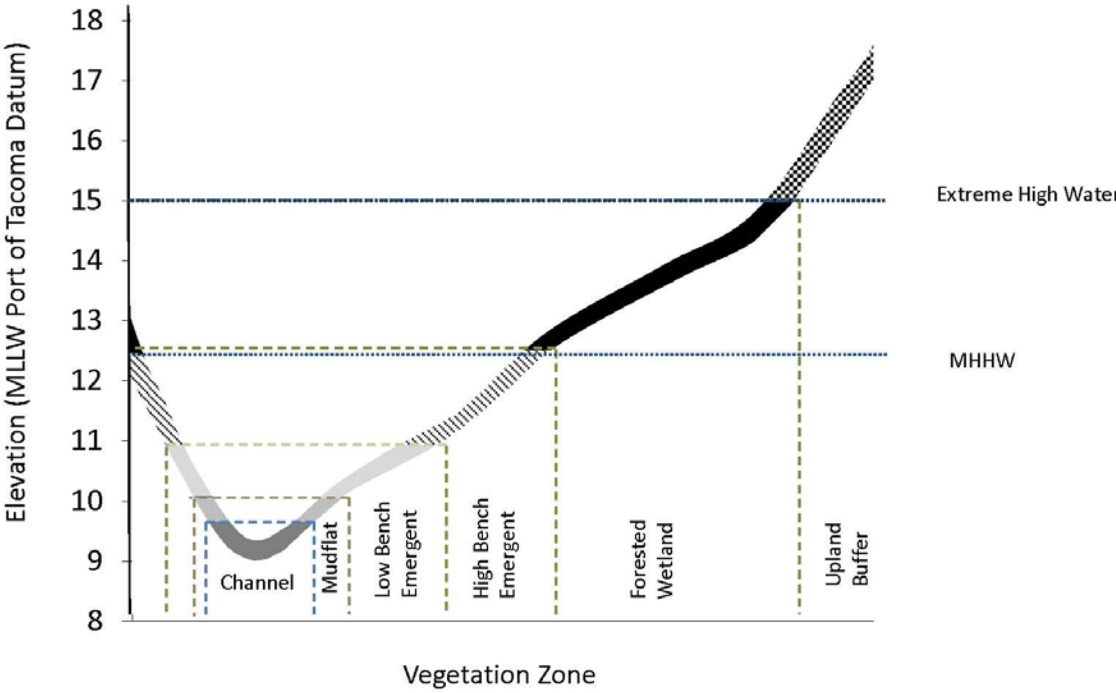

FIGURE 10. SCHEMATIC OF PROPOSED ELEVATION AND VEGETATIVE CROSS-SECTION OF THE HABITAT AREA

In the upper intertidal (11-13 feet MLLW), high bench freshwater emergent species will be planted, along with limited shrubs that tolerate frequent inundation. Lower elevation mudflats and low bench emergent areas will be concentrated in the western portion of the site where stream elevations are lower. Brackish water is expected in the lower elevations (note: this is based on field measurements collected 1 hour after high tide on June 21, 2012, where salinity in the downstream project reach ranged from 16.7 parts per thousand (ppt) at the bottom of the channel to 0.4 ppt 1 foot above the channel bottom). Natural re-colonization of salt-tolerant vegetation is expected to occur in these lower elevation sites (up to approximately 10.5 feet in elevation). Supplemental planting of salt-tolerant species, including Lyngbye's sedge (*Carex lyngbyei*), saltgrass, and seaside arrowgrass, may aid in a more rapid re- colonization of emergent cover in the low intertidal range.

Interspersion of vegetation types and marsh elevations will ensure that vegetative diversity is achieved and will limit the potential for existing invasive plant monocultures to reestablish. A gradient in elevations will allow fish access to significant areas of productive, shallow water habitat during all flows and tidal stages. The project wetland and floodplain areas will be graded to be free-draining (without closed depressions) to avoid fish stranding. Terrestrial wildlife species are expected to use the extensive large woody material and snags that are incorporated into the project design for rearing, nesting and foraging.

ALCOVE DESIGN

The conceptual design proposes to fill approximately 709 linear feet of the existing ditch-like section of Wapato Creek to create a large alcove along the western portion of the Wapato Creek Site parallel to Alexander Avenue. The alcove will resemble a large blind channel with mud flat habitat.

Sediment Transport and Erosion/Accretion

The project design is intended to allow natural sediment processes to occur within the site. The created channels will not be armored, with the exception of the large woody material structure downstream of the 12th Street culvert. The floodplain channel is expected to meander seasonally and annually and to create additional finger channels similarly to what has been observed at Place of Circling Waters Mitigation Site.

Sediment erosion and accretion was incorporated into the conceptual design. Deposition from on-site and upstream sources will form valuable mudflats or bench habitat overtime. Volumes of off-site sediments are not expected to be large and will mainly be related to stormwater events upstream. Neighboring industrial and residential properties will not be a large source of additional sediment because the proposed bioswale along 12th Avenue and the mitigation site's upland buffer should filter out most overland transportation of sediment.

Hummock Design

The restoration area is intended to provide significant habitat interspersion. Approximately 14 hummock structures of varying sizes and shapes will be created throughout the mitigation site using on-site spoils material. Forested and scrub-shrub vegetation will primarily be planted on elevated hummocks within the streamflow and tidally influenced wetlands. These hummocks will accommodate growth and survival of woody species that provide a source of future large woody material, and that are generally less tolerant of significant inundation. By maximizing habitat interspersion of forested and scrub-shrub vegetation on the hummocks with lower-elevation emergent vegetation, the restoration area will provide significant forested cover over much of the wetland.

Large Wood Structure Design

The conceptual design proposes several types of in-stream and floodplain large woody material structures. These structures include approximately 13 standing snags and 180 pieces of large woody material incorporated into structures. In-stream structures will include fallen trees, bank logs, revetment logs and rootwads and are intended to act as roughening structures and add habitat complexity. Floodplain and hummock structures will include standing snags, fallen trees and rootwads. Large woody material structures will be either partially buried, anchored or a combination of methods to prevent the structures from moving while the site is stabilizing.

Re-vegetation Design

The proposed re-vegetation design is intended to provide significant habitat interspersion and maximize protection of existing trees. Forested and scrub-shrub vegetation will primarily be planted on elevated hummocks within the wetland. These hummocks will accommodate growth and survival of woody species that are generally less tolerant of significant inundation. By maximizing habitat interspersion of forested and scrub-shrub vegetation with lower elevation emergent vegetation, the design will provide significant forested cover over much of the wetland. In the upper intertidal (11-13 feet MLLW), high bench freshwater emergent species will be planted, along with limited shrubs that tolerate frequent inundation. Lower elevation mudflats and low bench emergent areas will be concentrated in the western portion of the site where stream elevations are lower. Low-salinity water is expected in the lower elevation portion of the creek channel. Natural re-colonization of salt-tolerant vegetation is expected to occur in these lower elevation sites (up to approximately 10.5 feet in elevation). Supplemental planting of salt-tolerant species, including Lyngbye's sedge, saltgrass, and seaside arrowgrass may aid in a more rapid re-colonization of emergent cover in the low intertidal range.

Interspersion of vegetation types and marsh elevations will ensure that vegetative diversity is achieved and limit the potential for existing invasive plant monocultures to reestablish. A gradient in elevations will allow fish access to significant areas of productive, shallow water habitat during all flows. Wildlife species are expected to use the extensive large woody material and snags that are incorporated into the project design for rearing, nesting and foraging.

Reed Canarygrass Eradication

Currently, a large portion of the upland and riparian area is dominated by invasive species. Of the existing 18.68 acres, roughly 85 percent has been overrun with noxious and invasive species. In order to combat the invasive plant species prior to construction, Port of Tacoma Maintenance Staff have been following the *Washington State Integrated Pest Management Plan for Freshwater Emergent Noxious and Quarantine Listed Weeds* (WSDA, 2013) recommended approach to eradicating reed canarygrass by mechanical and chemical control methods. The Port has been relying on these methods to reduce seed production and root spread through rhizomes.

During construction, the Port's contractor will excavate between 12 and 18 inches of topsoil to remove the bulk root mass of the reed canarygrass. Post-construction control and eradication will include hand pulling and chemical spot treating in recolonized areas. Less conventional methods, such as weed matting and mulching may also be utilized. Densely planting of native vegetation to crowd and shade out potential re-colonization will also be used.

Floodplain Wetland Plant Communities

The LWCHP site has been designed to have a diverse, multi-zonal floodplain wetland plant community composed of emergent, shrub and tree species. The floodplain plant communities, based on tidal elevations, will include low bench emergent, high bench emergent and forested wetlands. The designed wetland elevations are based on known tidal elevations at the project site.

Based on existing site observations, salt-tolerant vegetation is expected at elevations below 12 feet MLLW, and vegetative species tolerant of periodic freshwater inundation are expected at elevations between 12 and 15 feet MLLW. The proposed wetland restoration design will incorporate each of the habitat types shown in Figure 9.

Lower elevation mudflats and low bench emergent areas will be concentrated in the western portion of the site where stream elevations are lower. Low salinity water (~3 ppt based on observed salt-tolerant vegetation and salinity measurements just downstream of Highway 509 Bridge) is expected in the lower elevations. Natural re-colonization of salt-tolerant vegetation is expected to occur in these lower elevation sites (up to approximately 10.5 feet in elevation based on on-site observations of existing conditions). This natural re-colonization of salt-tolerant vegetation has occurred at similar sites in the Port of Tacoma, including the recently constructed Place of Circling Waters. Supplemental planting of salt tolerant species, including Lyngbye's sedge, saltgrass, and seaside arrowgrass may aid in a more rapid re-colonization of emergent cover in the low intertidal range.

Forested Buffer Plant Communities

A 70-foot densely planted forested riparian buffer will be established adjacent to the created stream and forested wetland. The purpose of the forested buffer is to screen the floodplain from surrounding land uses, trap and filter sediment from stormwater runoff, provide habitat to various birds, mammals and insects, and act as a source of detrital input to aquatic habitats. The buffer will be planted with a mixture of native coniferous and deciduous trees, shrubs and grasses that are typical of functioning riparian and wetland buffers throughout the Puget Sound Lowlands.

Soil Preparation, Seeding, Fertilizing, Planting and Irrigation

Soil Preparation

The contractor and the Port's representative will assess the graded areas for excessive soil compaction. If an area exhibits excessive soil compaction those areas will be cross-ripped or tilled using a bulldozer or tractor fitted with ripping tines or a tiller. Cross-ripping activities will be monitored to preserve the dimensions of graded depressions. Additional light ripping may be necessary over hummocks to ensure adequate lofting of soils and optimum conditions for planting trees and shrubs.

Seeding

Native, certified weed free grass mixes will be used to stabilize work areas, prevent soil erosion, reduce re-colonization of invasive species and support native re-vegetation efforts. Grass mixes specially developed for wetland and upland areas will be used (Table 8). In addition to native species, sterile wheatgrass seed will be applied to disturbed areas to prevent soil erosion. The quick germination rate of wheatgrass quickly stabilizes soil, and the sterile nature prevents additional germination and growth during the following year, allowing native grass species to thrive.

To support maximum germination rates, seeding will occur during two windows including between September 1 and October 1, and between March 1 and May 15. In general, seeding will occur in the fall and, as necessary, overseeding will occur in the spring. If adequate soil moisture is present, seeding may occur outside of these seeding windows during the growing season (May 16 to August 31). For example, if excessively wet soil conditions are present during construction, localized areas may be seeded as grading and structure installation is completed, and temporary access (spur roads, wetland mats) are removed. If seeding occurs outside of the seeding windows in absence of adequate soil moisture, supplemental irrigation or temporary cover techniques will be implemented.

TABLE 8. COMPOSITION OF SEED MIXES FOR THE LOWER WAPATO COMBINED PROJECT

Scientific Name	Common Name
Wetland Seed Mix	
Festuca rubra commuta	Chewings fescue
Bromus carinatus	California brome
Elymus glaucus	Blue wildrye
Hoedeum brachy	Canby bluegrass
Glyceria occidentalis	Western manna grass
Dechampsia caespitosa	Tufted hair grass
Eleocharis palustris	Common spike rush
Carex obnupta	Slough sedge
Upland Seed Mix	
Festuca idahoensis	Idaho fescue
Bromus carnatus	California bromegrass
Elymus glaucus	Blue wildrye
Poa sandbergii	Canby bluegrass
Poa compressa	Cananda bluegrass
Lupinus polyphyllus	Bigleaf lupine
Lupinus bicolor	Two color lupine
Achillea millefolium	White yarrow
Erigeron speciosus	Showy fleabane

Seeding may be accomplished by either hydroseeding, drill seeding, or hand seeding, or a combination of techniques. Seeding rates and composition will follow specifications supplied on the project plans. If hydroseeding is conducted, a two-pass method will be implemented with the first pass intended to maximize seed contact with the soil surface, and the second pass intended to cover the seed with mulch. The first pass will consist of seed, water, organic fertilizer, tackifier, and a small amount of hydromulch to be used as a tracer. The second pass will consist of tackifier and hydromulch. If seeding is accomplished by drill seeded or hand seeded, an organic fertilizer and a thin layer (approximate 1-inch depth) of wood-strand mulch may be applied to protect the seed and prevent soil erosion.

Fertilizing

Fertilizing, using a slow release natural organic fertilizer, will occur during planting as necessary to support healthy establishment of vegetation. The fertilizer will support seed germination and growth of plants from seed (grasses), and establishment and growth of bare root, live stake and container stock. Fertilizer rates will be determined for the individual plant species and community needs.

Planting

The proposed planting schedule for the LWCHP site includes a mixture of native grasses, emergent, shrubs and trees (Table 9). The site will have five different planting zones, including: wetland emergent, wetland palustrine forested, transitional upland, upland and upland enhancement (Figure 9). Approximate spacing for the planted vegetation will be; 10 to 12 feet on center for trees, 5 feet on center for shrubs, and 1.5 or 2.5 feet on center for emergent species. Containerized plant stock will be planted immediately before or during the dormant period from October through March, following earthwork and seeding. All bare root emergent species will be installed between March 1 and March 31. The timing of installation will also depend on flooding and soil surface saturation levels. For example, live stake and emergent planting may occur after March to avoid flooded conditions. No plant installation will occur during freezing conditions or the summer dry season.

TABLE 9. COMPOSITION OF NATIVE PLANTS FOR THE LOWER WAPATO COMBINED HABITAT PROJECT SITE

Stratum	Scientific Name	Common Name
Tree	*Acer macrophyllum*	Big-leaf maple
	Alnus rubra	Red alder
	Fraxinus latifolia	Oregon ash
	Populus balsamifera	Black cottonwood
	Picea sitchensis	Sitka spruce
	Pseudotsuga menziesii	Douglas fir
	Thuja plicata	Western red cedar
Shrub	*Acer circinatum*	Vine maple
	Cornus sericea	Red-twig dogwood
	Corylus cornuta	Beaked hazelnut
	Lonicera involucrata	Black twinberry
	Mahonia Aqufolium	Tall Oregon grape
	Physocarpus capitatus	Pacific ninebark
	Rosa gymnocarpa	Baldhip rose
	Rosa nutkana	Nootka rose
	Rosa pisocarpa	Pea-fruit rose
	Spirea douglasii	Hardhack
	Salix hookeriana	Hooker's willow
	Salix lucida	Pacific willow
	Salix sitchensis	Sitka willow
	Salix scouleriana	Scouler's willow
	Symphoricarpos albus	Snowberry

Stratum	Scientific Name	Common Name
Emergent	*Carex lyngbyei*	Lyndby's sedge
	Carex obnupta	Slough sedge
	Carex stipata	Awlfruited sedge
	Eliocharis palustrie	Creeping spikerush
	Juncus acuminatus	Tapered rush
	Juncus ensifolius	Daggerleaf rush
	Scirpus americanus	Tule
	Scirpus maritimum	Saltmarsh bulrush

Irrigation

Irrigation may be utilized to prevent plants from drying out and becoming stressed during the first summer proceeding planting (Year 1). Irrigation is particularly important for upland species located on the hummocks and within the buffer areas. Irrigation may consist of a temporary system, and could include an above-ground system or a water truck. Irrigation will occur approximately once every 2 to 3 days during the summer and early fall, depending on the outside temperatures, recent precipitation, and surface saturation levels.

Construction Timing and Sequencing

Construction of the in-water elements of project, including the LWCHP, the 8th Street East culvert, and the Stormwater Storage Basin, is estimated to take approximately four months to complete. Construction would begin as soon as permits and scheduling would allow. The typical in-water work window stipulated by the USACE in Tidal Reference Area 4 (Tacoma) for the Port is July 16 through February 15 http://www.nws.usace.army.mil/Portals/27/docs/regulatory/ESA%20forms%20and%20templates/work_windows_all_marine & estuarine.pdf. The timing restriction for salmon and bull trout that applies to work in Wapato Creek is depicted graphically below. Note that nearly all of the proposed grading work for the combined channel relocation and wetland restoration area will take place within a closed topographic depression and so can be accomplished without the need to work in the existing Wapato Creek channel or be restricted to the in-water work window. Additionally, because anadromous fish are not present in Drainage District (DD) 23, in-water work at 8th Street East and the Stormwater Storage Basin would not be restricted to the work window.

TABLE 10. APPROVED WORK WINDOWS FOR TIDAL REFERENCE AREA 4 (TACOMA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bull Trout Work Window												
Salmon Work Window												

Note: Green is approved work window for each species; Red is closed.

The applicant would comply with any amendments made to the above timing restrictions following USACE, NOAA Fisheries, USFWS and WDFW review.

The upland mass grading portion of the project will occur over the course of one year. Although not limited to in-water work periods, the upland grading will occur during drier periods of the year and temporary erosion control measures will be in place in order to limit the generation of surface runoff.

CONSTRUCTION SEQUENCING FOR WAPATO CREEK AND WETLAND RESTORATION

1. Obtain all necessary easements and access authorizations for all construction activities.
2. Ensure copies of all permits and conditions from local, state and federal agencies are present on site for the duration of the work.
3. Receive NPDES Permit from Ecology
4. Hold a pre-construction meeting with the Port of Tacoma, City of Tacoma, and City of Fife.
5. Establish clearing limits, and install silt fence, sediment and erosions control systems and high visibility fencing on project perimeter.
6. Install construction entrance and staging area.
7. Locate, relocate or protect existing utilities within the project area.
8. Clear and grub area designated for excavation and construction.
9. Conduct rough grading, leaving a berm of material to isolate grading activities from the existing stream channel. Tracked excavators, dump trucks and other heavy equipment will be used.
10. Fill in the ditch along 12th Street between Wapato Creek and 46th Street to elevations shown in the plan set.
11. Leave berms at the upstream and downstream ends of the new channel to prevent water from flowing into the graded site until the contractor is ready to reroute Wapato Creek into the new channel.
12. Dispose of excess excavation spoils on the Port's undeveloped property east of the site in a manner that does not result in the generation of silt-laden runoff.
13. Pump any turbid water collecting in the depression during construction to a temporary infiltration area on the south side of the site. This water will not be discharged to Wapato Creek.
14. Conduct finish grading of habitat area features and new stream channel. Tracked excavators, dump trucks and other heavy equipment will be used.
15. Install stream gravel and large woody material.
16. Install topsoil and hydroseed per vegetation plan.
17. Install permanent and final stabilization. Remove temporary sediment and erosion control measures. (It is recommended that the Project Owner/Operator have the SWPPP Preparer or registration equivalent approve the removal of temporary structures.)
18. Re-direct Wapato Creek into the new stream channel by removing the berms per WDFW Hydraulic Project Approval Instructions.
19. Re-vegetate the specified planting areas during the first dormant season (October through March) following project construction according to re-vegetation plans.

20. Design and install the temporary irrigation system for buffer areas only. Operate the system for the first two years during summer growing season (June 1 – September 30), and then remove.
21. Remove any remaining TESC features from the project area after the site is stabilized.
22. Perform As-Built Survey and submit to Port of Tacoma for review and approval.

Note: Maintenance of sediment and erosion control measures must continue until the site is permanently stabilized and the controls are removed.

CONSTRUCTION SEQUENCING FOR OPTIONAL WAPATO CREEK 12TH STREET EAST CULVERT REPLACEMENT

1. Obtain all necessary easements and access authorizations for all construction activities.
2. Ensure copies of all permits and conditions from local, state and federal agencies are present on site for the duration of the work.
3. Receive NPDES Permit from Ecology
4. Hold a pre-construction meeting with the Port of Tacoma, City of Tacoma, and City of Fife.
5. Establish clearing limits and install silt fence and high visibility fencing on project perimeter.
6. Close the 12th Street East roadway during culvert replacement construction and/or implement the traffic control plan prepared for the project as directed by the City of Fife.
7. Locate, relocate or protect existing utilities within the project area.
8. Isolate the work area with coffer dams upstream and downstream, and install Temporary Flow Diversion system sufficient to carry flow and any fish around the work area to a point downstream.
9. Prior to or during the dewatering of the work area, remove fish per WDFW Hydraulic Project Approval Instructions using qualified professionals.
10. Excavate roadway and roadway embankment. Tracked excavators, dump trucks and other heavy equipment will be used.
11. Remove and dispose of existing culverts. Tracked excavators, dump trucks and other heavy equipment will be used.
12. Install culvert footings per approved shop drawings and geotechnical engineer’s findings of existing field and substrate conditions. Tracked excavators, dump trucks and other heavy equipment will be used.
13. Install culvert sides. Tracked excavators, dump trucks and other heavy equipment will be used.
14. Install streambed materials inside culvert. T racked excavators, dump trucks and other heavy equipment will be used.
15. Finish culvert installation. Tracked excavators, dump trucks and other heavy equipment will be used.
16. Backfill roadway embankment, culvert headwall and façade. Tracked excavators, dump trucks and other heavy equipment will be used.
17. Construct roadway subgrade and finished roadway. Tracked excavators, dump trucks and other heavy equipment will be used.

18. Complete final grading and stabilization at culvert inlet and outlet.

19. Remove temporary flow bypass system per WDFW Hydraulic Project Approval Instructions.

20. Remove temporary erosion and sediment control system.

21. Perform As-Built Survey and submit to Port of Tacoma for review and approval.

Note: Maintenance of sediment and erosion control measures must continue until the site is permanently stabilized and the controls are removed.

WETLAND MITIGATION ACTIVITIES

Two types of wetland mitigation activities are proposed at the LWCHP site including wetland re-establishment and forested riparian buffer enhancement. Wetland re-establishment is a form of restoration, both of which are defined below according to Ecology (2006).

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purposes of tracking net gains in wetland acres, restoration is divided into:

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former wetland. Re-establishment results in rebuilding a former wetland and results in a gain in wetland acres and functions. Activities could include removing fill, plugging ditches or breaking drain tiles.

Wetland re-establishment is proposed for 9.42 acres of the site. Wetland re-establishment will be achieved by removing invasive vegetation and fill to an elevation necessary to create tidal, stream, wetland and floodplain habitat and restore hydrogeomorphic conditions and vegetation zones. Habitat features will be installed (e.g., hummocks, large wood structures) and the site will be planted with native vegetation.

To protect the restored functions of Category I estuarine wetlands, a 70-foot-wide enhanced forested upland buffer will surround the mitigation site. Enhancement measures involve planting the upland area densely with native shrubs and trees to create a forested community. To prevent disturbance from humans and pets, impact minimization measures proposed for the mitigation bank site include planting the buffer with dense native vegetation and installing new fencing or maintaining existing fencing at the outer limits of the buffer.

In accordance with joint regulatory agency guidance (Ecology, 2012a; requirements 1.d. and 1.e, pp. 5 and 6), the LWCHP mitigation bank site will provide the following approximate mitigation areas:

- 9.42 acres of wetland re-establishment including hummocks
- 7.54 acres of forested riparian buffer enhancement

FUTURE SITES

Port development and remediation projects can impact a wide range of terrestrial and aquatic habitats and critical areas within Commencement Bay. While the Port will generally have adequate mitigation credits from the UCCMS and the LWCHP, maintaining balance between future development and mitigation needs is critical. Future mitigation for these impacts may occur on Port or non-Port owned properties. These properties may include areas set aside for future mitigation bank inclusion or redevelopment. Mitigation bank sites would be protected in perpetuity, while redevelopment sites would include project specific mitigation credit and would allow appropriate future use.

The Port has identified numerous sites that may be used for future mitigation (see Figure 1). Future sites must be carefully located to provide the highest practical ecological value while ensuring the working waterfront is not constrained. These potential sites in Commencement Bay and the lower Puyallup watershed may include sites that are not under Port ownership or control at this time. Several mitigation options for near-term development projects and regulatory obligations are listed below and will be approved by the IRT at a later date.

Future Mitigation Bank Projects

Future mitigation projects would be fully reviewed by IRT and protected in perpetuity under a long-term management plan and site protection tool (deed restriction, conservation easement, etc.)

Saltchuk and Marine View Drive

The Port is working with the WDFW, Washington State Department of Natural Resources (DNR), USACE, and the City of Tacoma to develop Saltchuk as an aquatic nearshore mitigation site. It would be built out to as many as 40 acres over time using dredged material as beneficial reuse. The site would be mitigation for future Port projects that impact aquatic habitat such as terminal redevelopment. This site would not only provide valuable aquatic habitat for migrating salmon and other marine species, it would also help protect the shoreline along Marine View Drive from wave erosion. If an appropriate lease can be worked out with DNR, this site could be constructed in phases and used for mitigation for years to come.

Sound Refining Cove (P74)

The Sound Refining (Targa Sound Terminal) property, located just south of the 11th Street Bridge on the eastern shore of the Hylebos Waterway, consists of two separate action sites. The first is a 20.66-acre Port-owned mitigation site used by Occidental Chemical Corporation for their habitat restoration obligations under their Consent Decree with EPA for the remediation of the Mouth of the Hylebos Waterway. The Port recently acquired 5 acres of the Sound Refining Cove property that has a significant potential to provide low- to moderate-cost marine or estuarine intertidal mitigation.

Pioneer Way Property

This is a 6-acre undeveloped site near the Upper Clear Creek site on Pioneer Way. It also serves as a part of the Port's portfolio of future mitigation sites. It has many degraded on-site wetlands and has good potential for mitigation credits.

Gog Le Hi Tee 3

This is a future mitigation site for the Port, which will yield up to 12.85 acres of mitigation credit. Its setback levees are already built, however, the remainder of the site will not be built until a Port development project requires it. This will be costly to develop as it sits on an old landfill and excavation is very expensive. Overexcavation will be necessary and all excavated material will need to be disposed of as solid waste. The site currently has invasive species, which must be controlled to protect adjacent sites.

Ruston Way

Ruston Way is a 2-mile long scenic waterfront street in Tacoma located along the southwest side of Commencement Bay. The shoreline is dotted with beaches, parks, restaurants and businesses. This popular Tacoma destination contains large pockets of remnants from its industrial and commercial past. Thousands of creosote piling, derelict overwater structures and concrete foundations continue to impact this heavily utilized salmon migratory corridor. Mitigation opportunities along Ruston Way include removing derelict structures, beneficial placement of clean "fish mix" substrate, and shoreline plantings. The majority of impacted properties are owned by DNR and Tacoma Metro Parks.

PROJECT-SPECIFIC MITIGATION

Project-specific mitigation would include habitat benefit actions on properties that may be redeveloped at a later time and would not have a deed restriction. There are dozens of projects around the Port and Commencement Bay that would provide beneficial fish habitat, wildlife habitat and water quality functions from the removal of overwater structures (docks, piers, footings, houses, etc.), bed coverage (fill, piling, concrete, asphalt, etc.), and/or bank stabilization and plantings. Mitigation from these types of project specific projects would be used to offset future Port development projects on or near the impact site. For example, overwater and bed coverage mitigation would be used on either the same Port-owned property or on a similar project site, as agreed upon by the IRT.

Canam Pier Removal

The purpose of this project is to remove two unused piers, an associated bulkhead, and prepare for future redevelopment efforts. A total of 57 existing creosote-treated piles and 2 steel piles will be removed. Pilings will be removed using a vibratory hammer and extracted whole, if possible. If they break, they will be cut 2 feet below the mudline. Voids will be filled with habitat mix. Decking and piles will be properly disposed of or recycled at an upland site. Removal of the existing bulkhead will require excavation and grading of the shoreline. Work will be done in the dry. Approximate volumes include 220 cubic yards of excavation and placement of 82 cubic yards of habitat mix (fill). This is necessary to re-grade the shoreline in the area of the excavated bulkhead. The shoreline will be graded to a 3:1 slope to match the existing grade of the adjacent shoreline.

Arkema Float Removal

This possible future project is located along the shoreline of the former ARKEMA manufacturing site on the Hylebos Waterway. A small float made of creosote-treated wood and open cell Styrofoam floats could be removed and disposed at an approved upland facility.

Earley Business Center

The Earley Business Center (EBC) is located on the west side of the mouth of the Blair Waterway. The original EBC boat building facility was constructed in the 1910s as part of a World War I shipyard and was redeveloped in the 1940s to construct ships during World War II. The site has been in continuous use for ship and marine construction since that time. For the last few decades, the site has been used as a private shipyard (Todd/Tacoma Boat) for the construction and launching of large yachts and other marine construction activities.

The property currently features a large fabrication building with associated offices, storage lots, and a concrete and rock vessel launching ramp. The ramp has been used to launch vessels from both wheeled launchers and using marine rails affixed to the steel ties and creosote cross timbers embedded within the ramp. To the east of the ramp are remnants of creosote piling and cross timbers from previous marine railways. Potential site-specific mitigation for this site includes the removal of historical fill material, removal of previous marine railways and the placement of beneficial beach substrate. Redevelopment of this site is likely to include an updated launching ramp, replacement marine railway, and breakwater/pier.

PROPOSED SERVICE AREA AND PROJECT NEED ANALYSIS

Proposed Service Area

The proposed service area for the Port of Tacoma Wetland and Habitat Conservation Umbrella Mitigation Bank includes areas of WRIAs 10 and 12 – Puyallup-White and Chambers-Clover Watersheds (see Figure 11). It would include the marine shoreline from Dash Point in the north to Chambers Bay in the south, lower Puyallup River and its major tributaries below the confluence of the White River. Independent tributaries to the Puget Sound, including but not limited to: Hylebos Creek, Wapato Creek, Puget Creek, Titlow Lagoon, and Chambers Creek are proposed to be included in the service area.

The limits of the proposed service area are based on a reasonable geographical distance of potential projects from the proposed and potential future mitigation bank site locations and the inclusion of developing areas where future projects would benefit from the use of the bank. Proposed mitigation bank sites would have direct and indirect benefits to impacted habitats and their associated fish and wildlife species and assemblages.

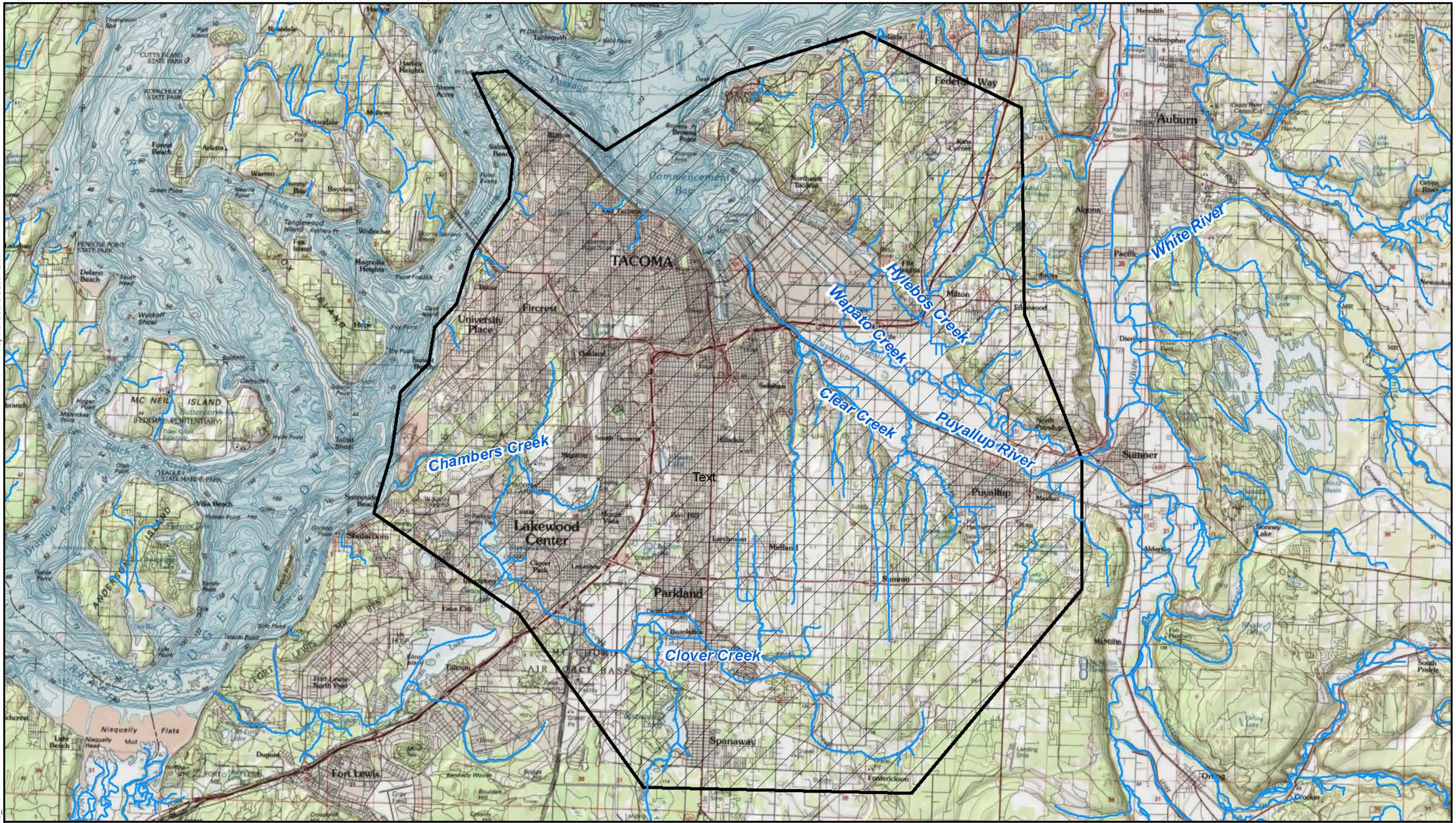

Figure 11. Wetland and Habitat Conservation Umbrella Mitigation Bank Service Area

0 1 2 3 4 5
Miles

N
W E
S

Legend

Service Area

Notes: The locations of all features shown are approximate. This drawing is for information purposes. It is intended to assist in showing features discussed in the attached document. Neither the Port of tacoma nor any of it's staff or consultants (GeoEngineers) makes any warranty of any kind for this information, express or implied, including but not limited to any warranties or merchantability or fitness for a particular purpose, nor shall the distribution of this information constitute any warranty.

Port of Tacoma

Reference: Topographic map obtained from National Geographic Society 2013.

Map Revised: 5/8/2014 smm

Path: Prospectus_F11

Office: TACO

Project Need Analysis

Commencement Bay is a major deep-water port and industrial area. The two watersheds associated with Commencement Bay and the lower Puyallup River are experiencing significant new growth and redevelopment. Although the umbrella bank would mainly be used for Port-related projects, there is the potential for others to use the mitigation credits for public infrastructure projects such as roads, railroads and bridges, public and private utility projects, and commercial and industrial development.

Currently, there are no approved public-user mitigation banks available or pending certification located in Pierce County (USACE and Ecology website). Two single-use advance mitigation banks do exist in the proposed service area. The Washington State Department of Transportation (WSDOT) has a small wetland advance mitigation bank they developed for their use for impacts caused along the I-5 corridor in Pierce County. The Port of Tacoma also has a small advance mitigation bank that is available for its own use. An In-Lieu Fee Bank is being developed in Pierce County, but its operating date is unknown. Given the Port's likely redevelopment and expansion scenarios, no options are available except for concurrent mitigation and developing their own umbrella mitigation bank.

SITE PROTECTION

The Port of Tacoma is proposing two distinct types of project site to include in its umbrella mitigation site: mitigation bank projects and project-specific mitigation projects. As described in the Future Mitigation Bank Projects section, mitigation bank projects would be sites that will be protected in perpetuity by a conservation easement or deed restriction. The Port will own and manage the mitigation bank sites in perpetuity unless ownership is transferred to local, state, or federal agencies; tribal governments; or private nonprofit nature conservancy corporations under RCW 47.12.370. If transferred, the mechanism for transfer will require that the site be maintained in a manner that complies with applicable permits, laws, and regulations pertaining to the maintenance and operation of the mitigation site. If not, the site will revert to Port ownership. Once performance standards are achieved and monitoring has been completed, long-term management of the site will begin by incorporating the site into the Port's "Habitat/Mitigation Site Stewardship" program.

Project-specific mitigation would occur on developed properties and would include the removal of structures or fill to provide ecological lift and benefits to fish and wildlife. This mitigation would be used in the future for redevelopment impacts associated with a commercial or industrial property. No protective mechanism would be placed on these properties.

QUALIFICATIONS OF SPONSOR AND DESIGN TEAMS

Sponsor Qualification

The Port has completed the construction of, or obtained conservation easements for, 19 existing mitigation and preservation sites including several phases within each of these sites. Existing mitigation sites include a broad mix of estuarine, riverine, and wetland habitats associated with marine, estuarine, and freshwater environments. The Port's current mitigation and preservation holdings total approximately 152 acres. As a result, the Port of Tacoma has a great deal of experience in designing, developing and maintaining compensatory mitigation sites.

The Port has a record of successfully completing and maintaining habitat/mitigation projects. The Port created its first habitat mitigation site at Gog-le-hi-te 1 in the mid- 1980s. Since then, over 19 sites have been restored or preserved, the most recent of which occurred at Place of Circling Waters in 2011. These habitat sites are a result of compensatory mitigation, impact remediation, or open space preservation provided as a public benefit.

A majority of the habitat mitigation sites have successfully completed a performance monitoring period to demonstrate that performance standards have been met. Others are still undergoing monitoring and ongoing maintenance.

Design Teams Qualifications

Upper Clear Creek Mitigation Site

Bruce Dees & Associates is the prime consultant for the UCCMS project. Bruce Dees & Associates is a Tacoma landscape architecture firm specializing in waterfront and environmentally sensitive design projects and was responsible for overall project management, development of construction documents, assisting with permit coordination, bidding assistance, and construction management assistance. Herrera Environmental Consultants and Grette Associates assisted with wetland delineation, hydrology report, wetland mitigation and design.

Brian Patnode, Project Manager for Bruce Dees & Associates, has 16 years of experience in designing, building, and managing public works contracts for local, state, and federal governments. Brian has managed a variety of waterfront projects in the past including waterfront campgrounds, fishing access sites, and parks and trails. Brian's key involvement in a variety of successful park projects such as the Nathan Chapman Memorial Trail in Puyallup, the Boeing Linear Park in Renton, the Columbia River Treaty Fishing Access Sites in Oregon and Washington and the Riley Creek Campground in northern Idaho have given him a broad range of experience in all aspects of design and construction management.

Kris Lepine, Associate Ecologist with Herrera Environmental Consultants, has 12 years of professional experience in wetland assessment, wildlife biology, fisheries biology, restoration and mitigation, wetland mitigation banking, environmental permitting, construction management, monitoring, water quality analysis, and environmental chemistry. He performs a variety of environmental studies for private and public development projects, which include wetland delineations, wildlife and habitat assessments, stream surveys, and mitigation plans. Kris' past projects include WSDOT Tacoma/Pierce County HOV Programm Pierce County, Washington; D-to-M Streets Track and Signal Project McKinley Park Wetland Mitigation, Tacoma, Washington; Skagit Environmental Bank, Skagit County, Washington; and Chico Creek Instream Restoration, Kitsap County, Washington.

Lower Wapato Combined Habitat Project

Shea Carr Jewell (SCJ) is a full-service professional engineering and planning firm located in Olympia, Washington. The 35-person firm specializes in solving the complex issues that challenge developing communities, ports, and public utility districts. SCJ has extensive experience in project site planning, permitting, design, and construction support in Washington and across the West. The Watershed Company, provided wetland delineation, fisheries and wetland science support and additional design support.

Amy Head, SCJ, has served as the Project Manager and the main point of contact for the Port. She has over 17 years of engineering design and project management experience and she will oversee the project delivery. Her experience includes managing multi-disciplinary civil design and planning teams for road and sidewalk projects, commercial retail centers, industrial parks, master plan communities, office parks and a variety of specialized studies involving stormwater design, site planning and land-use compliance. Amy has worked on many large commercial and industrial projects including projects on sites with specific design challenges such as high groundwater and floodplains.

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