



# HAYDEN ISLAND NATURAL RESOURCE INVENTORY

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City of Portland, Oregon  
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# CHAPTER 1. INTRODUCTION

## Report Purpose, Organization and Uses

The purpose of this inventory report is to provide useful, current, and accessible information on the location of existing natural resource features and functions for Hayden Island. The report includes descriptions and maps of the current relative condition of riparian corridors and wildlife habitat located on East and West Hayden Island and the portion of the Columbia River surrounding Hayden Island, including the Oregon Slough and southern bank of the Columbia River adjacent to the island.

The report is organized into chapters that provide a context for inventory work, describe the inventory methodology and present an inventory of natural resources for Hayden Island and the Columbia River surrounding the island. The following is a brief summary of the material contained in each chapter of this document:

**Chapter 1: Introduction** - This chapter provides background information and describes the regulatory context for the inventory.

**Chapter 2: Project Approach and Methodology Overview** - This chapter provides an overview of the citywide inventory project approach and the methodology used to identify and evaluate riparian corridor functions and wildlife habitat attributes. Following information on the citywide inventory approach, there is a section describing additional work done specifically for the Hayden Island Natural Resources Inventory report.

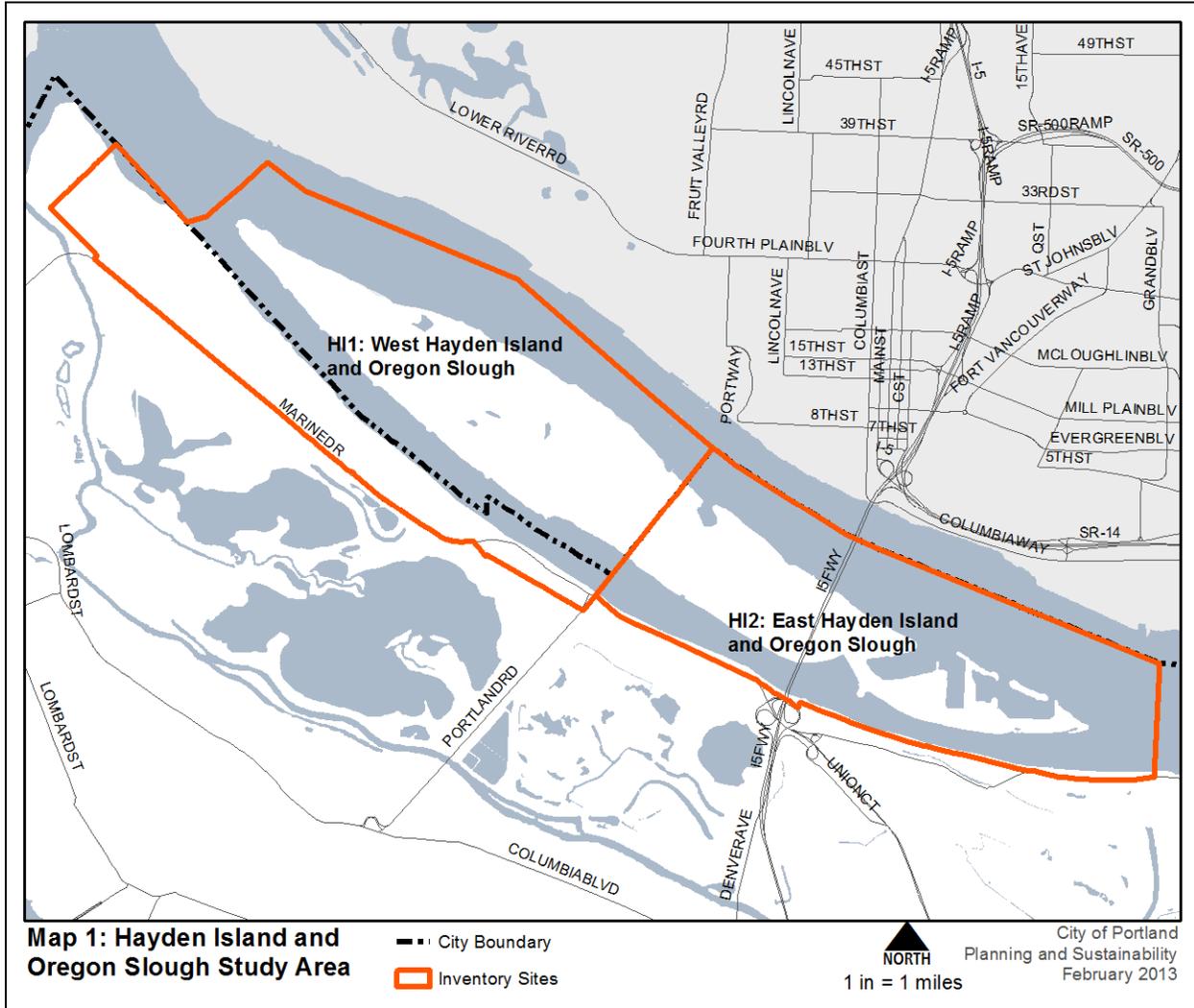
**Chapter 3: The Hayden Island Natural Resources Inventory** - This chapter begins with a general overview of the Columbia River basin focusing on the Columbia River near Portland. The summary includes general land uses, transportation, and commerce as well as existing natural resources. Following the overview, a short history of Hayden Island is presented. Continuing, the study area is split into two inventory sites for which natural resources descriptions are presented. The descriptions address the presence, type and extent of existing waterways, flood areas, wetlands, vegetation, and fish and wildlife habitats and species. Alterations and disturbances, such as flood control and invasive species, are also discussed. An evaluation of current riparian corridor and wildlife habitat functions and attributes is presented for each inventory site, followed by a map series including aerial photographs, water-related features, vegetation features, riparian corridor relative ranks, wildlife habitat relative ranks and combined riparian/wildlife habitat relative ranks.

The inventory is intended to inform and support a broad array of City and community activities relating to Hayden Island and the Columbia River near Portland. Such activities include long-range planning, implementing and updating city programs to manage natural resources, identifying priority areas for restoration, enhancement, and public acquisition, designing development and redevelopment projects, and meeting regional, state, and federal regulatory requirements.

Over the long term, this inventory can help the City achieve its River Renaissance Vision for clean and healthy rivers, and meet its watershed health goals. The inventory will inform the evaluation of program options and development of regulatory and non-regulatory tools through the City's West Hayden Island Phase II Project. The City also intends to submit this inventory to Metro in support of the City's compliance with the Title 13 Nature in Neighborhoods Program.

## Inventory Area

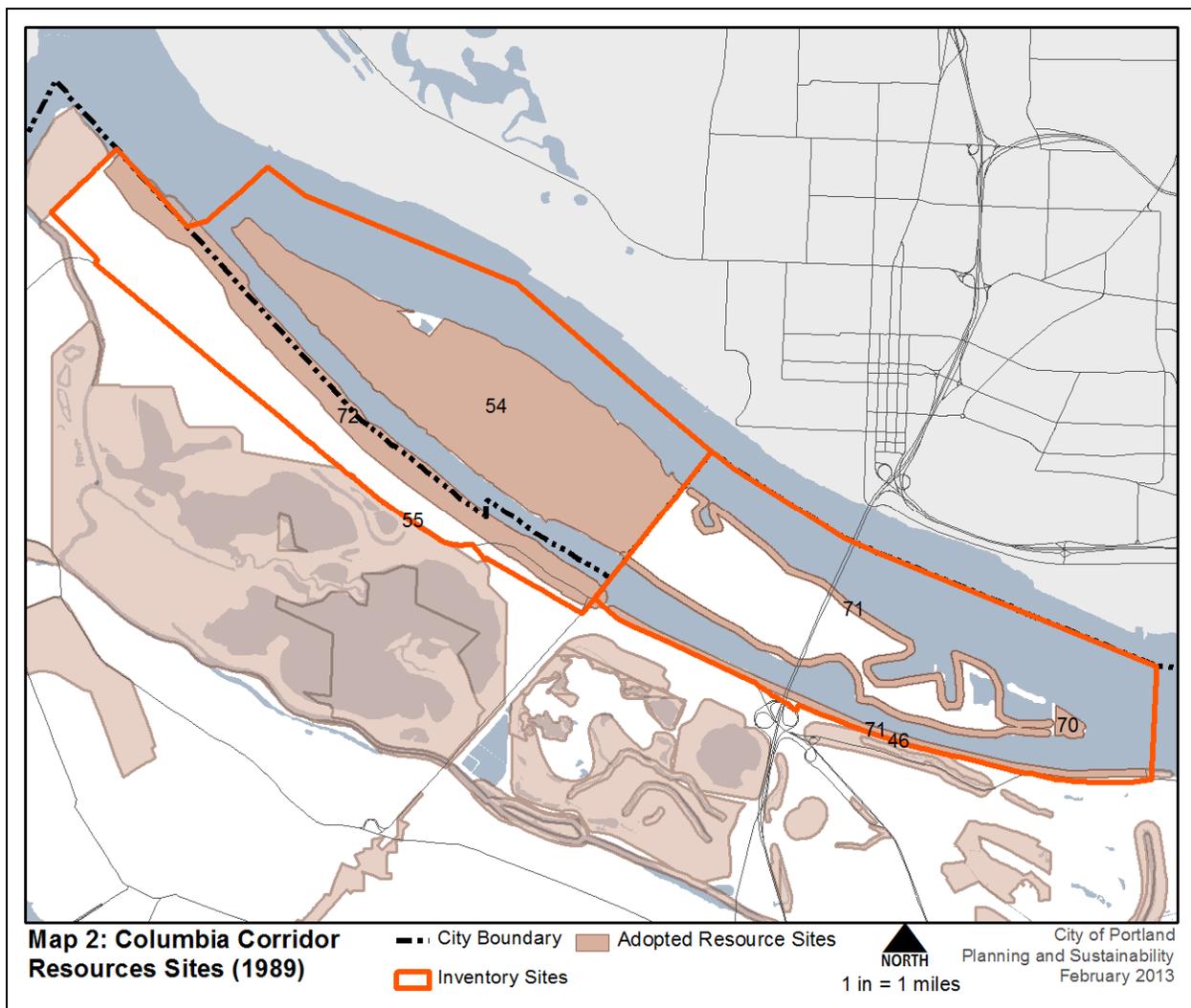
The inventory area includes Hayden Island, the Columbia River surrounding the island, the Oregon Slough and the southern bank of the Columbia River and addresses natural resource features and developed lands adjacent to the natural resource features. The boundary of this inventory is shown on Map 1.



## Background

More than 30 years ago the City began producing inventories of natural resources in Portland to support natural resource planning and management decisions. The first inventory which addressed the Willamette River Greenway was completed in 1975. Between 1989 and 2002, the City completed 10 inventories to meet state land use goals. Hayden Island and the south bank of the Columbia River were included in the *Inventory and Analysis of Wetlands, Water Bodies and Wildlife Habitat Areas for the Columbia Corridor* (1989), here after referred to as the Columbia Corridor inventory.

For the Columbia Corridor inventory, the City used a Wildlife Habitat Assessment (WHA) methodology to document and rank the conditions of existing natural resources. That inventory was divided into five segments, the fifth segment, called “Rivergate – Terminal 4 & Hayden/Tomahawk Island”, included Hayden Island. Each segment contained anywhere from seven to 15 resource sites depending on the complexity of the segment (Map 2). The highest value resource sites were identified as Rank I; lesser value habitat sites were identified as Rank II, III, IV, or V.



In the 1989 Columbia Corridor inventory, the natural resource features identified for east Hayden Island and the south bank of the Columbia River included forests, shrublands, meadows, wetlands and beaches that provide functions including drainage, flood storage, bank stabilization, erosion control, sediment trapping, pollution and nutrient retention and removal, and fish and wildlife habitat. Many of the

features were also identified as a visual amenity, having recreation potential and development potential. Because West Hayden Island was outside the city limits, the Columbia Corridor inventory only generally described the natural resource features; it did not evaluate functions and values to be protected. The 1989 inventory provided a basis for the application of environmental overlay zones on East Hayden Island to identified natural resources. The Columbia Corridor inventory has continued to provide guidance for protection and restoration opportunities in the watershed.

The Hayden Island Natural Resources Inventory (HINRI) is an update of the Columbia Corridor inventory. The HINRI development is part of an environmental program update for East Hayden Island, and part of planning process that will inform City decisions regarding annexation and potential future development and management of West Hayden Island. The information presented in this report incorporates updated information including new natural resource feature data, more recent field assessments, and resource evaluations. The data and resource evaluations build on Metro's approach and methodology used to produce an inventory of regionally significant fish and wildlife habitat, which was adopted in September 2005 as part of the Title 13 Nature in Neighborhoods program. The inventory does not identify, evaluate or make recommendations regarding potential policy or management decisions.

The work presented in this report is consistent with and advances the goals outlined in the *Portland Watershed Management Plan* and the *Framework for Integrated Watershed Management*, both of which were adopted by the City Council in 2005. These documents establish key ecological principles, restoration priorities, and recommended strategies to protect and restore watershed health. Portland's watershed goals and objectives are provided in Appendix A.

## Regulatory Context

Many federal, state, regional and local regulations and policies relate and are applicable to natural resources found in the Hayden Island inventory area. Policies and regulations relating most directly to the development of the inventory are certain Oregon Statewide Land Use Planning Goals and portions of the Metro Urban Growth Management Functional Plan. These requirements are summarized below. Appendix B provides a summary of the additional key state and federal natural resources regulations and policies.

### State Land Use Planning Program

Comprehensive land use planning was mandated by the 1973 Oregon Legislature, primarily in response to population growth pressures on valuable farm and forest land. Since 1975, cities and counties in Oregon have been required to comply with Statewide Planning Goals. Today there are 19 goals that Oregon cities and counties must comply with through the adoption and maintenance of local comprehensive plans. Portland adopted its first comprehensive plan in 1981 to satisfy the requirements of the state planning program.

Multiple state planning goals apply to the inventory area however only those goals most directly relating to the natural resource inventory, Goals 5, 6, and 7, are addressed in this section. Other goals, including Goal 9: Economy of the State and Goal 12: Transportation, will be addressed in separate documents that will be developed later in the program update process.

- **Goal 5, Natural Resources, Scenic and Historic Areas, and Open Spaces** – Goal 5 addresses many types of resources. It establishes a process in which resources are inventoried and evaluated for significance. If a resource or site is found to be significant, the local government must evaluate the consequences of three policy choices: protecting the resource, allowing proposed uses that conflict with the resources, or establishing a balance between protecting and allowing uses that conflict with the resources. The local government must then adopt a program based on the results of this evaluation

- **Goal 6, Air, Water, and Land Resources Quality** – This goal requires local comprehensive plans and implementing measures to be consistent with state and federal regulations on matters such as stream quality and groundwater pollution. Goal 6 provides guidelines for local jurisdictions, including that local plans should buffer and separate those land uses which create or lead to impacts on air, water as well as other resources. Further, plans should consider the carrying capacity of the air, land and water resources within the planning area.
- **Goal 7, Areas Subject to Natural Hazards** – Goal 7 deals with development in places subject to natural hazards such as flooding, landslides, or wildfire. It requires that jurisdictions apply “appropriate safeguards” (floodplain zoning, for example) when planning for development.

To address Goals 5 and 7, cities and counties must use inventories to inform development of their local compliance programs. Goal 5 requires local jurisdictions to develop their own resource inventories, while Goal 7 refers to land hazard inventories developed by federal and state agencies to be used for implementing policy. (Goal 6 does not require an inventory, but does require local programs to be consistent with adopted state and federal clean water and clean air laws.) Goal 5 requires the following resources to be identified in the city and county inventories:

- Riparian corridors, including water and riparian areas and fish habitat
- Wetlands;
- Wildlife habitat;
- Federal Wild and Scenic Rivers;
- State Scenic Waterways;
- Groundwater resources;
- Approved Oregon recreation trails;
- Natural areas;
- Wilderness areas;
- Mineral and aggregate resources;
- Energy sources;
- Cultural areas;
- Historic resources;
- Open space; and
- Scenic views and sites.

The Goal 5 Administrative Rule (OAR 660-015-0000(5)) requires local governments to follow a three-step planning process, and completing an inventory is the first step. The inventory includes an analysis of the location, quantity, quality, and significance of the resources identified. If a resource is not determined to be significant, it may be excluded from further consideration. The remaining resources are then subject to a “conflicting use” analysis (also known as the Economic, Social, Environmental and Energy Analysis), with the final step being development of a resource management program for significant resources.

The City of Portland addressed these inventory requirements when developing the Environmental Overlay Zoning program that currently applies to East Hayden Island, which is within the city limits. West Hayden Island is currently outside of the city limits and within the Metro Urban Growth Boundary and Portland Urban Service Boundary. Multnomah County designated West Hayden Island “Future Urban, Significant Environmental Concern.”

This Hayden Island Natural Resources Inventory report is an update of the City’s 1989 inventory for the Columbia Corridor. Consistent with Metro Titles 3 and 13 (see below), this inventory focuses on riparian corridors and wildlife habitat areas and contains general information pertaining to water quality; natural hazards including landslide and wildfire hazard areas and flood areas; hydrological conditions; ecologically fragile areas; significant natural areas; vegetative cover; and relationship with local, state and federal environmental regulations and policies. Thus, this inventory may be used to inform and support future updates to the City’s programs relating to relevant portions of Goals 5, 6, and 7.

## Metro's Urban Growth Management Functional Plan and Titles 3 and 13

The 1973 Legislature granted expanded powers for the Columbia Region Association of Governments (now called Metro), to “coordinate regional planning in metropolitan areas” and to “establish a representative regional planning agency to prepare and administer a regional plan.” During the 1990s, Metro worked with local jurisdictions to develop Regional Urban Growth Goals and Objectives (RUGGOs) and the *Urban Growth Management Functional Plan*.

The Urban Growth Management Functional Plan provides a regional approach to growth management by tailoring several key state planning goals to meet regional population growth expectations. This approach recognizes the interrelationship between housing, employment, clean air and water, natural resource protection, and transportation networks across jurisdictional boundaries. Metro developed the plan with input from the 24 cities and three counties within the Urban Growth Boundary at that time. The Urban Growth Boundary is one tool used to protect farms and forests from urban sprawl and promote efficient use of lands within the boundary. Uses of land within an Urban Growth Boundary support and are supported by urban services such as road, water and sewer systems.

In 1982, Metro expanded Portland's Urban Growth Boundary to include West Hayden Island. At that time, the area was re-designated by Multnomah County from “Multiple Use Forestry” to “Future Urban” use within the Multnomah County Framework Plan. The impetus for both actions was to provide a future site for waterfront industrial and marine terminal uses. An important element in the Multnomah County analysis was the County's finding that additional waterfront acreage was needed within the Urban Growth Boundary to meet the forecasted demand for marine terminal uses. That analysis also found that natural resources located on West Hayden Island are significant enough to warrant some level of protection. As noted above, the County applied the Significant Environmental Concern overlay to provide additional protections for natural resources on West Hayden Island.

Nine titles in the Urban Growth Management Functional Plan are derived from or relate to state planning goals and the rest are procedural. Title 3 and Title 13 pertain most directly to natural resources and the inventory information contained in this report.

**Title 3** is derived from portions of state planning Goals 6 and 7, and establishes regional requirements relating to water quality, erosion control, and flood hazard management. In September 2002, the City of Portland completed a detailed report titled *Title 3 Water Quality Compliance Report*. The report explains how the City complies with Title 3 requirements through the existing Environmental Overlay Zoning program and newer regulations established by the Willamette River Title 3 Water Quality Compliance Project (adopted by City Council in August 2002). Metro found the City in substantial compliance with Title 3 in December 2002.

**Title 13**, adopted by the Metro Council in September 2005, establishes the Nature in Neighborhoods program. The purpose of the program is to protect, conserve, and restore important riparian corridors and wildlife habitat areas in the region, and also serves as a supplement to Title 3 requirements relating to water quality, flood hazard, and erosion control. Title 13 establishes provisions intended to prevent impacts or ensure mitigation of unavoidable impacts on identified Habitat Conservation Areas within the region. Habitat Conservation Areas are comprised of regionally significant riparian corridors and wildlife habitat identified in Metro's inventory, including substantial portions of Hayden Island. Title 13 also establishes specific planning requirements for West Hayden Island, namely the development of a district plan.

In January 2007, the Oregon Department of Land Conservation and Development acknowledged the new Title 13 program, finding it in compliance with Goals 5 and 6. This acknowledgement establishes new Goal 5 and 6 requirements for cities and counties in the Metro area local jurisdiction. Metro area cities and counties had until January 2009 to show that their local programs meet the requirements of the regional program. In November 2009 and June 2011, Metro granted the City of Portland extensions to meet Title 13 requirements. The city outlined an approach to achieve substantial compliance, including the development of area-specific plans such as Airport Futures and River

Plan/North Reach, and other elements to be initiated or completed during the extension periods. The City included the completion to the natural resources inventory for Hayden Island in its Title 13 extension request. The inventory is a required step in developing a District Plan for West Hayden Island as required by Title 13.

Metro identified many of the natural resource areas addressed in this inventory in the regional Title 13 inventory. Metro documented these areas providing important riparian functions and wildlife habitat attributes during development of Titles 3 and 13. As noted above, this updated inventory is intended to replace the regional inventory for the inventory study area, , and will, among other uses, inform City program updates affecting the management of natural resources on and in the vicinity of Hayden Island.



## CHAPTER 2. PROJECT APPROACH AND METHODOLOGY OVERVIEW

The inventory presented in this report was produced by integrating information from several sources. Some of the information presented later in this report was taken directly from Portland's recently updated draft citywide inventory of riparian corridors and wildlife habitat. Other key information was produced specifically for the Hayden Island inventory area, including the delineation of inventory sites, field observations and supplemental studies. The following chapter describes the key information pieces that make up this inventory and how the information was developed.

### Background and Relationship to Metro's regional inventory

The Bureau of Planning and Sustainability, in consultation with other City bureaus and other technical experts, have recently produced substantial new inventory information for riparian corridors and wildlife habitat in Portland. Products include new natural resources descriptions, geographic information system (GIS) natural resource data and models, maps, and a report documenting the project approach, (Appendix K: *City of Portland Natural Resource Inventory Update: Project Report*).

The Bureau used Metro's inventory of regionally significant riparian corridors and wildlife habitat as a starting point for citywide inventory development. The new citywide inventory incorporates and builds on the extensive research, analysis, technical review, and public scrutiny that went into the development of Metro's regional inventory. Metro's inventory was reviewed by the Independent Multidisciplinary Science Team (a group of leading scientists in the Pacific Northwest), and other local experts. Public workshops were held and a public hearing was conducted before the Metro Council. The Metro Council endorsed the Regional Natural Resources Inventory in December 2001, and directed Metro staff to develop a regional program to protect, conserve, and restore regionally significant riparian corridors and wildlife habitat. The Metro Council adopted the inventory as part of the Title 13 Nature in Neighborhoods program in September 2005. The development of Metro's inventory is documented in the *Technical Report for Fish and Wildlife* (Metro, 2005), *Riparian Corridor and Wildlife Habitat Inventories* (Metro, 2005) and *Addendum and Update to Metro's Riparian Corridor and Wildlife Habitat Inventories* (Metro, 2005).

In 2007, The Oregon Department of Land Conservation and Development acknowledged Title 13 as in compliance with Statewide Land Use Planning Goal 5 Natural Resources, Scenic and Historic Areas, and Open Spaces, and Goal 6, Air, Water and Land Resources Quality. As such, Title 13 establishes new regional requirements that Metro area cities and counties must meet to achieve compliance with specified elements of Oregon Land Use Planning Goals 5 and 6.

Both the City's and Metro's inventory reflect fundamental information from Metro's extensive review of scientific literature pertaining to riparian corridors and wildlife habitat. The scientific foundation upon which both inventories are based can be summarized as follows:

Riparian corridors are comprised of rivers and streams, drainageways, riparian vegetation, and off-channel areas, including wetlands, side channels, and floodplains. Riparian corridors usually contain a complex mix of vegetation consisting of trees or woody vegetation, shrubs and herbaceous plants. Portland's urban riparian corridors may also include rip rap or other types of bank hardening, invasive species and development. Riparian corridors provide the transition between the stream banks and upland areas.

The predominance of riparian corridor functions occurs within 30 to 100 meters (approximately 100 to 300 feet) of a water body, but some functions, such as the microclimate effect associated with forest

vegetation, can occur up to several hundred feet from a water body. Functions provided by natural resources located in riparian corridors include:

- **Microclimate and shade** - Open water bodies, wetlands, flood areas and surrounding trees and woody vegetation are associated with localized air cooling, soil moisture, and increased humidity.
- **Bank function and control of sediments, nutrients and pollutants** – River, stream, drainageway channels and flood areas have a direct relationship to bank functions and the conveyance of sediments, nutrients and pollutants. Trees, vegetation, roots and leaf litter intercept precipitation; hold soils, banks and steep slopes in place; slow surface water runoff; take up nutrients; and filter sediments and pollutants found in surface water. Structures, such as pilings, can also help stabilize banks and contain contaminants.
- **Stream flow moderation and flood storage** – Waterways and floodplains provide for conveyance and storage of stream flows and floodwaters in channel and above and below the ground surface; trees and vegetation intercept precipitation and promote infiltration which tempers stream flow fluctuations or “flashiness” that often occurs in urban waterways.
- **Organic inputs, nutrient cycling and food web** – Water bodies, wetlands, flood areas and nearby vegetation provide food (e.g., plants, leaves, twigs, insects) for aquatic and terrestrial species and are part of an ongoing chemical, physical and biological nutrient cycling system.
- **Large wood and channel dynamics** – Rivers, streams, drainageways, riparian wetlands, flood areas and large trees and woody vegetation contribute to changes in location and configuration of the waterway channel over time.
- **Wildlife movement corridors** – Rivers, streams, drainageways, wetlands, floodplains and vegetated corridors along waterways allow wildlife to migrate and disperse among different habitat areas and provide access to water.

Wildlife habitats within and upland of riparian corridors provide food, cover, perching, roosting and nesting/ denning sites for a broad array of birds, mammals, reptiles and amphibians. The terrestrial habitat features that provide these functions include forests, woodland, shrubland, grassland and meadows, wetlands, rocky slopes and uplands, buttes, water features and other topographic features. The following wildlife habitat attributes are indicators of habitat function and habitat fragmentation due to urbanization:

- **Habitat patch size** – Larger habitat patches generally provide more food, cover, dispersal and nesting/denning opportunities for multiple wildlife species.
- **Interior habitat area** – Larger, rounder-shaped habitat patches experience less “edge effect” (disturbance from urban land uses such as noise/light/vibration, predation and invasive species) and provide more interior habitat area, a requirement for some sensitive wildlife species, than narrow patches.
- **Connectivity between habitat patches** (including distance and edge effect) – Patches located closer together allow for species dispersal and migration, and provide additional access to food, cover, nesting sites, and reproduction opportunities.
- **Connectivity/proximity to water** – Access to water is vital to wildlife survival.
- **Special Habitat Areas** – The inventory recognizes specific habitat types or features that provide important functions for wildlife, including habitats and species at risk, rare or declining habitat types such as native oak assemblages, critical habitat for threatened or

endangered species, and urban structures such as bridges that are utilized by Peregrine Falcons for nesting.

Within Portland, natural resources generally reflect the impacts of urbanization; however, the resources still provide critical riparian and wildlife habitat functions. For example, vegetated areas in riparian corridors and upland habitats are often comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as varied food sources for wildlife and more effective slope stabilization. However, non-native plants still provide important watershed functions such as water storage, nutrient cycling and cover and nesting opportunities for wildlife. Other examples of the effects of urbanization on natural resources include constrained or altered rivers and streams channels, wetlands with soil contamination, and developed floodplains. In each of these cases, the resource has experienced degradation but still provides important functions such as water conveyance and storage, and fish and wildlife habitat.

## City's Inventory Methodology

Below is a summary of the steps the Bureau of Planning and Sustainability took to produce the new citywide inventory of riparian corridors and wildlife habitat (also see figure 1). More detail regarding the inventory approach and methodology, including citations, can be found in Appendix K: *City of Portland Natural Resource Inventory Update: Project Report*.

**1. Compiled GIS natural resource data and mapped key features including rivers, streams, drainageways, wetlands, flood areas, vegetation and topography.** The natural resource feature data are the primary inputs to the GIS inventory models for riparian corridor and wildlife habitat. The Bureau has updated and improved Metro's regional natural resource feature GIS data by:

- Remapping more than 160 miles of stream/drainageway centerlines; adding 100 stream/drainageway miles to the maps.
- Mapping smaller vegetation units (1/2 acre minimum), and classifying forest, woodland, shrubland and herbaceous vegetation over a wider area (using the National Vegetation Classification System). Vegetation mapping does not include land that is sparsely vegetated.<sup>1</sup>
  - **Forest:** Trees with their crowns overlapping, generally forming 60-100% of cover.
  - **Woodland:** Open stands of trees with crowns not usually touching, generally forming 25-60% of cover. Tree cover may be less than 25% in cases where it exceeds shrubland and herbaceous vegetation.
  - **Shrubland:** Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching, generally forming more than 25% of cover with trees generally less than 25% of cover. Shrub cover may be less than 25% where it exceeds forest, woodland, and herbaceous vegetation. Vegetation dominated by woody vines (i.e., blackberry) is generally included in this class.
  - **Herbaceous:** Herbs (graminoids, forbs, ferns and shrubs less than 0.5m tall) dominant, generally forming at least 25% of cover. Herbaceous cover may be less than 25% where it exceeds forest, woodland and shrubland vegetation. This includes shrubs less than 0.5 m tall.
- Verifying the existing wetland data using state and city permits and site visits; modifying some wetland boundaries where there was sufficient data.
- Updating the City's flood area data for use in the inventory, including incorporation of the 2004 and 2010 FEMA 100-year floodplain.
- Utilizing Light Detection and Ranging (LiDAR), a method for precisely measuring the elevation of the Earth's surface, and objects on the surface (trees, buildings, etc.) to update the topographic and stream data layers.

**2. Developed criteria and GIS models to rank and map the relative functional value of existing natural resources.**

Like Metro, the City produced GIS models to assess the relative functional value of riparian corridors and wildlife habitat. The riparian corridor and wildlife habitat GIS models assign relative ranks of "high," "medium," "low" or no rank to natural resource features. The ranks are produced using a consistent and replicable scoring method based on the number and type of functions provided by specific natural resource features in the city. The ranks are not tied to a reference or baseline condition, but allow comparison of the relative condition of natural resources within the region or city.

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<sup>1</sup> Sparse vegetation is defined as areas with a predominance of boulders, gravel, cobble, talus, consolidated rock and/or soil with unconsolidated, low-structure vegetation.

Science-based model criteria were developed to score, assign relative ranks, and map the natural resources that provide the specific riparian functions and wildlife habitat attributes listed above. The City's model criteria focus on the presence, type and extent of specific natural resource features. Additional descriptive information on natural resource conditions and disturbances (e.g. development, contamination and invasive species) are provided in the inventory site narratives.

The City's inventory models apply the same general sets of evaluation criteria that Metro developed. However, the Bureau refined some of the regional criteria to reflect additional detail, more recent data and studies, and local conditions. For example, the City's wildlife habitat model was refined to assign a higher value to somewhat smaller habitat patches than Metro's model. Shifts in the patch size scoring thresholds were based on additional scientific studies and recent wildlife studies conducted in Portland natural areas.

The City worked closely with Metro and technical experts to ensure that refinements to the regional inventory are consistent with Metro's work and will support the City's watershed health goals. For more detail on the inventory refinement see Appendix K - *City of Portland Natural Resource Inventory Update: Project Report*.

#### Riparian Corridor Model

The riparian corridor GIS model assigns primary and secondary scores to natural resources for six riparian functions. The scores reflect the types of landscape features present and the proximity of those features to a river, stream or wetland. Primary scores are applied to features that provide the most direct and substantial contribution to a particular riparian function. Secondary scores are assigned to features that provide lesser, but still important, contribution to riparian functions. The scientific literature indicates that the preponderance of riparian functions, such as nutrient cycling, occurs within 30 to 100 meters (approximately 100 to 300 feet) of a water body. The microclimate effect associated with forest vegetation, can occur up to several hundred feet from a water body.

Table 1 presents the riparian corridor GIS model criteria. The criteria reflect some refinements to the criteria Metro used to map riparian corridors across the region. The criteria refinements are explained in Appendix K: *City of Portland Natural Resource Inventory Update: Project Report*.

For example, Metro assigned a medium or high rank to all river banks and land within 50 feet of rivers and streams to recognize the direct and important impact of those areas on the river. This methodology was reviewed by independent experts and adopted as part of Title 13 Nature in Neighborhoods. The City refined the regional inventory to further recognize the variability of riverbank conditions in Portland. The refinement resulted in a lesser level of function being assigned to hardened, non-vegetated banks along specific segments of the Willamette and Columbia rivers. Initially, this refinement was made to recognize the impact of extensive river bank hardening associated with Portland Harbor marine terminal facilities in the Willamette River North Reach. In the North Reach land within 50 feet of the river, where the river bank is hardened and not vegetated, is assigned a low relative rank, recognizing a lower level of function but continuing to highlight the importance of the banks and adjacent land to overall riparian function.

Through the Hayden Island Natural Resource Inventory the Willamette River North Reach refinement is proposed to apply to non-vegetated, hardened banks of the Columbia River, including along Terminal 6 and East Hayden Island. This particular refinement is also being proposed for application in the Willamette River Central Reach as well. The model continues to assign a medium or high aggregated relative riparian rank to vegetated, non-hardened river banks.

**Table 1: The City of Portland’s Riparian Corridor GIS Model Criteria**

<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>
Microclimate and Shade	Water bodies	River, stream/drainageway or wetland	2, 5		
	Vegetation	Forest vegetation within the flood area (except within a drainage district)	3, 4	Woodland vegetation within the flood area (except within a drainage district)	3, 4
		Forest vegetation that is outside the flood area and contiguous to and within 100 feet of a river, stream/drainageway or wetland	1, 2	Forest vegetation that is outside the flood area, contiguous to primary vegetation, and between 100 feet and 780 feet of a river, stream/drainageway or wetland	1, 2
				Woodland vegetation that is outside the flood area and contiguous to and within 100 feet of a river, stream/drainageway or wetland	1, 2
				Shrubland vegetation that is contiguous to and within 50 feet of a stream/drainageway or wetland	1, 2
Stream Flow Moderation and Water Storage	Water bodies	River, stream/drainageway or wetland	2, 5		
	Flood Area	Vegetation within the flood area (except within a drainage district)	3, 4	Non-vegetated land within the flood area (except within a drainage district)	3, 4
	Vegetation			Woodland or shrubland vegetation that is outside the flood area and within 300 feet of a river, stream/drainageway or wetland	1, 2
				Forest vegetation that is contiguous to primary forest vegetation or starts within 300' of a river, stream/drainageway or wetland, and is within 780' of a river, stream/drainageway or wetland	1, 2
				Herbaceous vegetation that is outside the flood area and within 100 feet of a river, stream/drainageway or wetland	1, 2
Where the slope is at least 25%: Herbaceous vegetation that is outside the flood area, that starts within 100 feet and is within 200 feet of a river, stream/drainageway or wetland				1, 2	

<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>	
Bank Function, and Sediment, Pollution and Nutrient Control	Water bodies	River, stream/drainageway or wetland (except Willamette River North and Central Reach)	2, 5	Willamette River North and Central Reach	Water bodies	
	Land	Land within 50 feet of a river, stream/drainageway or wetland except land within 50 feet of a hardened, non-vegetated river bank in the Willamette River North and Central Reaches and the Columbia River within the Hayden Island NRI study area	1, 2, 7	Land within 50 feet of a hardened, non-vegetated river bank in the Willamette River North and Central Reaches and the Columbia River within the Hayden Island NRI study area	7	
	Vegetation	Forest, woodland or shrubland vegetation within the flood area (except within a drainage district)	Forest and natural/semi-natural woodland or shrubland vegetation outside a flood area, between 50 feet and 100 feet of a river	3, 4	Herbaceous vegetation within the flood area (except within a drainage district)	3, 4
			Forest and natural/semi-natural woodland or shrubland vegetation outside a flood area, between 50 feet and 100 feet of a river	1, 6, 8	Herbaceous or cultivated woodland or shrubland vegetation outside the flood area, and between 50 feet and 100 feet of a river	1, 6, 8
			Forest, woodland or shrubland vegetation outside a flood area, between 50 feet and 100 feet of a stream/drainageway or wetland	1, 2	Herbaceous vegetation outside the flood area, and between 50 feet and 100 feet of a stream/drainageway or wetland	1, 2
			Where the slope is at least 25%: Forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area, and is between 100 feet and 200 feet of a river	1, 6, 8		
			Where the slope is at least 25%: Forest, woodland or shrubland vegetation that is outside the flood area, and is between 100 feet and 200 feet of a stream/drainageway or wetland	1, 2	Where the slope is at least 25%: Forest, woodland or shrubland vegetation that is outside the flood area, contiguous with primary vegetation, and more than 200 feet of a river, stream/drainageway or wetland, but does not extend beyond the area with at least 25% slope.	1, 2
			Where the slope is at least 25%: Herbaceous vegetation that is outside the flood area, contiguous to vegetation within 100 feet, and between 100 feet and 200 feet of a river, stream/drainageway or wetland		1, 2	

<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>	
Large Wood and Channel Dynamics	Water bodies	River (including Willamette and Columbia River beaches) or stream/drainageway	2, 5			
	Land	Land within 50 feet of a river, stream or wetland except land within 50 feet of a river in the Willamette River North and Central Reaches and the Columbia River within the Hayden Island NRI study area	1, 4			
	Vegetation	Forest vegetation within 50 feet of a river in the Willamette River North Reach and Columbia River surrounding Hayden Island			Woodland, shrubland, herbaceous or non-vegetated land within 50 feet of the river within the Willamette River North Reach and Columbia River surrounding Hayden Island	
		Forest vegetation within the flood area (except within a drainage district)	3, 4		Woodland, shrubland or herbaceous vegetation within a flood area (except within a drainage district)	3, 4
		Forest vegetation that is outside the flood area, contiguous to and within 150 feet of a river or stream/drainageway (except within a drainage district)	1, 3, 4		Where the slope is at least 25%: Forest vegetation that is outside the flood area, contiguous with primary forest vegetation, and between 150 feet and 260 feet of a river or stream/drainageway (except within a drainage district)	1, 3, 4
					Within a drainage district, forest vegetation that is contiguous to and within 150 feet of stream/drainageway	1, 4
		Forest that is contiguous to and within 150 feet of a wetland that is located completely or partially within the flood area or 150' of a river or stream (except within a drainage district)	1, 2, 3, 4		Where the slope is at least 25%: Forest vegetation that is contiguous with primary forest vegetation, and is between 150 feet and 260 feet of a wetland, where the wetland is located completely or partially in a flood area or within 150 feet of a river or stream/drainageway (except within a drainage district)	1, 2, 3, 4
	Water bodies	Wetland located completely or partially within the flood area or within 150 feet of a river or stream/drainageway (except within a drainage district)	1, 2, 3, 4			

<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>
Organic Inputs, Food Web and Nutrient Cycling	Water bodies	River, stream/drainageway or wetland	2, 5		
	Vegetation	Forest and natural/semi-natural woodland or shrubland vegetation within the flood area (except within a drainage district).	3, 4, 8	Cultivated woodland and shrubland vegetation within a flood area (except within a drainage district)	3, 6, 8
		Forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area, and within 100 feet of a river	1, 2, 6	Forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area, contiguous to primary or secondary vegetation, and is within 170 feet of a river	1, 2, 6
				Cultivated woodland or shrubland vegetation that is outside the flood area, and within 100 feet of a river	1, 2, 6, 8
		Forest, woodland or shrubland vegetation that is outside the flood area and within 100 feet of a stream/drainageway or wetland	1, 2	Forest, woodland or shrubland vegetation that is contiguous to primary vegetation and within 170 feet of a stream/drainageway or wetland	1, 2
Riparian Wildlife Movement Corridor	Water bodies	River, stream/drainageway or wetland	2, 5		
	Vegetation	Vegetation that is contiguous to and within 100 feet of a river, stream/drainageway or wetland	1, 2	Vegetation that is contiguous to primary vegetation and within 300 feet of a river, stream/drainageway or wetland	1, 2

Footnotes:

1. Rivers, streams/drainageways and wetlands are primary features for riparian functions under evaluation. The model produces functional rankings for such features if open water area has been mapped. Map notations will indicate relative riparian function levels associated with streams or drainageways where only centerline data are available.
2. All search distances are measured from either a) the edge of the mapped water body, or b) the stream/drainageway centerline.
3. "Wetland" refers to all mapped regional wetlands fully or partially within 1/4 mile of a river or stream/drainageway, unless otherwise specified.
4. "Flood area" is comprised of the combined FEMA 100-year floodplain (2004/2010) and the 1996 flood inundation area as initially adjusted and to reflect recent permitted activities affecting site elevation.
5. Portland-area drainage districts: Peninsula Drainage District #1, Peninsula Drainage District #2, and Multnomah County Drainage District #1.
6. Hardened, non-vegetated banks are defined as seawalls, pilings and non-vegetated riprap and adjacent land within 50 feet of the North or Central Reach of the Willamette River.
7. Natural/semi-natural vegetation has a composition or structure that is self-maintaining, can include native and non-native species, or is managed as a natural area or restoration/enhancement project. Cultivated vegetation is consistent with traditional landscaping and is highly manicured and regularly managed and maintained. Cultivated vegetation is often dominated by turf grasses and ornamental shrubs and trees and may be managed using a combination of mowing, pruning, fertilizers and pesticides. Residential yards, common areas, golf courses, parks and right-of-ways are typically considered cultivated.

The primary and secondary scores for each function are combined to produce aggregated relative riparian corridor rankings of “high,” “medium” or “low.” The formula is similar to those that Metro used for the regional inventory and also reflects the distribution of primary scores assigned to features in the city (table 2).

Riparian Corridor Relative Rank	Ranking Formula	
	Primary Functions	Secondary Functions
High	4-6	0-6
Medium	1-3	0-6
Low	0	1-6

Features that receive any score, primary or secondary, provide important riparian corridor functions. Features that receive at least one secondary score and no primary scores receive a low relative rank. Features that receive one or more primary scores receive a medium or high relative rank. The number of secondary scores does not affect medium and high ranks.

Typically, the riparian corridor model assigns aggregated relative ranks to natural resource features as follows:

- **High** - Rivers, streams, drainageways and wetlands; forest or woodland vegetation within a flood area or in close proximity to a water body; and woody vegetation on steep slopes
- **Medium** - Shrubland and herbaceous vegetation within a flood area or in close proximity to a water body
- **Low** - Vegetation outside the flood area and further from a water body; developed flood areas; and hardened, non-vegetated banks of the Willamette River North Reach and Columbia River surrounding Hayden Island<sup>2</sup>

Within the City, natural resources generally reflect the impacts of urbanization; however, the resources still provide critical riparian and wildlife habitat functions. For example, vegetated areas in riparian corridors are often comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as varied food sources for wildlife and more effective slope stabilization. However, non-native plants still provide important watershed functions such as water storage, nutrient cycling, erosion control and organic inputs. Other examples of the effects of urbanization include constrained or altered river and stream channels, contaminated wetlands and soil, and developed floodplains. In each of these cases, the resource has experienced some degradation but still provides important functions such as water conveyance and storage, and fish and wildlife habitat.

Wildlife Habitat Model

The wildlife habitat GIS model assigns scores to mapped habitat patches based on their size, shape, and connectivity to other patches or water bodies as shown in Table 3 below. For purposes of the inventory model, habitat patches are defined as areas of forest vegetation and wetland that are at least two acres in size, plus adjacent woodland vegetation.<sup>3</sup> The model does not assign scores habitat areas smaller than 2 acres or to shrubland or grassland habitats or woodland that is not associated with a 2 acre forest/wetland patch. However, these

<sup>2</sup> Hardened, non-vegetated river banks include seawalls, pilings and non-vegetated riprap.

<sup>3</sup> Woodland vegetation that is contiguous to a forest/wetland patch that is greater than 2 acres in size is evaluated for wildlife habitat. Woodland vegetation independent of a forest/wetland patch is not evaluated by the wildlife habitat model.

habitats may be designated Special Habitat Areas if the habitats meet specific criteria (described in Step 3 below). Additional detail regarding the wildlife habitat methodology can be found in Appendix K: *City of Portland Natural Resource Inventory Update: Project Report*.

<b>Table 3: Wildlife Habitat GIS Model Criteria</b>		
<b>High Value (3 points)</b>	<b>Medium Value (2 points)</b>	<b>Low Value (1 point)</b>
<b>Habitat Patch Size<sup>1</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is 585 acres or larger.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 30 acres and smaller than 585 acres.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres and smaller than 30 acres.
<b>Interior Habitat Area<sup>2</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is 500 acres or larger.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is at least 15 acres and smaller than 500 acres.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is at least 2 acres and smaller than 15 acres.
<b>Connectivity to Other Patches<sup>3</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and the patch proximity index value is 100 or more.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and the patch proximity index value is at least 30 and less than 100.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres and the patch proximity index value is less than 30.
<b>Connectivity to Water<sup>4</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and where at least 75% of the patch area is within 300 feet of a river, stream/drainageway or wetland.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and where at least 25% and less than 75% of the patch area is within 300 feet of a river, stream/drainageway or wetland.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and less than 25% of the patch area is within 300 feet of a river, stream/drainageway or wetland.

*Footnotes:*

1. A habitat patch is defined as an area of contiguous forest and/or wetland greater than 2 acres in size, plus any woodland vegetation adjacent and contiguous to the core forest/wetland area.
2. "Interior area" is defined as the area within the forest and/or wetland portion of a habitat patch that is situated at least 200' from the edge of that portion of the patch.
3. Proximity to water relative value thresholds were determined by identifying "natural breaks" in the distribution of the values using the Jenk's Natural Breaks method, which determines the best arrangement of values into a specified number of classes by comparing and minimizing the sum of the squared differences of values from the means of potential classes.
4. Proximity to other patches is calculated using the Fragstats 3.3 proximity index (PROX). The specified search radius is ¼ mile. The proximity index is a dimensionless measure of the relative size and distance of all patches whose edges are within the specified search radius of each vegetation patch. for more information on Fragstats and the proximity index, refer to <http://www.umass.edu/landeco/research/fragstats/fragstats.html>.

Features that receive scores for one or more attributes provide significant wildlife habitat functions. Individual scores for each attribute are combined to produce an aggregated relative ranking of "high," "medium" or "low" for each wildlife habitat patch. As with the riparian corridor model, the formula used to generate the aggregate wildlife habitat rank is similar to those Metro used for the regional inventory (see Table 4).

Wildlife Habitat Relative Rank	Ranking Formula
High	9 or more points
Medium	4-8 points
Low	1-3 points

Natural resource features that receive points for one or more of these attributes provide important wildlife habitat functions. Typically, the wildlife habitat model assigns aggregated relative ranks to natural resource features as follows:

- **High** – Large forest and wetland areas such as Forest Park, Smith and Bybee Wetlands, and Tryon State Park.
- **Medium** – Moderate sized forest and wetland areas such as those at Kelley Point Park, Oaks Bottom and Powell Butte.
- **Low** – Numerous smaller forest and wetland areas throughout the city.

Within the City, natural resources generally reflect the impacts of urbanization; however, the resources still provide critical riparian and wildlife habitat functions. For example, vegetated areas in upland habitats are often comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as varied wildlife food sources. However, non-native plants still provide important watershed functions such as cover and nesting opportunities for wildlife. Other examples of the effects of urbanization include rivers and streams with constrained or altered channels, wetlands with soil contamination, and developed floodplains. In each of these cases, the resource has experiences some degradation but still provides important functions such as water conveyance and storage, and fish and wildlife habitat.

### 3. Designated Special Habitat Areas and Updated the Regional Species Lists

As part of the regional Title 13 inventory Metro designated Habitats of Concern for areas with documented sensitive/threatened fish or wildlife species, sensitive/unique plant populations, wetlands, native oak, bottomland hardwood forests, riverine islands, river delta, migratory stopover habitat, connectivity corridors, upland meadow, and other unique natural or built structures or resources (such as bridges that provide habitat for Peregrine Falcons).

Portland has updated Metro's Title 13 Habitats of Concern and refers to these areas as Special Habitat Areas (SHAs). The City has expanded the documentation, refined the mapping, and honed the eligibility criteria explanations. The City has also added and removed SHA designations for certain areas based on additional analysis.

Like the Title 13 Habitats of Concern, SHAs are mapped more generally than the landscape feature data used in the riparian and wildlife GIS models. The SHA boundaries may extend beyond the specific landscape features to capture seasonal variations in conditions (e.g., water levels) or a feature containing one or more habitat points, such as nesting areas on a bridge. Boundaries are determined on a case-by-case basis rather than through the use of model criteria. The rationale for the boundary is described in the natural resource descriptions for each inventory site.

The City has updated the SHA criteria to include National Oceanic and Atmospheric Administration (NOAA) designated as Critical Habitat for anadromous salmonids. Within this inventory for Hayden Island, the Columbia River is designated as Critical Habitat for multiple fish species. The City has also designated certain urban structures as SHAs, including several bridges on the Willamette and Columbia Rivers that provide nesting sites for Peregrine Falcons. A full list of SHA criteria is available in Appendix C.

Like Metro Title 13 Habitats of Concern, SHAs receive a high relative rank for wildlife habitat, which supersedes medium or low ranks assigned by the Wildlife Habitat Model.

The citywide inventory also includes up-to-date plant and wildlife species lists. Metro's regional vertebrate species list has been refined to include species whose natural range includes Portland. The lists do not include all the plant and wildlife species found in the city. The lists focus on "special status" species which include fish, wildlife and plant species that are officially listed under the Endangered Species Act by the NOAA Fisheries or the U.S. Fish and Wildlife Service and species receiving specific designations from:

- Oregon Biodiversity Information Center ranked or listed species
- Oregon Watershed Enhancement Board priority species
- Partners In Flight focal species
- National Audubon Society & American Bird Conservancy watch list species
- Northwest Power and Conservation Council Willamette and Columbia Subbasin Plans focal species

Special status species are identified by these entities for a variety of reasons. For example, the species may be:

- experiencing local, regional, state or national population declines,
- endemic to Oregon,
- vulnerable to local extirpation,
- a focal or indicator species (a species that encompasses structural and functional needs of broader ecological communities), and/or
- a keystone species (a species that physically alters environments and whose absence is detrimental to ecosystem function)



The City uses this information to track species trends at different scales and to provide context for evaluating management options and prioritizing local habitat protection and enhancement efforts. Information about special status species is included in the natural resource descriptions for each inventory site.

The City also maintains a list of *at-risk* wildlife species. The *at-risk* species list is a subset of the full special status species list, and includes only those species that are:

1. Listed by USFWS or NOAA Fisheries as:
  - a. LE: Listed Endangered
  - b. LT: Listed Threatened
  - c. PE: Proposed Endangered
  - d. PT: Proposed Threatened
  - e. SoC: Species of Concern
2. C: Candidate Listed by ODFW as:
  - a. LE: Listed Endangered
  - b. LT: Listed Threatened
  - c. SC: Critical
  - d. SV: Vulnerable
3. Received an Oregon Biodiversity Information Center rank or list 1, 2 or 3.

These *at-risk* species are the most vulnerable of the special status species. The *at-risk* species list, not the full sensitive species list, is used to designate SHA based on the (S) criteria. The full special status species list and the list of *at-risk* species are identified in Appendix D.

#### **4. Produced Combined Relative Ranks and Maps**

Once the GIS models produce the aggregated riparian corridor and wildlife habitat ranks and Special Habitat Areas are designated, a single combined relative rank for riparian corridor/wildlife habitat areas is produced. Where ranked riparian corridors and wildlife habitat areas overlap, and if the two aggregated relative ranks differ, the higher of the two ranks becomes the overall combined rank for that resource area. For example, a feature that ranks medium for riparian corridor functions and low for wildlife attributes, would receive a medium combined relative rank.

As noted in previous sections, it is important to keep in mind that natural resource features can rank high based on the specific inventory criteria and also be impacted by land management activities, invasive plants or animals, or contamination as discussed in the natural resource description for each inventory site.

The City's can produce different inventory maps displaying the GIS model results for individual riparian and wildlife habitat functions and attributes, the Special Habitat Areas, the aggregated riparian corridor and wildlife habitat relative ranks, and the combined riparian corridor/wildlife habitat relative ranks. Maps of the aggregated riparian corridor and wildlife habitat ranks and combined riparian/wildlife habitat relative ranks are presented in this report for each inventory site.

#### **5. Addressed Resource Significance**

To comply with the Oregon Statewide Land Use Goal 5 rule, local jurisdictions must assess inventoried natural resources to determine if the resources are "significant" based on location, and relative quantity and quality. Resources that have been deemed significant must then be evaluated to determine if and how those resources should be protected by the local jurisdiction.

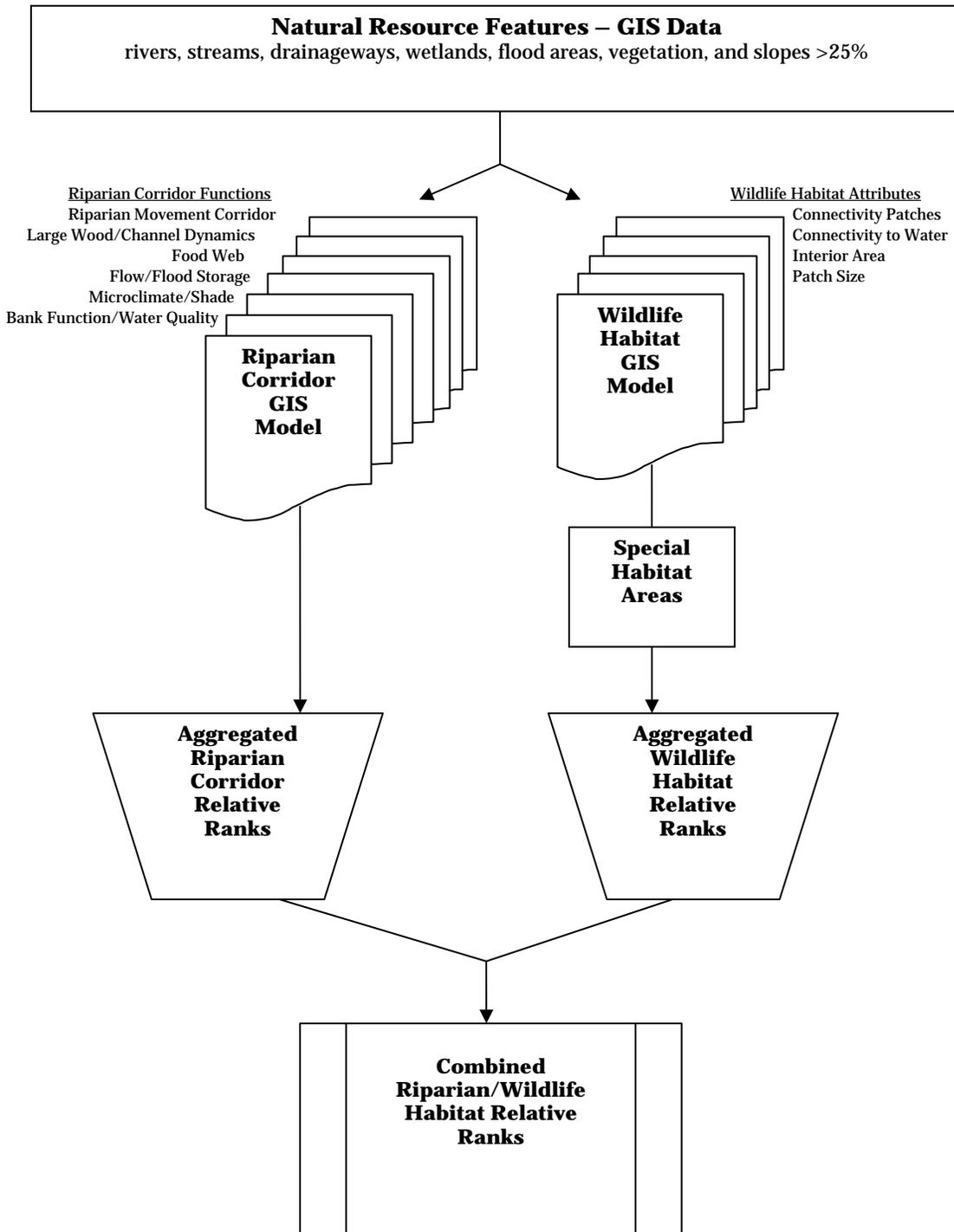
Metro determined the significance of inventoried natural resources by evaluating both ecological significance and regional significance. Metro determined the ecological significance of inventoried regional riparian corridors and wildlife habitat based on the scientific literature. For riparian corridors, Metro determined that all natural resources receiving scores for riparian functions are ecologically and regionally significant. For wildlife habitat, Metro determined that all ranked habitats are ecologically significant, and all but the lowest ranked wildlife habitats are regionally significant. Metro noted that these low ranked wildlife habitat areas could provide locally significant habitat and recommended that cities and counties consider these areas when developing local protection programs. When developing inventories for area-specific planning projects such as West Hayden Island Plan, the City considers the existing natural resource features and functions in the context of the planning area, the city as a whole, and the region. The City also considers relevant information beyond the immediate region such as fish and wildlife species that migrate over long distances and pass through Portland.

The Oregon Department of Land Conservation and Development acknowledged Metro's regional inventory and associated Title 13: Nature in Neighborhoods program as in compliance with the Goal 5 rule in January 2007.

The City's inventory is based on the science and approach Metro used to develop the adopted inventory of regional riparian corridors and wildlife habitat. The City's inventory also reflects updates and refinements to the regional inventory, and relates more closely to existing relative quality and functions of Portland's natural resources. These improvements have increased the accuracy and level of detail of the City's inventory information.

Following Metro's approach for determining resource significance, all natural resources receiving riparian corridor or wildlife habitat scores and ranks in the City's inventory would be deemed ecologically and locally significant. Official determination(s) of significance will take place at the time of adoption by the City Council.

**Figure 1: Natural Resources Inventory GIS Model Flow Diagram**

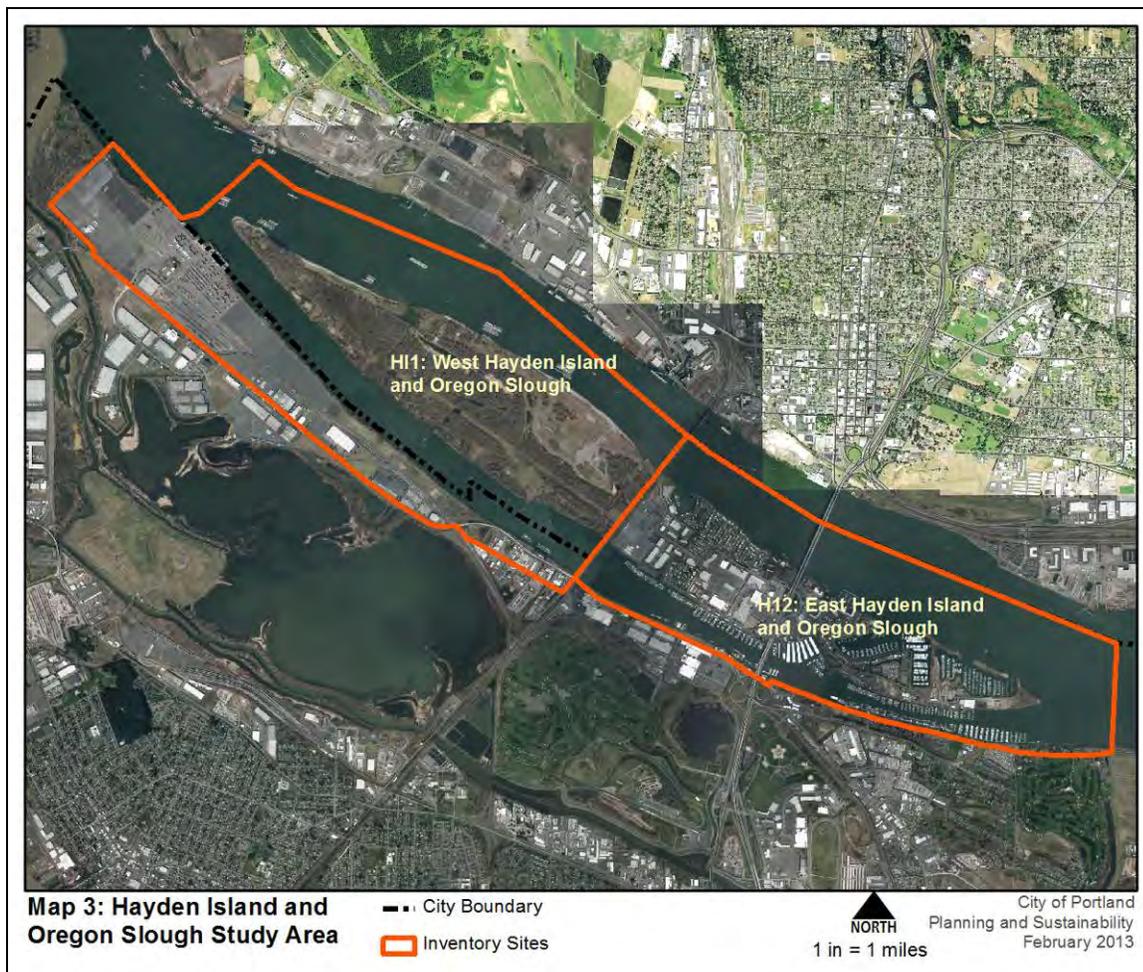


## Work Conducted for the Hayden Island Natural Resources Inventory

The Hayden Island Natural Resources Inventory presented in this report reflects the citywide inventory work discussed in the previous section, and additional work conducted specifically for the Hayden Island inventory study area, as described below.

### Delineation of Inventory Sites

The City has delineated two new inventory sites for the Hayden Island Natural Resources Inventory (Map 3). Consistent with more recent City inventories, the inventory sites are contiguous to each other and include not only natural resource features but the surrounding land uses as well.



Specifically, the inventory site boundaries are intended to:

- Capture similar and contiguous landscape features (natural and human-made) in the same inventory site.
- Abut one another – no gaps between inventory sites.
- Address areas included in Metro’s inventory of regionally significant riparian corridors and wildlife habitat.

To delineate the boundaries between inventory sites, a number of landscape features were considered:

- Streets, bridges, railroad tracks or other transportation facilities – The intent is to set boundaries co-incident with facilities that are likely to remain in the same location for many years. When a transportation facility is used as an inventory site boundary, the boundary will include the entire right-of-way within the inventory site. If the transportation facility is located between two inventory sites, the entire right-of-way will be included in one of the sites depending on development, property ownership, vegetation or other characteristics.
- Property boundaries and ownership – The intent is to avoid either bisecting a single property or bisecting multiple and adjacent properties that are under a single ownership.
- Contiguous undeveloped areas – The intent is to include contiguous, undeveloped areas in the same inventory site where possible.
- Topography – The intent is to use topography as a boundary where it forms a natural break between inventory sites.
- Vegetation – The intent is to include contiguous vegetation in the same inventory site, except when the vegetation type is significantly different or other landscape features such as steep slope indicate a distinction between habitat types.
- Columbia River Centerline – The intent is to include the near-shore habitat and river bank within the same inventory site as the riparian corridor.

The term “inventory site” or “site” is used, rather than “resource site” or “habitat site” which has been used in previous City inventories. The terms have been updated for clarity given that the current inventory sites contain and address natural resource areas and surrounding land uses including developed areas.

## Incorporating information from City of Portland Draft Inventories

In 1995 and 1999, the City of Portland produced two draft inventories of natural resources for West Hayden Island. Two studies were completed for the 1995 planning effort:

- Final Baseline Report for West Hayden Island Goal 5 Inventory and Assessment (Bakke, 1995)
- West Hayden Island Wetlands and Potential for Salmonid Rearing with Emphasis on Chinook Salmon Listed as Endangered Under the Federal Endangered Species Act (Smyth, 1995)

These studies assessments involved extensive field visits and completion of Wildlife Habitat Assessments which addressed the presence and availability of water, food, and cover for wildlife. Observations regarding water quality, riparian vegetation, wildlife use and habitat connectivity were recorded, as well as disturbance impacts, and connection with other natural areas. Unique or rare occurrences of plant and animals were also noted. Habitat sites received a numeric score, which provided a relative rank. Habitat descriptions, species observations and information about relative habitat quality have been incorporated into this inventory.

The 1999 *Goal 5 Natural Resources Inventory and Assessment* was largely a compilation of data from previous studies and relied on the 1995 Wildlife Habitat Assessments. Additional site-specific research was not completed. Descriptive information for the 1999 report is incorporated into this inventory.

## Incorporating information from the Port of Portland Natural Resources Inventory (2006)

In 2006, the Port inventoried natural resources on Port-owned property within the study area. The Port mapped land cover, both natural and anthropogenic, at the regional and local scale using the Johnson and O'Neill habitat classifications. The Port mapped 9 regional and 32 local habitat classifications at a scale of 400 square feet (see Table 4). The City utilized the Port's inventory, along with 2010 aerial photography, to update the City's vegetation and wetland data within the study area, while retaining the City's inventory mapping units.

Blackberry Scrub-Shrub	Herbaceous Wetland
Channel	Improved Pasture - Perennial Grass Seed/Hay
Conifer	Mixed Conifer-Hardwood
Conifer (Planted)	Mixed Conifer-Hardwood (Planted)
Cottonwood	Pervious Wasteland/Barren/Weedy Fill
Cottonwood, Willow Scrub-Shrub	Pond
Cottonwood, Willow Scrub-Shrub (Planted)	Railroad - Crushed Rock
Cottonwood, Willow, Ash Forest	Railroad – Gravel
Cottonwood, Willow, Ash Forest (Planted)	Railroad – Paved
Cultivated – Bare ground/Irrigated	River
Developed - Cultivated	River Beach (Modified/Protected)
Developed - Impervious	River Beach (Natural)
Developed - Pervious	Road - Crushed Rock
Ditch	Road – Dirt
Ditch – Roadside	Road – Gravel
Emergent Wetland	Road – Paved
Grass/Forb - Mowed	Savannah
Gravel Bar	Scrub-Shrub
Hardwood	Scrub-Shrub (Planted)
Hardwood (Planted)	Stream
Herbaceous Upland	Unimproved Pasture - no Active Management
Herbaceous Upland (Planted)	Water Related Structures

## Incorporating information from the *Environmental Foundation Study (ENTRIX, 2010)*

The City contracted with ENTRIX to produce an *Environmental Foundation Study* as part of the West Hayden Island Phase I planning project. ENTRIX used existing data from the Port of Portland and the City of Portland, and data from other sources including the US Army Corps of Engineers. ENTRIX did not perform additional on-site data gathering or monitoring.

As part of the study, the City asked ENTRIX to begin with the City's inventory methodology and suggest refinements to make the evaluation specific to the island. ENTRIX added functional criteria related to channel margin characteristics, habitat diversity/interspersion, vegetation community diversity and soil conservation. They also created new criteria for in-channel, shallow water habitat. The City considered each of ENTRIX's criterion for potential inclusion in the city's GIS model methodology. One goal of the City's inventory methodology is to produce

replicable and comparable results. ENTRIX's criteria diverge from the regional methodology adopted as part Metro Title 13 Nature in Neighborhoods and the methodology used in other parts of the City. In addition, the data required to apply ENTRIX's criteria using GIS models are not available for much of the island or for other parts of the city. Therefore, it was not feasible to incorporate ENTRIX's criteria into City's GIS models for this inventory. However, the City continued to explore options for evaluation of shallow water habitat in response to ENTRIX's work.

Shallow water habitat is evaluated in the GIS riparian corridor model as part of the open water and is ascribed all of the riparian corridor functions, resulting in a high relative rank. As a first step in developing the Hayden Island Natural Resources Inventory, the City convened a Technical Panel. The City consulted with the Technical Panel to determine if the shallow water habitat criteria developed by ENTRIX should be brought into the City's methodology. ENTRIX evaluated shallow water habitat based on the adjacent river bank and riparian corridor features and condition. Shallow water habitats adjacent to forest were scored higher than shallow water habitat adjacent to shrubland, herbaceous or non-vegetated areas. The result was that some shallow water habitat received a low relative rank. During the technical review of ENTRIX's methodology, multiple technical experts stated that adjacent bank and riparian corridor features and conditions are not the most appropriate features to used in assessing shallow water habitat functions. These experts recommended considering river substrates, micro-flows, ground water inputs, and in-water structure to assess functions provided by shallow water habitat.

The Technical Panel confirmed that all shallow water habitats are critical for anadromous salmonids and other native fishes and should be mapped and highlighted in the inventory. Some suggested that optimally GIS data and model criteria would be developed so that different shallow water habitat areas could be assigned relative ranks. The experts suggested features and functions be used to update the City's GIS model. Examples include ground water upwelling areas, micro-flows, substrates, undercut banks, large wood, etc. The panel recognized that the necessary data do not exist for the study area and there is insufficient time and resources to gather the data. Further, developing new GIS modeling criteria would require extensive research, analysis, and review, which is not feasible for this planning effort.

The City's inventory does incorporate descriptive information from ENTRIX's *Environmental Foundation Study* regarding natural resource features, fish and wildlife use and the relationship of West Hayden Island to habitats in the Metro region, Lower Columbia River and along the Pacific Flyway.

## Supplemental Site Visits

Starting in October 2010, staff from the bureaus of Planning and Sustainability, Environmental Services, Parks and Recreation and the Office of Healthy Work Rivers, the Port of Portland, and other technical experts conducted site visits within the study area. The purpose of the site visits is for staff to become familiar with the environs within the study area, to revisit information contained in the previous City and Port natural resource and wildlife inventories and to document observation of plant and wildlife species. The City has developed a strategy to gather data on the presence/absence of wildlife species and vegetation composition within the Hayden Island study area. These data are used to:

1. Inform designation of Special Habitat Areas
2. Confirm and supplement the GIS data and mapping
3. Provide sufficient detail to inform future management discussions

Staff, working with the Technical Panel for the Hayden Island Inventory, identified the following species as a high priority to gather additional data:

- amphibians
- avian: grasslands
- avian: riparian forests
- reptiles
- bats
- rodents
- vegetation: grassland
- vegetation: riparian forest
- vegetation: wetland

Data gathered during the site visits are incorporated into the natural resource descriptions. The data are also used to make determinations about Special Habitat Areas. Information from the site visits is detailed in the following appendices -

- Appendix E: All Fish and Wildlife Species Observed on HI1 – West Hayden Island and Oregon Slough
- Appendix F: At Risk Species Mapping Project
- Appendix G: West Hayden Island Vegetation Survey
- Appendix H: West Hayden Island Bat Survey
- Appendix I: Amphibians and Reptiles of West Hayden Island

#### Vegetation Survey

In the winter of 2010-2011, Bureau of Environmental Services staff surveyed all areas of WHI as well as the Terminal 6 Vacant Industrial Lands on the mainland (Map 14). As part of this survey, forms were filled out describing the plant community for each unit and documenting plant species and cover class for a tree, shrub and groundcover levels. The densities of tree regeneration, coarse woody debris and snags were also described. Additional plant surveys were conducted in spring and summer 2011 to document rare plant species. Appendix G includes a map and full list of plant species surveyed in the inventory site.

#### Avian Surveys

In order to collect avian observations (both visual and auditory), wildlife units were surveyed for birds, primarily from existing trails and open areas. Experienced field ornithologists recorded date, species, number, behavior, habitat associations and wildlife unit. Staff made over 3300 observations of more than 160 avian species, 13 of which are *at risk* species, from December 2010 to September 2011. Some units were surveyed with a systematic “area search” protocol. Walking surveys were completed for other units where observers stopped to identify species and record data as birds were encountered. Efforts were made to capture each migratory season, as well as breeding and wintering avifauna. Generally, site visits were conducted in the early morning hours to maximize observation. Special efforts were made for specific sensitive species, species groups, and wildlife units of particular interest. Efforts were made to visit each wildlife unit in all seasons; however, due to seasonally flooding some portions were not accessible during some portions of the year.

#### West Hayden Island Bat Inventory

SWCA Environmental Consultants (SWCA) conducted acoustic surveys and performed capture on WHI during July 2011. Each survey type was conducted for three habitat types: forest, open and wetland. Bat capture using mist nets were conducted from July 11-16; no bats were caught. Acoustic Surveys were conducted between June 17<sup>th</sup> and July 15. Acoustic surveys record the species and amount of calls. The results were that seven species of bats, including five at risk species were identified using WHI habitats. The wetland station recorded the most activity, followed by the open station and then the forest station. Wetlands are very important drinking and foraging habitat for bats. Forests are important roosting areas. The study suggests that the open areas may be used for movement to and from foraging and roosting sites or bats may be

foraging over the open areas. Activity spiked at all stations just after sunset and just before sunrise. Detailed results from the survey are included in the site description. The SWCA report is Appendix H of this report.

#### Amphibians and Reptiles of West Hayden Island

Rombough Biological was contracted with to perform surveys for reptiles and amphibians during the spring and summer 2011. Twelve wetlands were surveyed for amphibian egg masses, amphibian larvae and turtles. The forest areas were surveyed for presence of terrestrial amphibians. Four species of amphibians were found on WHI: long-toed salamander, Pacific tree frog, northern red-legged frog and American bullfrog (a non-native and invasive species). Three species of reptiles were found on WHI including northwestern garter snake, common garter snake and slider turtle (non-native); in addition a single western painted turtle was observed along the islands south shore. Detailed results from the survey are included in the site description. The Rombough Biological report is Appendix I of this report.

## Technical Review

The Bureau of Planning and Sustainability convened a group of technical experts to collaborate on development of the Hayden Island Natural Resources Inventory and to review early drafts of the report. The twenty-member Technical Panel included representatives from: Port of Portland, Metro, US Fish and Wildlife Service, NOAA Fisheries, Audubon Society of Portland, and the Lower Columbia River Estuary Partnership. A project team, consisting of city staff from City of Portland Bureau of Environmental Services, Office of Healthy Working Rivers, Portland Parks and Recreation and Bureau of Planning and Sustainability, was established to support the inventory development.

#### Technical Review Process Summary:

1. Key topics were originally identified by the technical panel and project team and the issues were outlined in a series of memos during the fall 2010.
2. On December 6<sup>th</sup>, 2010, the technical panel and project team met to discuss the key topics and resolve issues.
3. The results of the memos and discussion were incorporated into the HINRI Technical Review Draft (March 2010), which was reviewed and commented on by the Technical Panel.
4. After all comments on the draft report were assembled and most were addressed, a HINRI Public Review Draft (June 2010) draft was completed and made available for broader public review, which closed on September 30, 2011.
5. A Technical Work Session was held on August 5<sup>th</sup>, 2011 to address two main points of disagreement that were identified from the technical review.
6. Following the work session, one topic area remained unresolved; the designation of the Dredge Deposit Management Area as a SHA based on two criteria. The Technical Panel reviewed and provided comments on the staff recommendation for this topic.
7. Results from the memos, comments, discussions, work session and additional research were incorporated into the HINRI Proposed Draft (February 2012), which will be considered by the Planning and Sustainability Commission in spring 2012.

Appendix J is the Technical Review Report that summarizes the topics, comments and discussions during the technical review process, and staff recommendations. The main topics were:

- Special Habitat Areas: Grasslands and Sparsely Vegetated Areas
- Hydrology Affects on the Cottonwood Forest
- Special Habitat Area: Island Habitat (I)
- NRI Model Criteria Revisions
- Shallow Water Habitat
- Indicator Species and Habitat Requirements

- **Habitat Relationships**

**The Hayden Island Natural resources Inventory Proposed draft reflects input from the Technical Panel discussions and comments received during review of early drafts of the report.**



## CHAPTER 3. HAYDEN ISLAND NATURAL RESOURCES INVENTORY

Chapter 3 provides information, data and maps that describe the presence, extent and condition of natural resources on Hayden Island and the Columbia River within study area. This chapter is organized into the following sections:

**Section 3a:** The Columbia River Basin and Lower Columbia River – Provides a summary of the Columbia River Basin, focusing on the Lower Columbia River from the Bonneville Dam (RM 146) to the Pacific Ocean (RM 0). Included is a general description of natural resource features and functions of the Lower Columbia including hydrology, bathymetry, water quality, habitat and fish and wildlife species use. This section provides a geographic and functional context for the more detailed inventory information in subsequent report sections.

**Section 3b:** The Hayden Island Natural Resources Inventory Study Area – Includes information, data and maps for the study area including Hayden Island, the Columbia River around the island, and the southern bank of the river. This section includes detailed information on the following:

- 3b.1: Hayden Island History** – Context and short overview of Hayden Island history related to natural resources.
- 3b.2: Inventory Site HI1: West Hayden Island and Columbia River South Bank** – Detailed natural resource inventory for the western portion of Hayden Island, Oregon Slough and the Columbia River southern bank across from West Hayden Island. Addresses wetlands, flood plain, vegetation, habitat and wildlife species use. Includes maps of GIS model results for riparian corridor functions, wildlife habitat attributes and relative riparian corridor and wildlife habitat functional rankings.
- 3b.3: Inventory Site HI2: East Hayden Island and Columbia River South Bank** – Detailed inventory for the eastern half of Hayden Island, Oregon Slough and the Columbia River southern bank across from East Hayden Island. Addresses flood plain, vegetation, habitat and wildlife species use. Includes maps of GIS model results for riparian corridor functions, wildlife habitat attributes and relative riparian corridor and wildlife habitat functional rankings.

### Section 3a: The Columbia River Basin and Lower Columbia River

#### Columbia River Basin Overview

The second largest river in the United States, the Columbia River drains a 260,000 square mile watershed that encompasses much of the Pacific Northwest between the coastal ranges in the west and the continental divide in the east. The Columbia River flows for more than 1,200 miles, from the Rocky Mountains of British Columbia to the Pacific Ocean. The basin includes seven states, 13 federally recognized Indian reservations, and British Columbia. Major tributaries include the Kootenai, Okanagan, Pend Oreille, Spokane, Snake, Yakima, John Day, Deschutes, Sandy, Willamette and Lewis Rivers.

The Columbia River Basin is commonly divided into three sub-basins: the Upper Basin above the Grand Coulee Dam in Central Washington; the Middle Basin between Grand Coulee and the Bonneville Dam in the Columbia River Gorge; and the Lower Basin from Bonneville to the Columbia River Bar at the Pacific Ocean. These sub-basins vary greatly in terms of elevation, hydrology and landscape.

The Columbia River Basin is the most hydroelectrically developed river system in the world. Hundreds of dams were built in the basin including more than 400 dams on tributary streams and 14 dams on the mainstem river that assist the region with flood management, irrigation, and power generation. The Bonneville Dam, completed in 1938, is the lowest dam on the Columbia River located at river mile (RM) 146. The Lower Columbia River Basin is still a free flowing river with tidal fluctuations to Bonneville.



Map 4. Columbia River Basin

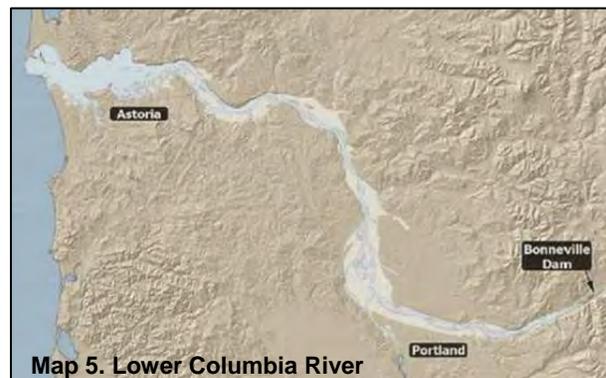
The dams alter the flow regime of the river. The artificial hydrologic period results in impacts to natural resources that include:

- modified water temperature;
- reduced flood storage capacity and geomorphic maintenance of the river, channels, and floodplain;
- reduced sediment and nutrient transport and distribution; and
- fish passage barriers, which reduces the ability of ESA listed fish to reach spawning habitat in the tributaries streams.

The ecology of the Columbia River basin is diverse and ranges from temperate rain forests to semi-arid plateaus. The Columbia River is part of the Pacific Flyway for migratory birds and provides an extensive network of spawning streams for anadromous salmon, steelhead, smelt and Pacific Lamprey. Columbia River fish and wildlife species that are listed, candidate or species of concern under the federal Endangered Species Act include: sockeye salmon, chum salmon, Chinook salmon, coho salmon, steelhead trout, coastal cutthroat trout, bull trout, green sturgeon, Columbia eulachon, Pacific lamprey, Band-tailed Pigeon, Streaked Horned Lark, Yellow-breasted Chat, olive-sided flycatcher, purple martin, multiple bat species, Northern Red-legged Frog, Oregon silverspot butterfly, and water Howellia .

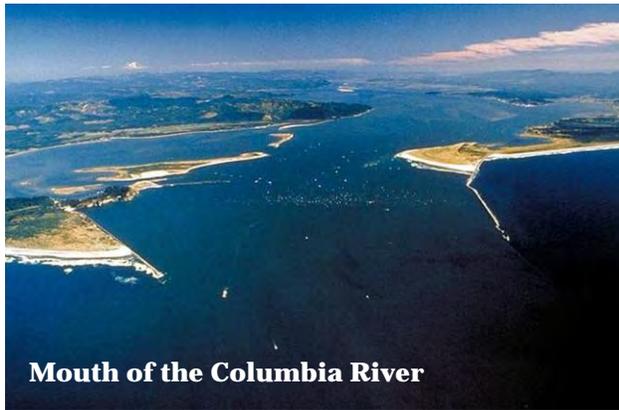
## Lower Columbia River

The Lower Columbia River includes the 146 miles of river from the Bonneville Dam to the Pacific Ocean. The mainstem is free flowing. The Willamette River confluence is located at RM 100 at the cities of Portland and Vancouver. In all, 19 jurisdictions and nine counties border the Lower Columbia River Basin, and six bridges connect the states of Oregon and Washington below Bonneville Dam including: the Glenn L. Jackson I-205 bridge, the two bridges that provide the I-5 crossing, the railroad bridge on Hayden Island, the Lewis and Clark Bridge on highway 433 at Longview, Washington and the Astoria bridge at the mouth of the River.



Map 5. Lower Columbia River

The Coast Range is the result of relatively recent tectonic uplift and separates the mild marine climate along the coast from the drier Willamette Valley that experiences greater temperature ranges. The geology of the Lower Columbia River Basin is also defined by historic basalt flows and the Missoula floods. The floods from glacial Lake Missoula beginning 14,000 years ago scoured the Gorge exposing steep walls of columnar basalts before spilling into the wider plain between the Cascade and Coast ranges. In the Lower Columbia River Basin, Missoula flood deposits of sand and gravel define many of the landforms.



**Mouth of the Columbia River**

Early European explorers repeatedly missed the mouth of the Columbia in their search for a passage inland. Obscured by the rolling waves at the Columbia bar, the entrance to the river remained elusive even as the freshwater plume was evident far out to sea. The Lewis and Clark expedition used the untamed river for the final leg of their journey to the Pacific Ocean, noting the immense salmon runs and Native American villages clustered along the river. The earliest permanent European settlers also located on the Lower Columbia River to take advantage of the river transportation network. Astoria was founded in 1812 at the river's mouth to control the fur trade and Fort Vancouver was located at the confluence

of the Willamette and Columbia Rivers in 1824 to direct interior trade and to propagate settlement in the Willamette and Cowlitz Valleys, and the Tualatin plains. The stretch of the river adjacent to the Fort Vancouver site continues to support the largest human population in the Columbia Basin and remains a focal point for river commerce and recreation.

Ocean going vessels use the Lower Columbia River for import/exports of goods and regional barge transportation makes use of a system of locks to navigate up to Lewiston, Idaho on the Snake River. The Lower Columbia River has been maintained as a shipping channel since the 1800's. In order to maintain the channel, dredging must occur. Early dredging efforts started in 1864 at the mouth of the Columbia River and in 1898 the Columbia's main channel was deepened to 25 feet. Today the main Columbia River channel is up to 48 feet deep and 600 feet wide. The material dredged from the river must be deposited outside of the shipping channel. The US Army Corps of Engineers performs much of the dredging activities and disposes of nearly 6.9 million cubic meters of Columbia River dredge material annually. The dredged material is disposed of in water, upland, or in shoreline (beach) areas. The beach disposal is generally considered a beach nourishment action because beaches have been losing sediment that is either impounded in upstream reservoirs or locally displaced from currents and ship wake-wave erosion.

Beginning in 2005, the US Army Corps of Engineers dredged the Columbia River from river mile 95 to 105 near Hayden Island in Portland. In 2006, dredging occurred from river mile 88 to 95 at the mouth of Multnomah Channel. Dredging of this shipping channel has resulted in the disposal of massive quantities of sediment elsewhere in the floodplain.

Hayden Island has been receiving dredge materials from the Columbia and Willamette River since the early 1900's. The landmass of single Hayden Island is significantly larger than the historic multiple, smaller islands found here. The dredge spoil disposal sites were often colonized by early succession vegetation and limited wildlife communities. Increased elevation of floodplain habitat on Hayden Island has created extended drier periods and allowed bottomland or woodland habitat to establish whereas more frequent inundation would preclude hardwood forest establishment.

Prior to the installation of dams on the river and its tributaries, many of the islands and much of the floodplain in the Lower Columbia River basin were inundated several times a year during periods of high flow and/or snowmelt runoff. Historic spring floods affected the entire Columbia River system and were the primary force influencing the landforms and vegetation within the channel migration zone. These floods were caused by snowmelt usually between April and August, although concentrated in May or June. Average annual spring floods had flows of about 600,000 cubic feet per second (cfs). These average flows were punctuated by huge flows with tremendous impact on the lower river. Spring floods greater than 600,000 cfs occurred 46 times between 1858 and 1956, with six floods between 800,000 and 900,000 cfs. The largest flood in 1894 reached 1,254,000 cfs (Christy 1992).

Currently the lowest river flows occur during September and October and the highest flows occur from April to June. High flows can also occur between November and March during periods of heavy

precipitation. The discharge at the mouth of the river ranges from 100,000 to 500,000 cfs. Normalizing the flow downstream of dams has minimized the peak flow hydrology of the river, and stifled the primary processes that create and maintain natural river habitat. It has also altered the transition zone between saltwater and fresh water in the estuary, shifting sediment budgets and food webs, changing habitats and food availability, and influencing migratory patterns of many fish and wildlife species. The altered flood regime is listed as a primary cause of the decline of many protected fish species in the Columbia River basin in nearly all of National Marine Fisheries Service and US Fish and Wildlife Services recovery plans.

The populations of cities surrounding the Lower Columbia River are supported by flood control, available hydroelectric power and clustering of heavy industry on the Willamette and Columbia Rivers. The river-dependent industries along the Columbia River are a key component of the regional economy, particularly due to the proximity of significant air, rail, barge and freight transfer points to port facilities for ocean-going vessels. Marine cargo activities are common, with large vessels docking at berths accessed via a deepwater channel dredged for ocean-going vessels.



There have been major changes in the habitat of the Lower Columbia River in the 74 years after the Bonneville Dam was completed. Sherwood et al. (1990) estimated that the area of tide flats, swamps, and wetland in the Lower Columbia River were reduced by 40 percent between 1870 and 1970. A comprehensive, large-scale study of toxics and other ecosystem components in the Lower Columbia River found that the amount of riparian habitat and tidal swamps and marshes has decreased by as much as 75 percent from historic levels (Tetra Tech, 1996). Estuaries have several zones that qualify habitat types, from subtidal aquatic beds and intertidal wetlands to salt marsh, scrub-shrub, and forested wetlands. Each zone reflects a range of salinities that result from the river's freshwater mixing with the ocean's saline water; therefore, each zone provides a unique habitat type that functions for unique groups of natural resources. The common thread that unites the various zones to define an estuary, though, is the variation in water surface elevation that each zone continually experiences as a result of the tidal prism. Water bodies that ebb and flow with the tide are classified as estuarine, whether they are fresh water or saline streams and sloughs.

In Portland and Vancouver, riverfront industrial facilities, recreational marinas and housing developments are found along the river banks. The history of industrial activity and shipping has reshaped the banks of the river, particularly since World War II. Within the cities, substantial portions of the river banks have been fortified with riprap, seawalls and docks. Pilings, piers and other human-made structures extend out into the river. A dike system, managed by the Multnomah County Drainage District (MCDD), extends along the length of Portland's bank of the Columbia River as far as Smith & Bybee Lakes, where it meets the Port of Portland's Terminal 6. The bank alterations have disconnected the river from its floodplain, minimized channel dynamics, reduced the extent of shallow-water areas and reduced wildlife connections between upland, riparian and in-water habitat areas.

Diking and filling activities that decrease the tidal prism and reduced emergent and forested wetlands and floodplain habitats have likely reduced the river's salmon-rearing capacity. Bottomland forest habitat, an extensive landscape feature maintained by flood disturbance, have been drastically reduced as a result of modifications to the river's hydrology. Bottomland forest habitat is known to support some of the highest diversity of neotropical migrants in the region. Extensive wood removal and changes in sediment dynamics were also major contributors to changes in river processes.

A NOAA technical memo indicates that habitat and food-web changes within the Lower Columbia River and other factors affecting salmon population structure and life histories have altered the river's capacity to support juvenile salmon (Bottom et al., 2005). Other problems that continue to have negative impacts on native fish populations include an increase in non-native fish, plant and animal species that have further altered food web dynamics, shifted habitats, and introduced diseases and parasites.

Before Euro-American settlement, the Columbia River basin was used extensively by four salmon species: Chinook, chum, coho, and sockeye salmon; plus three trout species: bull, steelhead and cutthroat (Lichatowich 1999). Within these seven salmon and trout species, 13 evolutionarily significant units (ESUs), representing more than 150 populations of salmon and steelhead, have been listed as threatened or endangered under the Federal Endangered Species Act (Bottom et al. 2005). The National Marine Fisheries Service listed the Columbia eulachon for protection under the Endangered Species Act in 2011, increasing the number of ESUs that rely on the Hayden Island area for critical habitat to 14. All 14 of these ESUs use the Lower Columbia River between the Bonneville Dam and the mouth at Astoria as an essential link in their far-reaching life cycles.

Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*), as well as endangered Stellar sea lions (*Eumetopias jubatus*), are regular salmon and sturgeon predators in the Lower Columbia River. These large aquatic mammals pool at the base of Bonneville Dam because the dam hinders upstream passage of adult salmon, sturgeon, and trout, and creates a large, continuous source of prey for the protected animals. A recent study of sea lion predation of fish at Bonneville Dam found that one individual gained 450 pounds in less than three months, gorging on salmon and sturgeon (Barry McPherson [ODFW, retired], personal communication, February 24, 2011).

The Lower Columbia River in the Portland area is currently on the Clean Water Act 303(d) list because it does not meet water quality standards for temperature, PCBs, PAHs, DDT and its metabolite DDE, and arsenic. An Environmental Protection Area Region 10 study on the ecologic conditions of the Columbia River Estuary<sup>4</sup> also looked at chemicals in fish tissue. Within the estuary, samples were collected that had high levels of mercury, zinc and DDT; however, more than 70% of the sample were below Toxic Tissue Screening Criteria (2007).

Tetra Tech's report (1996) found that Dioxins and furans, metals, PCBs, PAHs, and pesticides impair water, sediment, and fish, and wildlife in the Lower Columbia River. Some toxic contaminants move up the food chain and accumulate in the bodies of animals that eat fish; this is called bioaccumulation. Reproductive abnormalities were observed in river otters, some of whom had concentrations of PCBs that exceeded threshold levels. Nesting bald eagles showed signs of accumulating DDE and PCBs at levels high enough to impair reproduction. Arsenic, a human carcinogen, exceeded both the Environmental Protection Agency ambient water quality criteria for protection of human health and the Environmental Protection Agency human health advisories for drinking water (Fuhrer et al. 1996). Sediment contamination was found to be the highest near urban and industrial areas, with contamination in excess of levels of concern for DDE (a breakdown product of DDT), PCBs, dioxins and furans, and PAHs.

A Lower Columbia River Estuary Partnership study monitored water quality for toxics on a monthly basis throughout the Columbia River estuary (Morace, 2006). The report found widespread distribution of PCBs, PAHs and PBDEs in the lower river's foodweb. It also found that urban and industrial areas in the lower river contribute significantly to contaminants in juvenile salmon, and that juvenile salmon from upstream watersheds are absorbing toxic contaminants during their rearing period in the estuary. Juvenile salmon are accumulating DDT, and the breakdown DDE and dieldrin, in their tissue and are exposed to estrogen-like compounds in the lower river (likely associated with pharmaceuticals and personal care products). Concentrations of copper were present at levels that are known to interfere with crucial salmon behaviors such as imprinting, homing, schooling, predator detection, and predator avoidance. There were three pesticides regularly detected throughout the sampling period in the lower river that are known hormone disruptors: simazine, atrazine, and metolachlor. Two toxins are known to impart negative impacts on fish: simazine reduces milt production and the ability to detect female priming hormone (Turner, 2003), atrazine results in loss of egg production (Tillitt et al., 2010); and metolachlor, although not thoroughly studied in salmonids, is a known thyroid disruptor of killifish (Jin et al., 2011).

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<sup>4</sup> The Lower Columbia River and the Columbia River Estuary are the same extent of the river; RM 0 to RM 146 at the Bonneville Dam.

In addition to toxic contaminants, the Environmental Protection Agency has approved Total Maximum Daily Loads (TMDLs) for dioxin and dissolved gass in the lower Columbia River. TMDLs are created to protect beneficial uses by placing limits on the amount of pollutants that can be discharged to a water body. For example, salmonid require dissolved oxygen for survival and to thrive. The State of Oregon set a range for dissolved oxygen in the Columbia River, the lower end of that range being 6.5 mg/L which is based on migrating salmon requirements. An Environmental Protection Agency Region 10 study found that 93% of the samples taken in the estuary have dissolved oxygen concentration above the lower limit of 6.5 mg/L (U.S. EPA, 2007). Dissolved oxygen concentrations are influenced by many factors including water temperature, nutrient concentrations, plant production and biological processes that use oxygen, such as decomposition.

Even with historic alterations, pollution, and other impacts, the Lower Columbia River Basin provides habitat for other wildlife such as the Endangered Columbian white-tailed deer (*Odocoileus virginianus leucurus*); candidate species or state species of concern including the streaked horned lark (*Eremophila alpestris strigata*), northern red-legged frog (*Rana aurora*), and western painted turtles (*Chrysemys picta*); and more common species such as American beaver, red fox, coyote, opossum and raccoons, have adapted well to urban environments. Wetland and riparian habitats adjacent to the river are used by a variety of amphibians including Larch Mountain salamander, Cope's giant salamander, Oregon spotted frog, western gray squirrels, river otter, fisher, bushy-tailed woodrat, and several bat species.



**Peregrine Falcon on the Interstate Bridge**  
 Courtesy of Bob Sallinger, Audubon Society of Portland

The confluence of the Willamette and Columbia Rivers is a regional nexus on the Pacific and Columbia River flyways. In general, birds move north-south along the Pacific flyway and birds also move east-west along the Columbia River corridor. Over 200 species occur in the Portland area, including resident and migratory species. Migrants pass through the region in large numbers, moving along both flyways, utilizing habitats along the Willamette and Columbia Rivers. Piscivorous diving birds use the near shore water for foraging: horned grebe, eared grebe, western grebe, surf scoter and common loon. Lesser Scaup occur in large flocks in the river feeding on aquatic invertebrates and other prey. Mudflats, shoals and beaches provides habitat for migratory shorebirds: least sandpipers, solitary sandpipers and semi-palmated plovers. Approximately 25% of North American bird species are currently experiencing significant long term population declines (US Fish and Wildlife Service, 2009). Many of these species occur in the Portland-Vancouver region, with most utilizing riverine and riparian habitats for some phase of their life cycle.

The Columbia River provides habitat for anadromous salmon, steelhead and Pacific Lamprey. Within the Lower Columbia River, juvenile salmonids both migrate and overwinter in shallow water habitat before entering the ocean. As adults returning to spawn, these fish are dependent on good water quality, complex habitat and cover for predator avoidance. These needs are served by intact riparian corridors, off-channel refugia, floodplains and established riparian forests and overhanging that can regulate water temperature in the summer, provide protection from UV exposure, and provide protection from predators. Habitat connectivity along the shoreline is also crucial to the salmon's survival. As both juveniles and adults move along the shoreline, they seek refugia habitats<sup>5</sup> that provide opportunities to feed, rest, recharge, and hide from predators.

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<sup>5</sup> Refugia habitat in this context includes shallow water areas with sandy substrates and may have large woody debris, overhanging vegetation and undercut banks that provide food, resting, recharging, and hiding opportunities for juvenile salmonids.

The distance between shallow water refugia is important to the health and survival of salmonids. Long periods of sustained swimming between refugia habitats deplete energy reserves. Fish with low energy resources caught migrating between refugia areas are more vulnerable to predation, as their flight response diminishes with a reduction in stamina. The more “pit stops” fish can make along their way up and downstream, the more likely they will complete their migration in good health. Therefore, salmonid productivity and survival is expected to be greater in locations with the shortest distance between refugia where the fish can rest, feed, and rebuild their energy supplies. (Sauter, et.al., 2001; C.L. Groot, et.al., 1995; R.C. Eaton, 1991; M.B. Foreman, 1990; Sedell, et.al., 1990).

Below is a general explanation of the anadromous fish that use the Lower Columbia River:

Chinook Salmon (*Oncorhynchus tshawytscha*)

Chinook, or “king” salmon, were listed for ESA protection in 1999. At that time, six Chinook ESUs were described in the listing; of the six, three are found in the Lower Columbia River. These three populations joined two previously-listed (1992) Snake River Chinook populations to make up the listed Chinook component in the Columbia River basin that rely on the lower river for critical migration and rearing habitat. The five Columbia basin Chinook populations protected through ESA regulation are:

1. Snake River spring/summer Chinook: listed as threatened in 1992
2. Snake River fall Chinook: listed as threatened in 1992
3. Upper Columbia River spring Chinook: listed as endangered in 1999
4. Lower Columbia River Chinook: listed as threatened in 1999
5. Upper Willamette River Chinook: listed as threatened in 1999

The Columbia River surrounding Hayden Island is designated critical habitat for the first four populations. The Columbia River and Willamette River confluence, in close proximity to Hayden Island, is designated critical habitat for the Upper Willamette River Chinook. Critical habitat includes the main river channel, shallow water habitat, tidal swamps, emergent marshes, and forested wetlands with a tidal or seasonal surface connection to the river.

Lower Columbia River Chinook display three life history types including an early fall runs (“tules”), a late fall run (“brights”) and a spring run. Fall Chinook enter freshwater typically between August and October to spawn in river and tributary mainstems through November. Fall Chinook juveniles migrate through freshwater as subyearlings (zero-age, typically). Spring Chinook enter fresh water between March through June to spawn in upstream tributaries until October 1, and generally migrate through freshwater as yearlings.

Sockeye Salmon (*Oncorhynchus nerka*)

There are two distinct populations of sockeye salmon listed for protection by the federal government, the Lake Ozette population in Washington State, and the Snake River population in Idaho, Oregon, and Washington states.

The Snake River population was listed as endangered in 1991. Snake River sockeye salmon enter the Columbia River primarily during June and July and migrate to Redfish Lake, Idaho. Spawning occurs along the lake’s shoreline in October. Eggs hatch in the spring and emerge through May. They move immediately into the lake, where they feed for one to three years before migrating to the ocean; a two-year lake residence is common (NOAA: Federal Register Vol. 56, No. 66, April 5, 1991; FR Vol. 70, No. 123, June 28, 2005).

Between listing the Snake River sockeye salmon as endangered in 1991 and when this species status was reviewed in 2005, only 16 naturally produced adults have returned to Redfish Lake. All 16 fish were taken into the captive broodstock (hatchery) program. The return of 250 adults in 2000 was encouraging; however, subsequent returns have been fewer than 30 fish (NOAA: Federal Register Vol. 70, No. 123, June 28, 2005). The Hells Canyon dam complex on the lower Snake River effectively blocks all migratory fish passage, and is charged with the primary factor contributing to this species’ decline.

Critical habitat designated in the federal recovery plan includes the entire Snake River from its confluence with the Salmon River in Idaho, to its confluence with the Columbia River, and the Columbia River from its confluence with the Snake River to the Pacific Ocean; this includes the waters and floodplain habitats on and around Hayden Island (NOAA: Federal Register, Vol. 57, No. 232, December 2, 1992).

#### Chum Salmon (*Oncorhynchus keta*)

Chum, or “dog” salmon, were once the most abundant of all salmonids. Neave (1961) estimated that prior to the 1940s, chum salmon contributed almost 50% of the total biomass of all salmonids in the Pacific Ocean. Chum salmon also grow to be among the largest of Pacific salmon, second to only Chinook salmon in adult size, with individuals reported up to 42-inches long and 46-pounds in weight (Pacific Fisherman, 1928).

Chum salmon in the Columbia River once numbered in the hundreds of thousands of adults and, at times, approached a million per year. The total number of chum salmon returning to the Columbia River in the last 50 years has averaged a few hundred per year, returning to a very restricted subset of the historical range. Historically, there were 16 chum stocks that comprised three major population groups in Oregon and Washington between the mouth of the Columbia River and the Cascade crest. Today, significant spawning occurs for only two of the historic populations; as a result, almost 90% of historic Columbia River chum populations are nearly extirpated (Johnson et al. 1997).

Chum salmon return to the Columbia River in late fall (mid-October to December). They primarily spawn in the lower reaches of rivers, digging redds along the edges of the mainstem and in tributaries or side channels. Spawning survey records indicate that chum favor habitat near I-205, the shorelines around Pierce and Ives Islands below Bonneville Dam, and the alluvial fan at the mouth of Multnomah Falls (McElhany et al. 2007). Chum fry emerge from gravel in the early spring, and immediately begin downstream migration to the estuary to feed. This contrasts the rearing of other salmonids (e.g., steelhead trout, coho salmon, and most Chinook salmon), which usually migrate to sea at a larger size after months or years of freshwater rearing. Due to this reduced rearing phase, juvenile chum salmon must feed heavily in the estuary to gain size and bulk before beginning a long-distance oceanic migration. The period of estuarine residence appears to be a critical life history phase and may play a major role in determining the success of the subsequent adult run back to fresh water.

#### Coho Salmon (*Oncorhynchus kisutch*)

The coho salmon Lower Columbia River ESU was listed as threatened 2005. It includes 24 historic populations in three major groups. Wild populations are critically low, and have been impacted by significant hatchery production.

There are two distinct coho runs in the Lower Columbia River: early returning and late returning. Early returning coho generally arrive to the Columbia River in mid-August, and to their spawning grounds in early September. Spawning peaks from mid-October to early November. Later returning coho have a northern distribution in the ocean, return to the Columbia River from late September through December, and enter their natal streams from October through January. Most of the late returning coho spawning occurs from November through January, but some spawning occurs in February and as late as March.

Juveniles, whether they are progeny of early or late returning adults, rear in freshwater for up to 18 months. Suitable rearing habitat is critical to the survival and production of coho salmon in the Columbia basin.

NOAA Fisheries has not yet designated critical habitat for this ESU. The public comment period ended in February 2011. Coho salmon habitat requirements are similar to those of both Chinook salmon and steelhead trout, thus critical habitat designation can be expected to be similar.

Steelhead Trout (*Oncorhynchus mykiss*)

Columbia River basin steelhead were first listed for federal protection in 1997 when the Snake River and Upper Columbia River populations were given threatened and endangered status protection. The Lower Columbia River population followed in 1998, and the Middle Columbia and Upper Willamette River populations were listed as threatened in 1999. The Upper Columbia River steelhead were downgraded to threatened in 2006. Many of the same threats to habitat quality and passage through their migratory corridors impact the production of these fish; however, the added long-term supplementation of hatchery steelhead trout throughout the Columbia basin has eroded the fitness of the wild fish and has significantly reduced the productivity of wild stocks.

There are two races of steelhead in the Columbia River. The summer-run returns to freshwater between May and November, entering the Columbia River in a sexually immature condition and requiring several months' rearing in before successfully spawning. Winter-run steelhead enter fresh water between November and April. They are close to sexual maturation and spawn shortly after arrival to their natal streams. Where both races may spawn in the same stream, summer steelhead tend to spawn at higher elevations than the winter forms. Juveniles of both races rear for up to 18 months in fresh water before migrating into the estuary and out to the ocean.

Steelhead trout are iteroparous, meaning that they often survive after spawning, and return to reproduce multiple times to spread genetic contribution over multiple generations. Prior to dam construction in the Columbia River basin, iteroparity in steelhead was once estimated to be as high as 17% in some rivers (Busby et al., 1996), with some individuals spawning up to four consecutive times (Leider et al., 1990). In the Snake River, iteroparity may be limited by postspawning mortality as individuals attempt to navigate eight dams during seaward migration.

The Lower Columbia River is important habitat for all Columbia River basin juvenile steelhead trout. It has been designated Critical Habitat for five distinct populations: Snake River; Upper, Middle and Lower Columbia River; and Upper Willamette.

Columbia Eulachon (*Thaleichthys pacificus*)

The Columbia River smelt, or Columbia eulachon, was listed as threatened under the ESA in 2010. The lower Columbia River and its tributaries support the largest known spawning run of eulachon (NOAA 2010: Federal Register Vol. 76, No. 3). It provides spawning and incubation habitats, and a large migratory corridor to spawning in tributaries for the eulachon. During spawning, adult eulachon are found in the Lower Columbia River from the mouth of the river to immediately downstream of Bonneville Dam (ODFW and WDFW, 2001), indicating that the entire Lower Columbia River is the primary migration corridor. Prior to construction of Bonneville Dam, eulachon ascended the Columbia River as far as Hood River, Oregon (Smith and Saalfeld, 1995). A fish passage facility is built at the dam; however, eulachon have not been reported upstream of Bonneville Dam since 1953 (FCO, 1953), and it is uncertain whether they can navigate the facility.

The mainstem of the Lower Columbia River provides spawning, incubation, rearing and migratory habitat necessary to produce eulachon; therefore, all of the mainstem Lower Columbia River in both Washington and Oregon state has been designated as Critical Habitat (FR Vol. 76, No. 3).

Pacific Lamprey (*Lampetra tridentata*)

Shallow-water, nearshore areas with sand and gravel substrate in the lower Columbia River are important for Pacific lamprey. Adult lamprey enter the Columbia River in late spring-early summer, and spend up to one year in freshwater to over-winter. Adults favor channel margins and pool habitats as they migrate to spawning grounds. Spawning takes place in low gradient river habitats with gravel and sand-dominant substrate. After broadcast dispersion, eggs incubate for two to three weeks on the substrate they attach to; thereafter, young lamprey, called ammocoetes, are algae filter feeders that burrow in sandy stream margins and side channels for up to 6 years before downstream migration. (LCSRB, 2004).

Pacific lampreys were historically present in the interior Columbia River basin well into the Snake River basin (Kostow 2002). Pacific lampreys are now absent above several dam complexes including

Hells Canyon on the Snake River, Pelton/Round Butte on the Deschutes River, and Powerdale on the Hood River.

Pacific lampreys were listed as an Oregon State sensitive species in 1993 and were given further legal protected status by the state in 1996 through restriction of harvest and harvest methods (OAR 635-044-0130). In 2003 eleven environmental organizations petitioned for the listing of Pacific lamprey and three other lamprey species as endangered in Oregon, Washington, Idaho, and California by the U. S. Fish and Wildlife Service under the Endangered Species Act. The petition cited Pacific lampreys as being vulnerable to habitat losses due to reduced river flows, water diversions, dredging, streambed scouring, channelization, inadequate protection of stream side vegetation, chemical pollution, and impeded passage due to dams and poorly designed road culverts. Introductions of exotic fish predators such as smallmouth bass were also cited as a factor in the decline of lampreys. The U.S. Fish and Wildlife Service recently determined that the petition does not contain sufficient information to warrant further review (ODFW, 2005).

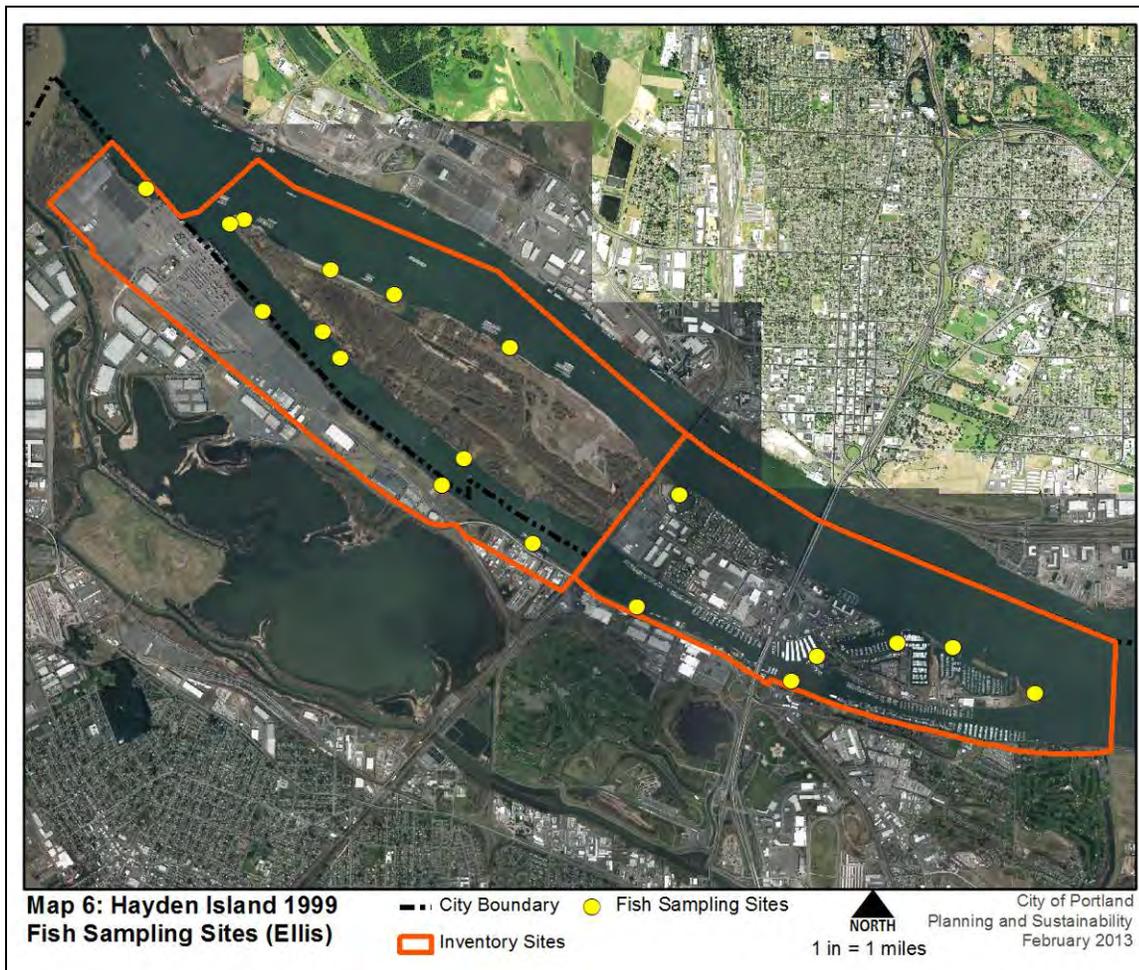
At Hayden Island seasonal fish use studies were conducted by Ellis Ecological Services during the winter-spring seasons of 1997 - 1999. The study sampled 24 fish species in shallow water habitat at 19 sampling sites in Oregon Slough and Columbia River nearshore habitats on and around Hayden Island (Map 6). Electrofishing was the primary method of capture; however, in areas inaccessible to the boat-mounted electrofisher, alternative sampling techniques like beach seining and backpack electrofishing were employed. A 90-foot beach seine with 3.8-inch mesh was used at the Benson Pond site, and a backpack shocker was used in the shallow backwater wetland on the northern Oregon Slough side of the island.

All sites were characterized with sand and silt substrate; however, stream bank characteristics ranged from mature riparian canopy with complex cover, to rip rapped shorelines in industrial areas with vegetation dominated by Himalayan blackberry. Table 6 is a list of fish species observed during the two sampling events. All salmonids caught were yearling or sub-yearling juveniles.

**Table 6: Partial List of Fish Species Caught at Hayden Island December 1997-April 1999 (Ellis, 1999)**

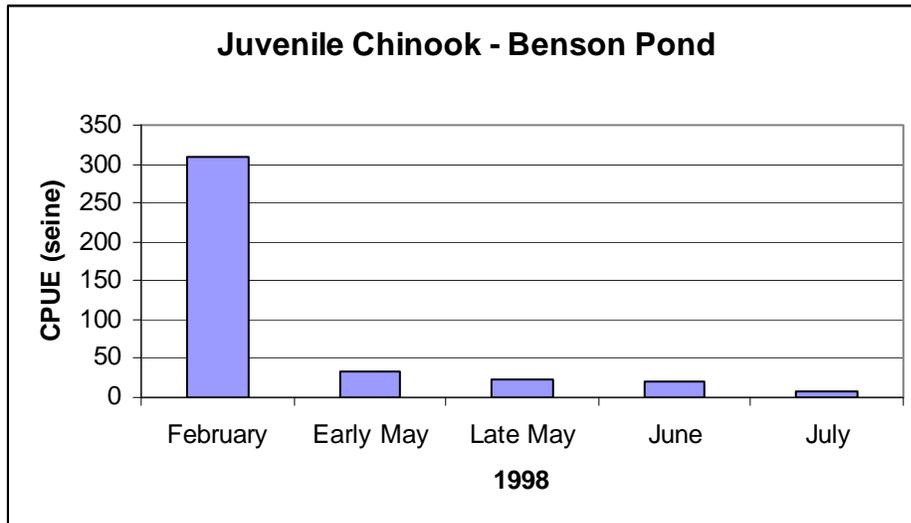
Winter – Spring 1998			Winter – Spring 1999		
Species	#	% catch	Species	#	% catch
Chinook Salmon	1153	25.5	Chinook Salmon	550	47.3
Coho Salmon	10	0.2	Coho Salmon	17	1.5
Chum Salmon	0	0	Chum Salmon	16	1.4
Steelhead Trout	45	1.0	Steelhead Trout	58	5.0
Cutthroat Trout	0	0	Cutthroat Trout	2	0.2
Mountain Whitefish	5	0.1	Mountain Whitefish	2	0.2
White Sturgeon	24	0.5	White Sturgeon	0	0
Sculpin, spp.	238	5.3	Sculpin, spp.	22	1.9
Largescale Sucker	1147	25.3	Largescale Sucker	348	29.9
Three-spine Stickleback	347	7.7	Three-spine Stickleback	10	0.9

\* The results are inclusive of all sites around Hayden Island because the species individuals-by-site data were not available for analysis.



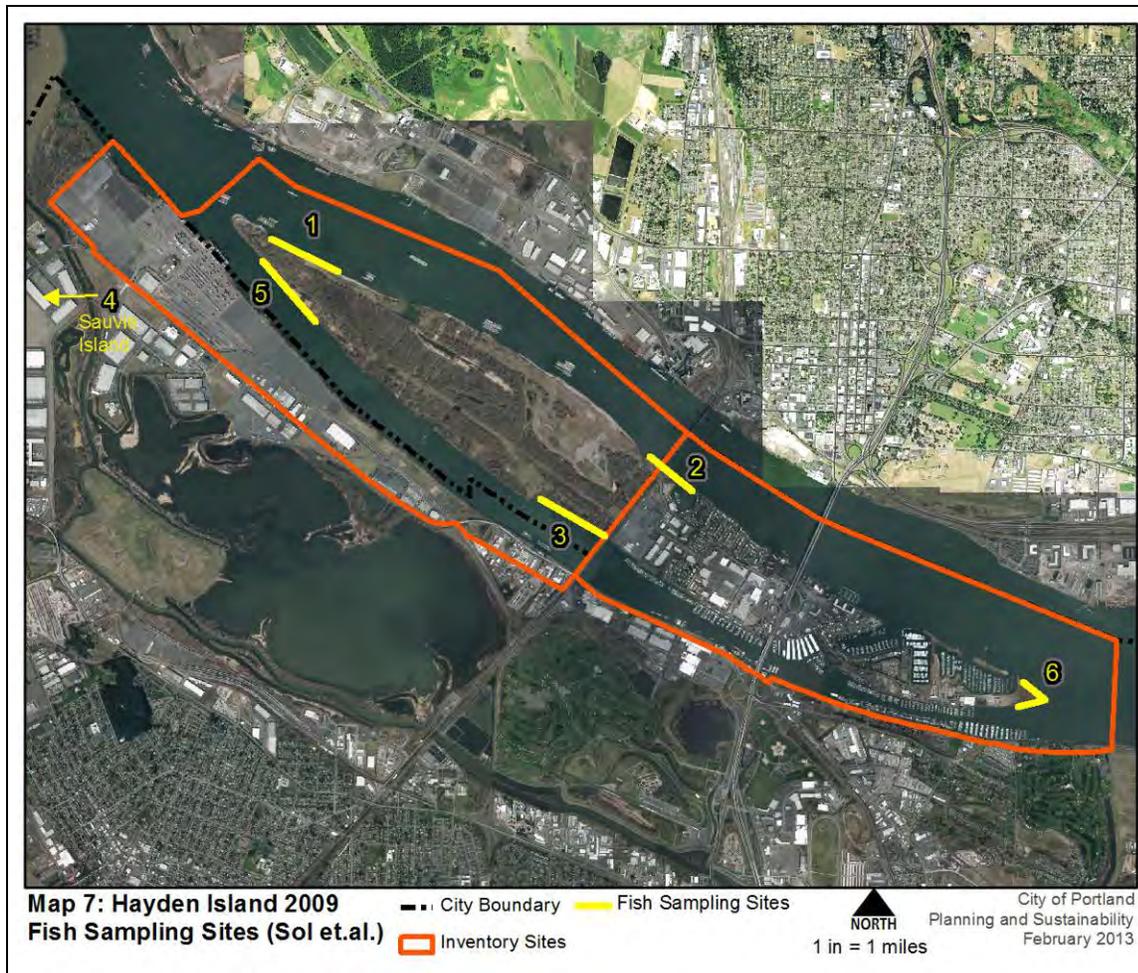
The study findings included:

- Chinook salmon juveniles and largescale suckers were most abundant during both sampling periods.
- Large predator fish were not abundant at any of the shallow water sites at Hayden Island.
- Stomach content analysis of the large predators collected revealed that over 60% of the fish had empty stomachs. None of the fish collected had juvenile salmonids in their stomachs. The most common prey species found in stomach contents was three-spine stickleback.



(Ellis, 1999)

Another data set of seasonal fish use of Hayden Island and surrounding nearshore habitats was compiled in 2009 by the NOAA Fisheries' Northwest Fisheries Science Center (Sol, S., et al., 2009a; Sol, S., et al., 2009b) to supplement existing data collected by the City of Portland and ODFW on habitat use of juvenile salmonids in the Lower Columbia and Willamette Rivers near their confluence. Sites 1-6 were sampled with beach seines six times each between June and November, 2008, and again between February and June, 2009 (Map 7).



The most productive Chinook salmon sites were 1 and 2, located along the northern shoreline of Hayden Island, west of the railroad bridge. Site characteristics here include low gradient, sand and gravel beach, intermittently submerged riparian root networks and overhanging vegetation during high flows, and large pieces of wood that are primarily transient. The highly productive Benson Pond backwater habitat that was sampled by Ellis (1999) is located just upstream of site 1.

There were low catch rates of known juvenile salmon predators (smallmouth bass, northern pikeminnow) and high abundances of non-salmonid predators (starry flounder and three-spine stickleback). The dominant presence of three-spine stickleback can be beneficial to Chinook juveniles because they are a primary prey item of bass and northern pikeminnow, and when abundant, ease the predation burden on Chinook.

The winter-spring season yielded significantly more Chinook than the summer-fall season. After June, all yearling and some zero-age individuals move even lower in the river, to the saline estuary, where prey abundance is high and the fish can grow considerably while they transition into their ocean phase. However, Chinook salmon still represented a significant portion of the overall catch composition during the summer and fall months, especially at sites one, two, three and six. All salmonids caught were yearling or sub-yearling juveniles.

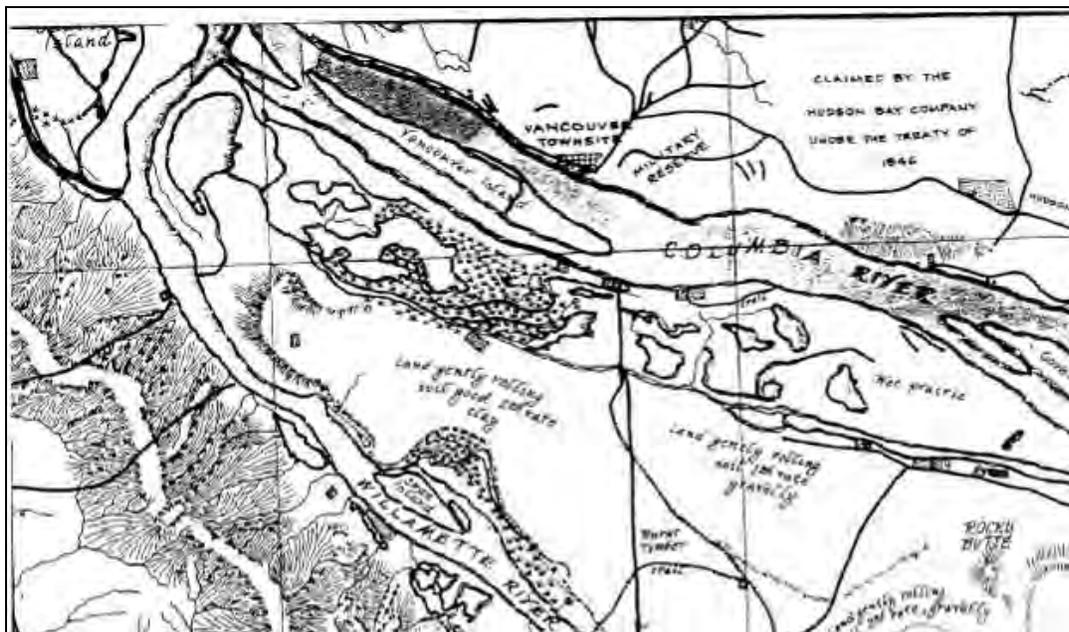
<b>Table 7: Percent of Total Fish Species Caught at Sample Sites Summer-Spring 2009 (NMFS, 2009)</b>						
	<b>Site 1</b>	<b>Site 2</b>	<b>Site 3</b>	<b>Site 4</b>	<b>Site 5</b>	<b>Site 6</b>
	<b>Summer-Fall 2008</b>					
Chinook Salmon	19.5	26.0	15.0	2.2	2.8	11.0
Coho Salmon	0.3	0	0	0	0	0
Chum Salmon	0	0	0	0	0	0
Steelhead Trout	0	0	0	0	0	0
Three-spine Stickleb	25.7	7.4	22.5	45.2	39.4	8.4
Starry Flounder	2.8	1.0	1.0	0	1.0	2.0
Chiselmouth	12.9	23.2	24.9	22.3	25.2	60.3
Smallmouth Bass	0.3	1.0	1.0	1.0	1.0	0
American Shad	3.9	10.2	11.2	24.6	23.7	6.3
	<b>Winter-Spring 2009</b>					
Chinook Salmon	75.9	72.0	33.7	44.6	58.7	48.0
Coho Salmon	0.3	0	0	0	0	2.1
Chum Salmon	0.5	0.5	15.0	0	0.6	0.9
Steelhead Trout	0	0.5	0	0	0	0
Three-spine Stickleb	1.8	4.7	43.5	23.1	16.6	42.7
Starry Flounder	17.3	14.0	5.5	22.0	5.73	5.4
Chiselmouth	1.8	3.1	0	2.1	10.0	0.1
Smallmouth Bass	0	0	0.7	0.5	0	0.1
American Shad	0	0	0	1.8	1.7	0

### 3.b.1: Hayden Island History

The Portland-Vancouver area was inhabited for thousands of years by a rich and diverse Native American population prior to the arrival of European settlers in the late 1700's. The Portland area served as a natural gathering place for tribes from across the entire northwestern region of the United States. During the 1800's approximately 50,000 Native Americans inhabited villages along the Columbia River (Con and Ridlington, 1996; Thompson, 2001). It is estimated that there were approximately 17,840 native peoples lived in the Portland-Vancouver region; however, the number of native peoples was likely much higher prior to the 1800's because by that time native populations had suffered extreme losses from disease and dislocation (Elis, 1986; City of Portland, 1996). Most of what is known about native peoples before European settlement comes from accounts by early explorers, fur traders, missionaries and military personnel that traveled along the Columbia River; therefore, the information is not thorough and may not provide accurate accounts. Starting in 1977, archeological studies and cultural resource inventories have been performed in the region. Based on early accounts and more recent archeological research, it appears unlikely that there were permanent Native American villages on Hayden Island; however, there may have been seasonal villages.

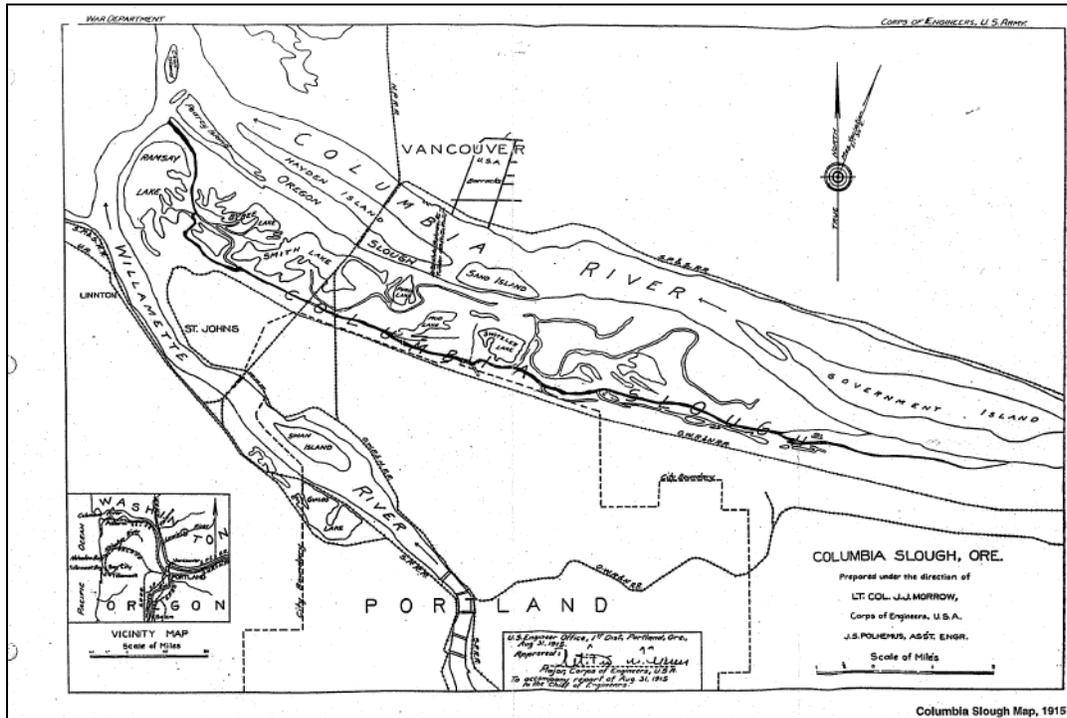
Prior to the 1900's, the confluence of the Columbia and many of its tributary streams, including the Willamette River, were characterized by multiple islands that changed with seasonal flooding. The islands had many names over the years. The earliest description of what is believed to be now Hayden Island was by Lt. William Broughton in 1792 (Ellis, 1986). He noted "a small wooded island, about three miles in extent" and called it "Menzie's Island."

Beginning in 1805 with the Corps of Discovery and increasingly with the Donation Land Claim Act of 1850, European settlers from the east came to Portland. Lewis and Clark described the island as being nine miles long with multiple smaller islands surrounding it; they referred to the island as "Image Canoe Island." Accounts of the Columbia River during low flows and flood events mention the changes in islands, shoals and sand bars near Fort Vancouver. Because of the seasonal changes, there were many names given to the different island formations. The first documented settlement on the main island, then called "Vancouver Island," was the Hayden family in 1851; the homestead was used for cattle ranching. More recently the islands that now make up Hayden Island were called, from east to west, Tomahawk, Hayden and Cigar islands.



Map 8: Federal Township Survey Map of 1852

Mid- and late-19th century texts and mapping describe a woodland forest land and lowland area on the southern portions of Hayden Island located among shoals, other islands, and channels. Wildlife that used the island included black-tailed deer, white-tailed deer, bobcats, gray wolves, coyotes, mink, river otter, beaver, muskrat, harbor seals, sea lions, moles, voles, shrews, band-tailed pigeon, Canada goose, mallard, American wigeon, wood duck and many other migratory bird species. The river and shorelines surrounding the island were used by eulachon (smelt), seven salmonid species, sturgeon, lamprey, chiselmouth, peamouth, chub and pike minnow.



Map 9: US Corps of Engineers Columbia Slough, ORE. map 1915



Figure 2: 1924 Aerial Photograph of Hayden Island

The most significant human-made changes to the island began in the late 19<sup>th</sup> century. In the 1880's a railroad was constructed across the island. Dredging of the Oregon Slough was authorized by the River and Harbor Act of 1912 with work occurring between 1913 and 1916. This work resulted in placement of dredge material along the south shore of western Hayden Island, near the rail bridge. Additional dredging in the Oregon Slough occurred between 1915 and 1917 to provide material for the Vancouver approach embankments for the Columbia River Interstate Bridge on both the mainland and eastern Hayden Island. Several pile dikes were installed by the US Army Corps of Engineers in the 1920's along the northern shoreline of western Hayden Island to assist in navigation maintenance. Around this same time the island became a receiving site for dredge materials. Placement of a series of eight permanent spur dikes, or groins, during the early 1920s on the southeast shore of western Hayden Island and north shore of the Oregon Slough served to narrow the navigation channel and assist in maintaining channel depth in the southern channel in service to early industry located near the rail line. Figure 2 shows the southern shoreline of Hayden Island, east and west, post installation of the easterly spur dike just beyond the rail bridge. The observable effect of the groins from aerial image analysis is sediment accumulation and the formation of moderately sloped beaches on the west (downstream) side. Portions of western Hayden Island's north shore have been used by the US Army Corps of Engineers to dispose of materials dredged from the Columbia River navigation channel since the 1920's. To a lesser extent, dredge deposits were also placed near the original south shoreline. Historic and modern log-booming practices also likely contribute to formation of low energy shoreline areas.

In 1927 the United States Board of Geographic Names was petitioned to rename the island as Hayden Island. Tomahawk Island, west of Hayden Island, was still a separate island at that time. Over the years, river silting has filled in the gap between Tomahawk and Hayden Island. Finally, road construction connected the two so that Tomahawk is no longer a separate island.



**Figure 3: 1940 Aerial Photograph of West Hayden Island**



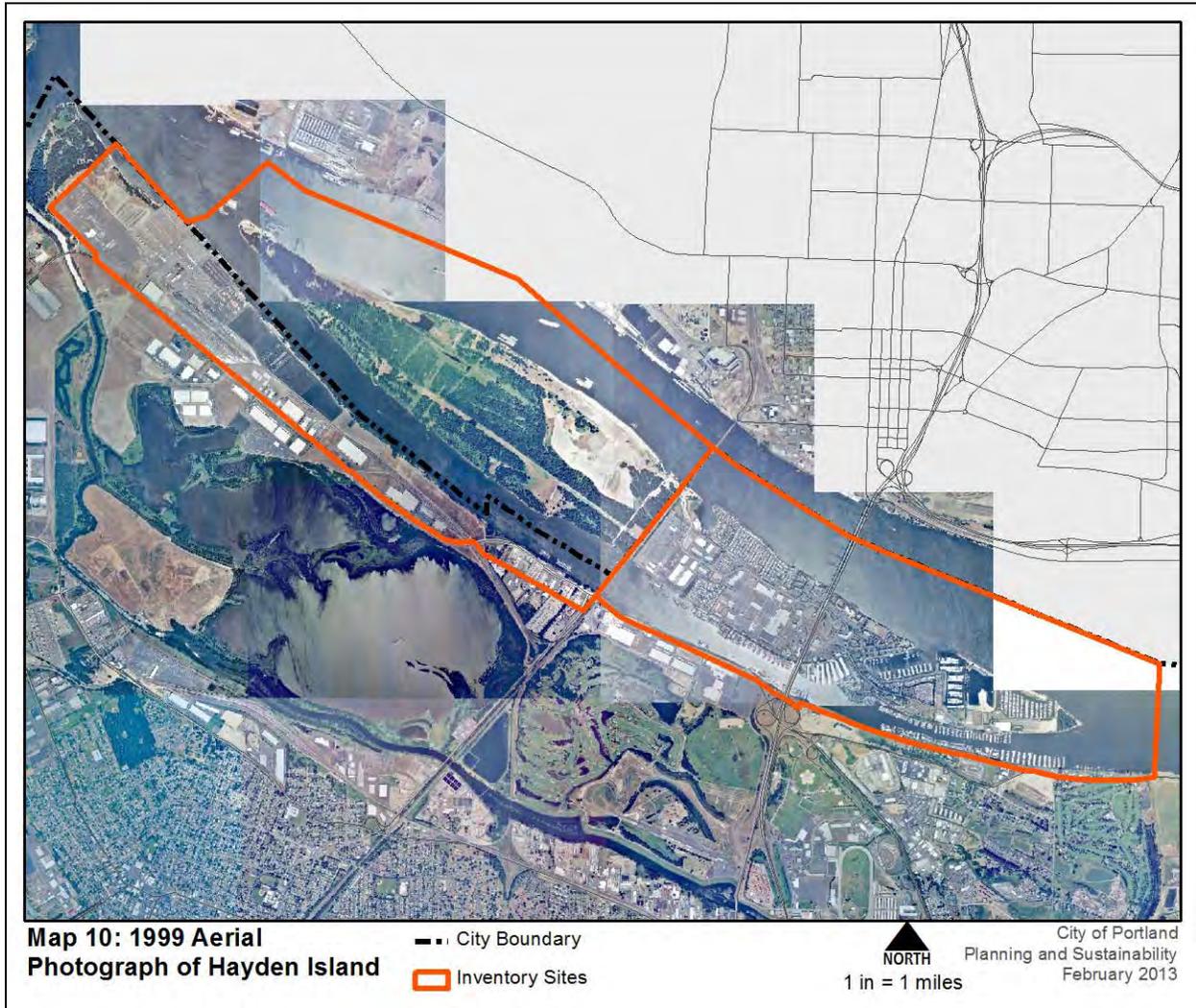
**Figure 4: 1960 Aerial Photograph of West Hayden Island**

Portions of western Hayden Island have continued to be used periodically for cattle grazing through 2006. Grazing significantly impacted the vegetation composition by suppressing the recruitment of cottonwood and ash seedlings and supporting grasses and forbs, including invasive species.

For more than 40 years the eastern Hayden Island was home to the "Jantzen Beach Amusement Park", also known as "The Coney Island of the West". The park opened on May 26, 1928, and, at the time, it was the largest amusement park in the United States. Eventually the park covered more than 123 acres and featured a carousel, roller coaster, ballroom, swimming pools and picnic grounds. The amusement park closed in 1970. Today the merry-go-round resides inside the Jantzen Beach Shopping Center and the pumping system from the swimming pools is used to pump drinking water to residents of Hayden Island. Eastern Hayden Island was incorporated into Portland in 1986 and 1990 (Map 10) and developed with commercial, residential and some industrial land uses.

In 1977, Multnomah County designated West Hayden Island "Natural Resource, Multiple Use Forestry" because the need for future urban uses was not identified. In 1982, the county changed the designation from "Natural Resources" to "Significant Environmental Concern" and stated that any long term environmental and recreational losses from urban uses would be identified and addressed in the community planning process. The adopting ordinance also stated that future use of West Hayden Island is anticipated to be marine industrial. Also in 1982 the regional government (Metro) expanded Portland's Urban Growth Boundary to include West Hayden Island. In conjunction with the Urban Growth Boundary expansion, Multnomah County re-designated West Hayden Island from "Multiple Use Forestry" to "Future Urban" within the Multnomah County Framework Plan. The impetus for both actions was to provide a future site for waterfront industrial and marine terminal uses. An important element in the Multnomah County analysis was the finding by the County that additional waterfront acreage was needed within the Urban Growth Boundary to meet the forecasted demand for marine terminal uses. That analysis also found that natural resources located on West Hayden Island are significant enough to

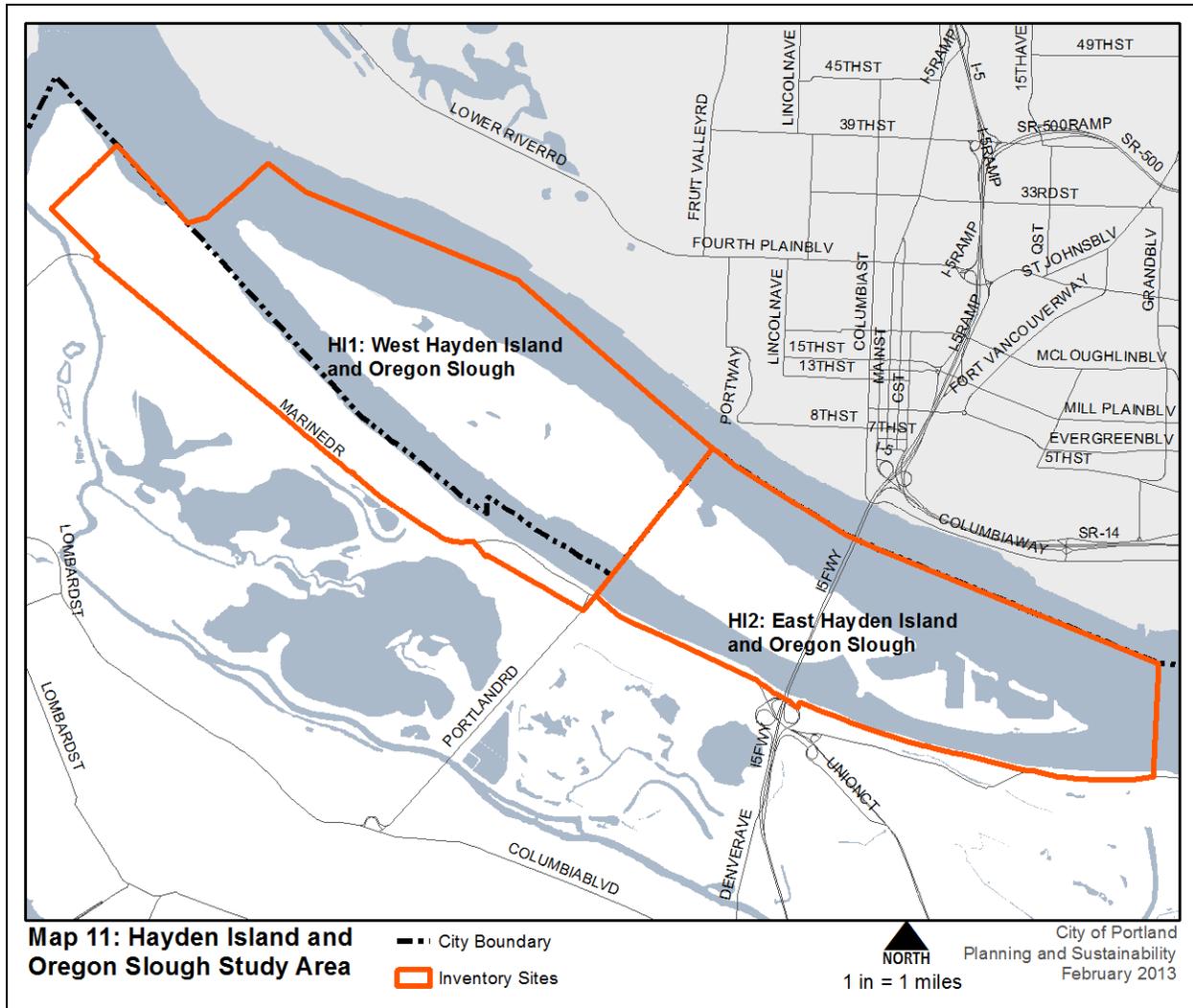
warrant some level of protection. West Hayden Island was owned at that time by Portland General Electric and the James River Corporation. In 1994 the Port of Portland acquired West Hayden Island.





### 3.b.2: Inventory Sites

There are 2 inventory sites in the Hayden Island Natural Resources Inventory study area (Map 11). Site HI1: West Hayden Island and the Oregon Slough, includes the land north west of the rail road bridge. West Hayden Island contains a mix of natural resource features, as well as utility corridors and a dredge deposit management area. The southern bank of the Oregon Slough includes Port of Portland Terminal 6 and a narrow riparian corridor. Site HI2: East Hayden Island and Oregon Slough includes the land to the south east of the rail road bridge. East Hayden Island and the southern bank of the Oregon Slough are largely developed with residential, commercial and industrial uses. A few areas of natural resources still exist, including vegetated river banks, Lotus Isle Park and the far eastern tip of the island.



The following report sections provide information for each inventory site. Each site section starts with a summary of site characteristics (Table 9) and is followed by a description and evaluation of natural resources.

**Table 8: Explanation of Inventory Site Summary Information**

<b>Characteristic</b>	<b>Explanation</b>
<b>Watershed</b>	The name of the watershed(s) within which the resource site is located.
<b>Neighborhood:</b>	The name of the neighborhood(s) within which the resource site is located.
<b>Legal Description:</b>	USGS quadrangle maps, and quarter section maps
<b>River Mile:</b>	Columbia River river mile, beginning at the confluence with the Pacific Ocean; Oregon Slough river mile, beginning at the downstream confluence of the Oregon Slough and Columbia River main channel
<b>Site Size:</b>	Size estimates include land features, streams and drainageways, wetland and river
<b>Previous Inventory:</b>	City-adopted natural resource inventories in which the site or portions of the site were addressed.
<b>Zoning:</b>	Zone designations within the site, including overlays (e.g. height, design, open space, scenic, and environmental)
<b>Existing Land Use:</b>	Primary land uses currently on the site.
<b>General Resource Description:</b>	Brief description of the site, its geographic location, natural resources and other key features.
<b>Resource Features:</b>	Specific natural resource features found on the site (e.g., stream, drainageway, wetland, flood area, vegetation, beach, steep slopes, open water). Features may be in relatively good or poor/degraded condition.
<b>Resource Functions :</b>	Riparian and wildlife habitat resource functions relate directly to the resource features found on a site. They are functions that may be performed by the resources present.
<b>Special Habitat Area:</b>	Special Habitat Areas (SHAs) are designated where natural resources have been documented to include critical or rare or declining habitat types, or critical habitats for special status species.
<b>Special Status Species:</b>	Special status species are wildlife (including fish) or plant species known or reasonably expected to occur within or use the site and that have been officially listed by the NOAA Fisheries or the U.S. Fish and Wildlife Service (Candidate, Threatened, Endangered, Species of Concern), or the Oregon Department of Fish and Wildlife (Threatened, Endangered, State Sensitive, State Strategy); or ranked by Oregon Natural Heritage Information Center (Ranked or Listed Species), Oregon Watershed Enhancement Board (Priority Species), Partners In Flight (Focal Species), the National Audubon Society & American Bird Conservancy (Watch List), and the Northwest Power and Conservation Council Willamette and Columbia Subbasin Plans (Focal Species). Special status species lists for Portland can be found in Appendix C.
<b>Hazards</b>	Indicates whether any portion of the site is within City-designated Wildfire Hazard Zone, Landslide Hazard Zone, or the Flood Area (FEMA 100-year floodplain and/or adjusted 1996 flood inundation area).
<b>Contamination</b>	Indicates whether any portion of the site is contaminated per the Department of Environmental Quality, Environmental Cleanup Site Information (ECSI) database.

After the inventory site summary, the following information is provided:

## Site Description

The site description is a brief, general description of site boundaries, current and historic land uses, development characteristics, natural resource features, and other issues such as known contamination, mitigation sites, revegetation projects and natural hazards, if applicable. This section is intended to provide important context for the following descriptions and evaluations of the natural resources on the site.

## Natural Resource Description

The general site description is followed by an account of the types and condition of natural resources present on the site. The natural resource description provides information on water bodies, wetlands, water quality, plant assemblages, habitat types, and wildlife species found at the site. Natural resource functions are addressed, as are factors that may affect the overall function of these resources. Such factors include invasive species, development-related disturbances, extensive impervious surfaces, and contamination.

The natural resource descriptions, in conjunction with the natural resource evaluations, are intended to provide a general understanding of the presence, functions and relative quality of the natural resources. The descriptions are based in part on research and site visits completed by City staff between 2010 and 2011. Other information sources used to develop these descriptions include: West Hayden Island Environmental Foundation Study (ETNRIX, Inc., 2010); Strategic Environmental Evaluation (Port of Portland, 2006); DRAFT West Hayden Island Plan, Volume 2 Natural Resources Element (Bureau of Planning, 1999); Department of Environmental Quality information on contaminated sites; City data on natural resources and landslide and wildfire hazard areas; and various other documents.

## Natural Resource Evaluation

This section presents and describes key natural resource functions and values that currently exist in each inventory site. The resource evaluations are presented in three sub-sections – riparian areas, wildlife habitat, and combined riparian and wildlife habitat areas. The methodology used to produce the relative rankings, including the process listed below, is summarized in the previous chapter and a more detailed description is found in Appendix J - *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat Project Report – Recommended Draft June 2011* (City of Portland).

The natural resource evaluation process includes:

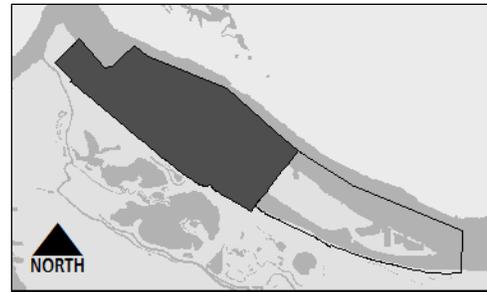
1. Mapping key resource features associated with riparian corridors and wildlife habitat
2. Applying science-based criteria using GIS models to assess functions and attributes and generate initial relative ranks for natural resource features in the site
3. Incorporating Special Habitat Areas
4. Combining Relative Rankings

It is important to emphasize that the relative rankings denote the current conditions and the relative functional quality of natural resources in a given site. The relative quality of existing natural resources in the study area ranges from relatively functional to highly degraded. This information is intended to inform, but not dictate, how these areas could be managed. For example, understanding the relative quality of existing resources can inform planning efforts, design of development projects, and priority-setting for natural resource protection or restoration.

It should also be noted that all ranked resources provide important watershed values and functions that should be taken into consideration when making management decisions to protect, restore, or disturb these areas.



# INVENTORY SITE HI1: West Hayden Island and Oregon Slough



## A. Summary Information

Watershed: Columbia River

Neighborhood: Hayden Island, Kenton and St Johns

USGS quadrangle and quarter section maps: 2N1W23, 2N1W24, 2N1W25, 2N1E19, 2N1E20, 2N1E28, 2N1E29, 2N1E30, 2N1E31, 2N1E32 and 2N1E33

River Mile: 102 – 105.6

Site Size: 2,165 acres

Previous Inventories: Inventory and Analysis of Wetlands, Water Bodies and Wildlife Habitat Areas for the Columbia Corridor: Industrial/Environmental Mapping Project (City of Portland January 1989)

Zoning: Multnomah County Future Urban (MUF)

Industrial (IH, IG2)

Single Dwelling Residential (RF)

Aircraft Landing height overlay (h)

Airport Noise overlay (x)

Environmental Conservation overlay (c)

Existing Land Use: industrial; railroad; natural area

General Description: This site includes the western half of Hayden Island and part of the Lower Columbia River and Oregon Slough.

Resource Features: open water, shallow water; beaches; vegetated and non-vegetated river bank; vegetated flood area; wetlands; bottomland hardwood forest; woodland, shrubland and grasslands/ sparsely vegetated areas

Functional Values: microclimate and shade; stream flow moderation and water storage; bank function, and sediment, pollution and nutrient control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; wildlife habitat; habitat connectivity/movement corridor

### Special Habitat Areas:

- Columbia River, Oregon Slough and Shallow Water Habitat are designated SHA because they meet the following criteria:
  - (C) – Wildlife connectivity corridor
  - (M) – Migratory stopover habitat
  - (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- The T6 Vacant Industrial Lands is designated SHA because it meets the following criteria:
  - (C) – Wildlife connectivity corridor habitat

(G) – Feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis

(S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

- All of West Hayden Island (WHI) is designated a SHA because it meets the following criteria:
  - (C) – Wildlife connectivity corridor habitat
  - (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species

In addition to meeting the (C) and (I) criteria, specific features on WHI meet other SHA criteria as well:

- All wetlands are designated SHA because they meet the following criteria:
  - (W) – Wetlands
- Benson Pond, South Bank Wetlands, Mitigation Wetland, Middle Wetland and Stickleback Pond are designated SHA because they meet the following criteria (see Map 19):
  - (S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
  - (W) – Wetlands
- Forest and woodland vegetation is designated SHA because it meets the following criteria:
  - (B) – Bottomland hardwood forests
  - (M) – Migratory stopover habitat
  - (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- The Dredge Deposit Management Area is designated SHA because it meets the following criteria:
  - (G) – Feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis
  - (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

Special Status Species:

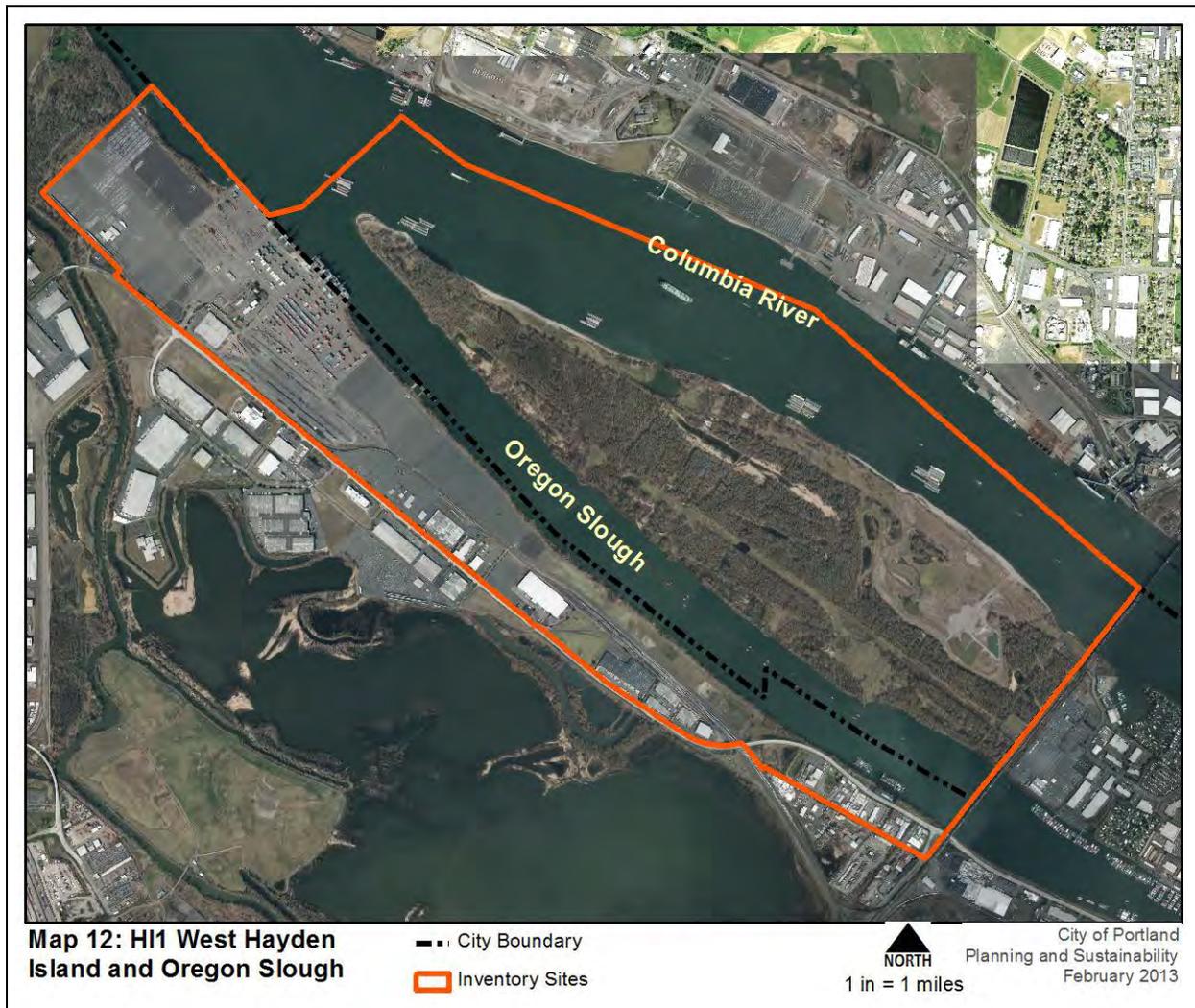
- *Fish:* Chinook salmon, chum salmon, coho salmon, sockeye salmon, steelhead trout, bull trout, eulachon, Pacific lamprey, white sturgeon, coastal cutthroat trout, Oregon chub
- *Birds:* American kestrel, bald eagle, band-tailed pigeon, black-throated gray warbler, brown creeper, Bullock's oriole, bushtit, chipping sparrow, common yellowthroat, downy woodpecker, great blue heron, hooded merganser, house wren, merlin, northern harrier, orange-crowned warbler, pacific-slope flycatcher, peregrine falcon, pileated woodpecker, purple finch, red-necked grebe, rufous hummingbird, Swainson's thrush, varied thrush, western meadowlark, western wood-pewee, white-breasted nuthatch, willow flycatcher, Wilson's warbler, winter wren, wood duck, yellow warbler, yellow-breasted chat
- *Mammals:* American beaver
- *Amphibians:* northern red-legged frog (*Rana aurora*)

Natural Hazards: flood area

Contamination: Yes

## B. Site Description

The West Hayden Island (WHI) and Oregon Slough inventory site is 2,429 acres in size. The site includes industrial land uses around the Oregon Slough including the Port of Portland Terminal 6 that provides container loading and barging services, as well as containerized intermodal rail transportation. On West Hayden Island there is a mix of natural resource features as well as multiple utility corridors and a federally designated dredge deposit management area. The inventory site contains approximately 271 acres of impervious surface area, primarily consisting of Terminal 6 and 9.3 acres of roads. The site contains approximately 3 ½ miles of the Columbia River main channel and a three-mile long section of the Columbia River southern arm, known as the Oregon Slough, extending from the railroad bridge to just upstream of the confluence with the Willamette River. Site HI1 Map 12 shows an aerial view of the WHI/Oregon Slough inventory site. Maps 1-6 are located at the end of this chapter and depict the natural resource features and relative ranks.

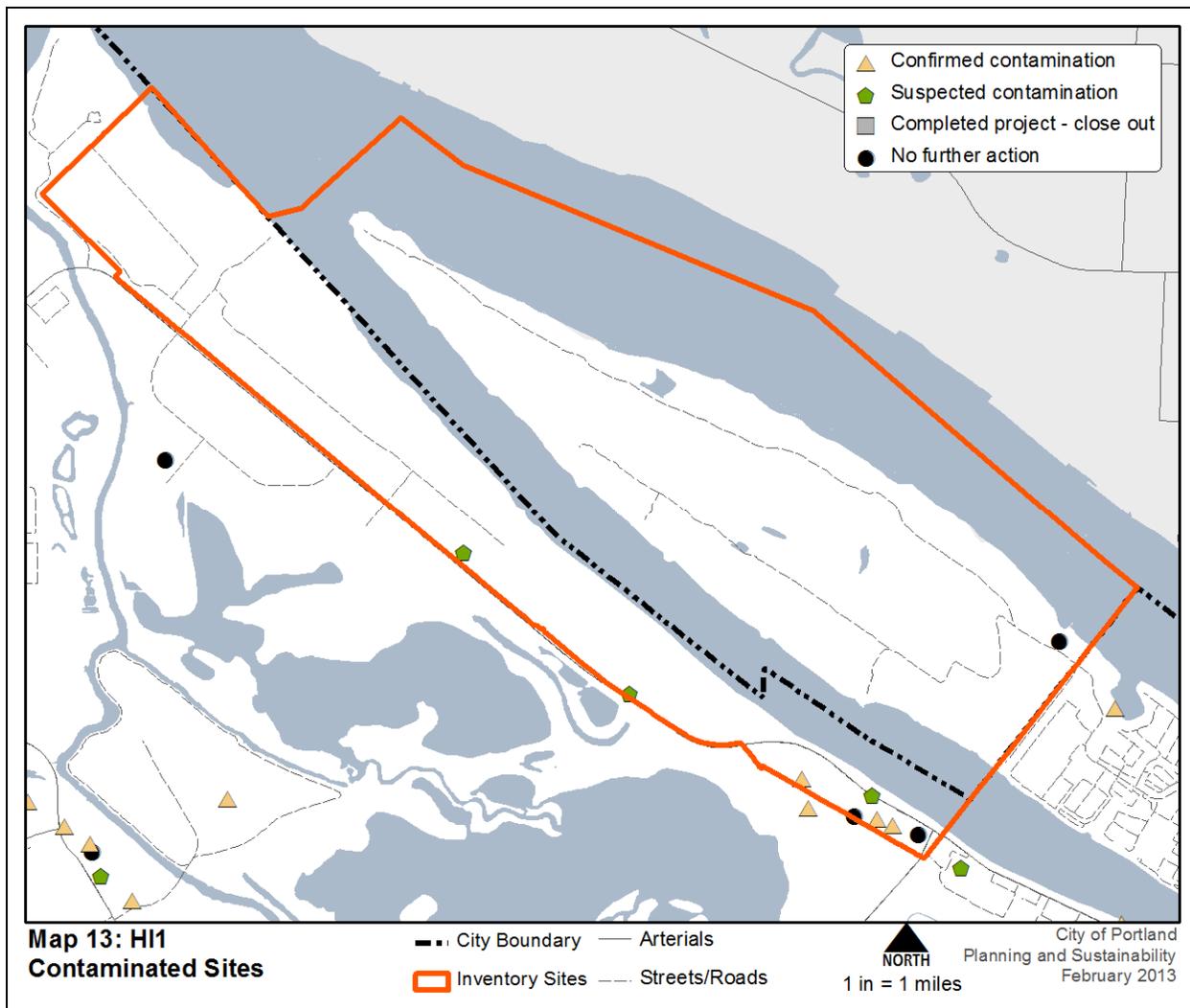


The site contains roughly 30 wetlands, ranging from 300 square feet to 6 acres in size, which combine for a total of approximately 48 acres (Port of Portland, 2007). The 1,891-acre flood area includes 938 acres of open water, 787 acres of vegetated flood area and 167 acres of non-vegetated flood area (Map 2). Vegetated areas are at least ½ acre in size and include approximately 419 acres of forest, 127 acres of woodland, 27 acres of shrubland and 203 acres of herbaceous cover (Map 3).

<b>Table 9: Summary of Natural Resource Features in HI1: West Hayden Island and Oregon Slough</b>	
<b>Study Area</b>	<b>2,429</b>
<b>River (miles/acres)</b>	3 / 938
<b>Stream/Drainageway (miles)</b>	0
<b>Wetlands (acres)</b>	48
<b>Flood Area (acres)*</b>	1,891
Vegetated (acres)	786
Non-vegetated (acres)	167
Open Water** (acres)	938
<b>Vegetated Areas &gt;= ½ acre (acres)+</b>	775
Forest (acres)	419
Woodland (acres)	127
Shrubland (acres)	27
Herbaceous (acres)	203
<b>Impervious Surfaces (acres)</b>	271
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the Columbia River	
+ The vegetation classifications are applied in accordance with the National Vegetation Classification System specifications developed by The Nature Conservancy. The data within the primary study area and within 300 feet of all open water bodies in Portland is draft and is currently being updated based 2011 aerial photography.	

The Port of Portland owns the majority of land within the WHI/Oregon Slough inventory site. The Port has conducted, in conjunction with other agencies and organizations, numerous revegetation projects along the southern portion and bank of WHI. The Port has one 3.4 acre mitigation project on WHI, which includes 2.2 acres of wetland.

The Oregon Department of Environmental Quality (DEQ) has identified *suspected* and *confirmed* contaminated areas within the inventory site (Map 13); there are no contaminated areas identified on WHI. Soil, groundwater and surface water along the south bank of the Columbia River contain contamination resulting from past land use practices and current activities. Historic industrial uses, combined sewer overflows and agricultural runoff likely contributed to contamination over the past 50 years. Currently, most contamination is the result of underground storage, abandoned drums, wastewater lagoons and other industrial uses. Pollutants confirmed at the site included polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), lead, total petroleum hydrocarbons (TPH), DDT/DDE, toluene, benzene, chlorobenzene, dieldrin, methylene chloride, xylenes, zinc, lead, and arsenic. Potential environmental and health risks include contact with soil and groundwater, discharge to groundwater, and discharge to the Columbia River. Ingestion of sediment, water and organisms may pose a threat to fish and wildlife. Bioaccumulation may pose a particular risk to animals at the top of the food chain. For more information regarding contamination, visit the DEQ website at <http://www.deq.state.or.us/lq/ecsi/ecsi.htm>.



## C. Natural Resource Description

The natural resources description is divided into sections: West Hayden Island as one habitat area, hydrology, and the individual habitat types within the inventory site. The individual habitats in the inventory site include:

- Forest/woodland
- Shrubland
- Herbaceous and sparsely vegetated areas
- Wetland
- Upper beach and shallow water habitat
- Open water

### C.1 West Hayden Island (WHI)

Hayden Island is one of four major islands in the Portland Metropolitan area; the others are Ross Island, Sauvie Island, and Government Island. West Hayden Island, along with other natural areas, functions as part of a network of habitats allowing the movement of wildlife through areas that are otherwise highly urbanized. WHI is located near the estuarine confluence of the Columbia and Willamette rivers; therefore, it is an important corridor for fish and wildlife passage along river, and wildlife movement among habitats on the island.

WHI forms a large, complex mosaic of habitats that provide a range of functions and values. WHI includes emergent and herbaceous wetlands, backwater channels, grasslands, interior forests, and bottomland hardwood forests and riparian habitats contiguous to beaches and open water river habitat. These habitat types are identified as “Special Status Habitats” in the City of Portland’s Terrestrial Ecological Enhancement Strategy ([www.portlandonline.com/bes/fish/index.cfm?c=51052](http://www.portlandonline.com/bes/fish/index.cfm?c=51052)). Special Status Habitats are those that are rare or declining in Portland.

Like most undeveloped areas in Portland, the vegetation on WHI contains a mix of native and non-native plant species. Based on the 1999 botanical survey and 2010/2011 vegetation survey, over 180 plant species have been identified within the inventory site (Appendix G: West Hayden Island Vegetation Survey). These species range from native trees, such as Oregon ash, and native shrubs, like snowberry, to non-native and invasive species like Armenian blackberry and clematis. Both native and non-native plants provide natural resource functions such as food sources, nesting and perching opportunities, as well as other functions. Additional detail regarding plant species surveyed in each habitat type is provided below.

West Hayden Island functions as one of the largest intact island habitats (830 acres) in the Lower Columbia and Willamette Rivers, third to Sauvie and Government Islands. WHI is one of two non-developed island habitats within the City of Portland’s Urban Growth Boundary. This natural area provides a north-south connection between Vancouver Lake and its associated riparian vegetation with the Smith and Bybee Wetlands Natural Area. There are approximately 435 acres of cottonwood-ash riparian forest, making WHI one of the few local natural areas with large contiguous areas of bottomland hardwood-riparian forest habitat remaining in Portland-Vancouver region. Within Columbia River miles 0 and 146 (at the Bonneville Dam), WHI forests represent 4% of the total existing bottomland hardwood forests (ODFW, 2006; ENTRIX, 2010) in the lower Columbia estuary.

The WHI habitat complex functions as one habitat unit providing a range of life history requirements for fish and wildlife. There are multiple wetlands that have a surface water connection to the Columbia River during high flows and function as critical habitat for federally-listed fish species. Additionally, wetlands located within the forests provide an accessible and secure source of drinking water for wildlife, as well as breeding areas for native amphibians. For example, the long-toed salamander lay its egg masses and its larva rear in shallow wetlands, while the adult salamanders require forest leaf litter and downed logs for thermal protection and foraging areas. The WHI habitat complex also provides suitable nesting, foraging, shelter, and travel corridors for many local and neo-tropical migrant bird species. Dead wood, both standing and downed, provides nesting, foraging, hiding, and thermal cover for many species. Appendix E provides a full list of fish and wildlife species that have been observed in inventory site HI1. The data come from 2010/2011 field visits and numerous other studies. The list indicates which species are migratory/resident status and habitat association(s).

WHI is also part of the east-west regional complex of habitats which includes the Columbia Gorge and Columbia River islands to the east, Sauvie Island and Forest Park to the west, and the Vancouver Lake and Ridgefield areas to the north. These natural areas form corridors that are used by numerous migrant bird and fish species. The periphery of the island (shallow water and near-shore vegetation) along the lower Willamette and Columbia River banks provide feeding, watering, perching, nesting, resting and predator avoidance resources for fish and wildlife. Occasional large natural areas along these corridors provide habitat diversity and rest areas necessary for a variety of wildlife species. These corridors allow

for the introduction, recharge, and passage of bird and animal species not normally observed in large cities, such as bald eagles, willow flycatchers, and Chinook salmon.

The Lower Columbia River, which includes Hayden Island has been designated as critical habitat for fourteen populations of federally-listed salmon and trout species. For salmonid juveniles migrating out of the Columbia River system, this is the area where they begin experiencing increased intertidal action as they transition from their natal streams into the marine environment. Fish in this life stage can have extended outmigration periods in freshwater, and extended estuarine rearing prior to their marine life history phase, both of which are advantageous to marine survival and life history diversity (Myers, J.M., et.al., 1998). The longer these fish feed on the estuary's diverse food web, the larger and more robust they become, increasing their ability to escape predators and fend off parasites and bacteria that commonly impact their health. The fish that survive to return to spawn as adults also depend on the estuary as they make the physiological transition from marine back to freshwater animals and complete the migration to their spawning beds.

In addition to providing important habitat for fish, the Lower Columbia River corridor around WHI provides habitat for red-legged frogs, western painted turtles, western meadowlarks, pileated woodpeckers, willow flycatchers and other special status species. Distribution map of *at risk* species are provided in Appendix F: At Risk Species Mapping Project.

Previous natural resource inventories of WHI's fish and wildlife habitats have been performed. As a whole, WHI received scores of 95-99 (out of a maximum 100 points), based on the availability of water, food, and cover; the diversity of interspersions; and its uniqueness as a forested island habitat in the Lower Columbia River.

## C.2 Hydrology

The Columbia River Basin is the most hydroelectrically developed river system in the world. More than 400 dams including 11 dams on the mainstem and hundreds of major and modest structures on its tributaries, block river flows and tap a large portion of the Columbia's generating capacity: more than 21 million kilowatts (Lang 2011). The Bonneville Dam, completed in 1938, is the most downstream dam on the Columbia River (RM 146). Before the hydroelectric effects of dams impacted the river's hydrology, many of the islands and much of the floodplain were regularly inundated with water several times a year. In addition to sustaining bank habitat function and bottomland hardwood forests, these natural flood events contributed to the creation and maintenance of shoal and alluvial island habitats. In effect, the dams have normalized river flows, thereby reducing peak flows and eliminating the smaller, more regular floods that historically shaped and maintained valuable river habitat resources. This has also modified the function of lower river habitat by shifting sediment budgets and food webs, changing habitat and food availability, and influencing the migratory patterns of estuarine fish and wildlife.

The hydrology within the study area is tidally-influenced. The tidal range in this reach of the Columbia River is between three to four feet, depending on the season and the lunar cycle. The natural rise and fall of the elevation maintains dynamic shoreline habitat around WHI and along the Oregon Slough beach where the river is connected to its floodplain. The habitat includes embayments, pocket beaches, backwater slough and wetlands, undercut banks, embedded logs and rootwads, and a wrack line of woody debris accumulation. The daily water level fluctuations are a key habitat forming processes for the island. The Columbia River hydropower system has impacted flow characteristics in relation to tidal ebb and flow dynamics, which negatively impacts habitat-forming processes. The elevating and fortifying of some portions of the river banks along sections of the island also impact island habitat-forming processes by reducing the capacity of the river to inundate its floodplain.

The Lower Columbia River within the inventory site includes two periods of significant freshets (high flows). The winter (December-February) and spring (April-June) events provide conditions that serve Pacific salmon during rearing and migration life stages. High flows activate highly complex side channels and backwater areas where flows are slowed and food resources are high. Also, for juvenile fish that pass through the estuary quickly, the increased outgoing flows facilitate transport through to the ocean. The regulation of flood flows by the Bonneville Dam has dampened the capacity of natural flood events, and affected the rearing and migratory life history strategies of the Columbia River's salmon and trout.

WHI's surface and groundwater hydrology is most influenced by precipitation (average of 36.3 inches per year at the Portland International Airport), river elevation, flood inundation, percolation through the soils from the Columbia River and North Portland Harbor into the interior of the island, and to a limited extent, tidal action (USACOE 2004). The river's flood conveyance and capacity are directly related to connectivity between its floodplain and flows. The river's floodplain plays a role in mitigating flood hazards because it moderates downstream flood peaks through temporary upstream storage of water. The vegetated floodplain also helps stabilize banks and reduce erosion. These floodplain functions are provided by both native and non-native vegetation; however, native vegetation provides more varied natural resource functions including wildlife food sources and nesting opportunities.

Free-flowing, perennial channels are absent on WHI; however, backwater channels and ephemeral outlet channels from wetlands and interior forest areas are dispersed around the entire island. These outlets also serve as inlets during high river flows and facilitate inundation of major portions of the river's floodplain, in both wetland and forested areas (Figs 6 and 7).

In the early 1900's, a rock jetty, several spur dikes (groins) and pile dikes were installed on and around Hayden Island. In 1916, a rock jetty was installed on the north shore of WHI just upstream of Benson Pond and may have contributed to the formation, development and ongoing presence of the pond. The jetty angled downstream and away from the island. The jetty is visible in several historic photos but is no longer visible in current aerial photographs and has likely been buried by dredged material or natural deposition.

In the 1920's, the Port of Portland, in coordination with the US Army Corps of Engineers, constructed spur dikes or rock and timber groins along the south shore of WHI and the south shore of the Oregon Slough. These structures trapped sediment, directed water flows and influenced beach development along the southern side of the island. These changes affected the hydrology of the Oregon Slough, narrowing the channel and increasing the flow velocity.

The US Army Corp of Engineers also constructed pile dikes made of timber and stone along the north shore of WHI in the 1920s. These were installed as a means of maintaining navigability in the adjacent Columbia River shipping channel. There are six of these features on the north shore that may or may not be visible in the field and on aerial photography, depending on site conditions.

The island began receiving dredged river bottom materials from local sources in the early 1900's, with the first recorded placement occurring in 1907 (USACE 2004). Placement has continued over the past 100+ years in conjunction with various channel deepening and maintenance activities. Placement of material has caused the western portion of the island to increase in size by approximately 200 acres since the mid-nineteenth century (Ellis, 1986) providing increased shoreline and beach areas, increased shallow water habitat, greater floodplain and additional upland habitat. In 2003, the Port improved the dikes around the dredge deposit management area as part of the approved Final Environmental Impact Statement that detailed plans for placement of dredge material from the Columbia River Channel Deepening Project. The USACE, NOAA Fisheries and other regulatory entities approved the dredge deposit management area for upland placement of dredge materials. The placement of dredged materials has raised the elevation of the island in some locations and disconnected floodplain access and storage.

Even with all of the changes to the hydrology around WHI and the placement of dredge materials, nearly all of WHI remains within the FEMA-designated 100-year floodplain. Without the overflow mechanism in a stream bank to dampen water surface elevations, floodwaters from overland flow and tributary streams and rivers are conveyed laterally and downstream. This reduced flow conveyance capacity in the Columbia River created flood-magnitude surface waters which, when combined with the tidal influences, backed water upstream. Because of WHI's proximity to the Willamette River confluence, the island is subject to extensive flooding when the Willamette River experiences high flood levels as well. This hydraulic effect, along with other regional storm activity, was a contributor to the Willamette River flood event of 1996.

During the 1996 flood, most of the island was submerged. The undeveloped nature of the shorelines around much of WHI allowed high water to overflow banks and inundate the floodplain, providing some flood relief in the lower Columbia and Willamette Rivers. Its sandy, well drained soil characteristics provided storage capacity for flood waters and reduced flood risk downstream during this period. The floodplain-river connection is an important function for fish and wildlife for habitat maintenance and to public safety. Floodplain inundation can also greatly increase the surface area of tidal estuarine and riverine habitats available to salmonids, allowing fish to expand their distribution into potentially more productive off channel (Fresh et al. 2005). For example, recent studies in a nontidal portion of the lower Sacramento River found that tagged juvenile Chinook salmon released in the seasonally inundated floodplain had better growth, higher consumption rates, and improved survival compared with others released into the main river channel (Sommer et al. 2001).

Building dikes along the river bank and filling in the floodplain significantly decreases beach, bank and flood storage. The southern bank of the Oregon Slough is diked to just west of the rail road bridge. Much of the floodplain. Dikes prevent overbank flow and affect the connectivity of the river and floodplain (Tetra Tech Inc. 1996); thus the diked floodplain is higher than the historical floodplain and inundation of floodplain habitats only occurs during times of extremely high river discharge (Kukulka and Jay 2003). Elimination of overbank flooding can prevent the pulsed delivery of structural and energetic components to the rest of the estuary, including large wood, sediments, detritus, and prey organisms produced in adjacent riparian and floodplain habitats



**Figure 5: Aerial photo of WHI during the 1996 flood.**

WHI continues to experience some flooding every few years, albeit the frequency and magnitude of these events have been diminished by river and floodplain management. In spring 2011, heavy snow pack and warm spring rains contributed to high flows in the Columbia River. Flood storage was occupied along the north and south shorelines of WHI, as well as in the interior forests and wetland areas where the river can still access its floodplain.



**Benson Pond dry (left) and flood (right) conditions, 2011**



**Interior wetlands connected to Benson Pond overflow channel during dry (left) and flood (right) conditions, 2011.**

### C.3 Individual Habitats

WHI and the Oregon Slough are located at the juncture of the Willamette Valley and Puget Trough Physiographic Provinces (Franklin, 1988). The site is a mosaic of the following habitat types: forest/woodland, shrubland, herbaceous and sparsely vegetated areas, wetland (scrub/shrub and emergent), upper beach and shallow water areas, and open water. The island's hydrology, which is a determining factor in the habitat types found on WHI, has been modified by hydroelectric dams, pile dikes and rock groins in the nearshore, agriculture and homesteading, climate change, and placement of dredged materials.

#### C.3.a Forest and Woodland Habitats



Forests are differentiated from woodlands at the 60% canopy cover mark, with woodlands having less canopy cover but still having a predominance of tree canopy as compared to lower structure vegetation. For the purposes of this summary forests and woodlands are lumped together because they have similar vegetative composition and provide similar habitat functions on WHI.

WHI and the south banks of the Oregon Slough contain one of the largest remnant stands of historically abundant cottonwood-ash floodplain forests in the Lower Columbia River Basin, 546 acres in total. Other islands with large stands of cottonwood-ash include Sauvie Island, Government Island and Lady Island.

Between the 1850's and early 1990's, the extent of this plant community has declined by over 70% in the basin's lower watersheds (Graves et.al.,1995). Development and farming has reduced much of the bottomland hardwood forest in the Columbia's lowlands. The forest habitats on WHI represent 4% of the total remaining bottomland hardwood forests in the entire Lower Columbia River (ODFW, 2006; ENTRIX, 2010).

The altered hydrology of the Columbia River has contributed to the reduction of bottomland hardwood forests throughout the lower river by reducing naturally disturbance caused by peak river flows. The seasonal flooding deposited new sediment allowing establishment of cottonwoods and associated understory plants in the floodplain. Also, the depth to groundwater shows a direct correlation to the precipitation level in the Willamette River basin and varies with climate (Conlon, et.al, 2006). These changes affect the plant community of the Columbia River floodplain, including WHI. Today, only during high flood events or mechanical placement of sediments, do conditions allow for new stands of cottonwood to establish.

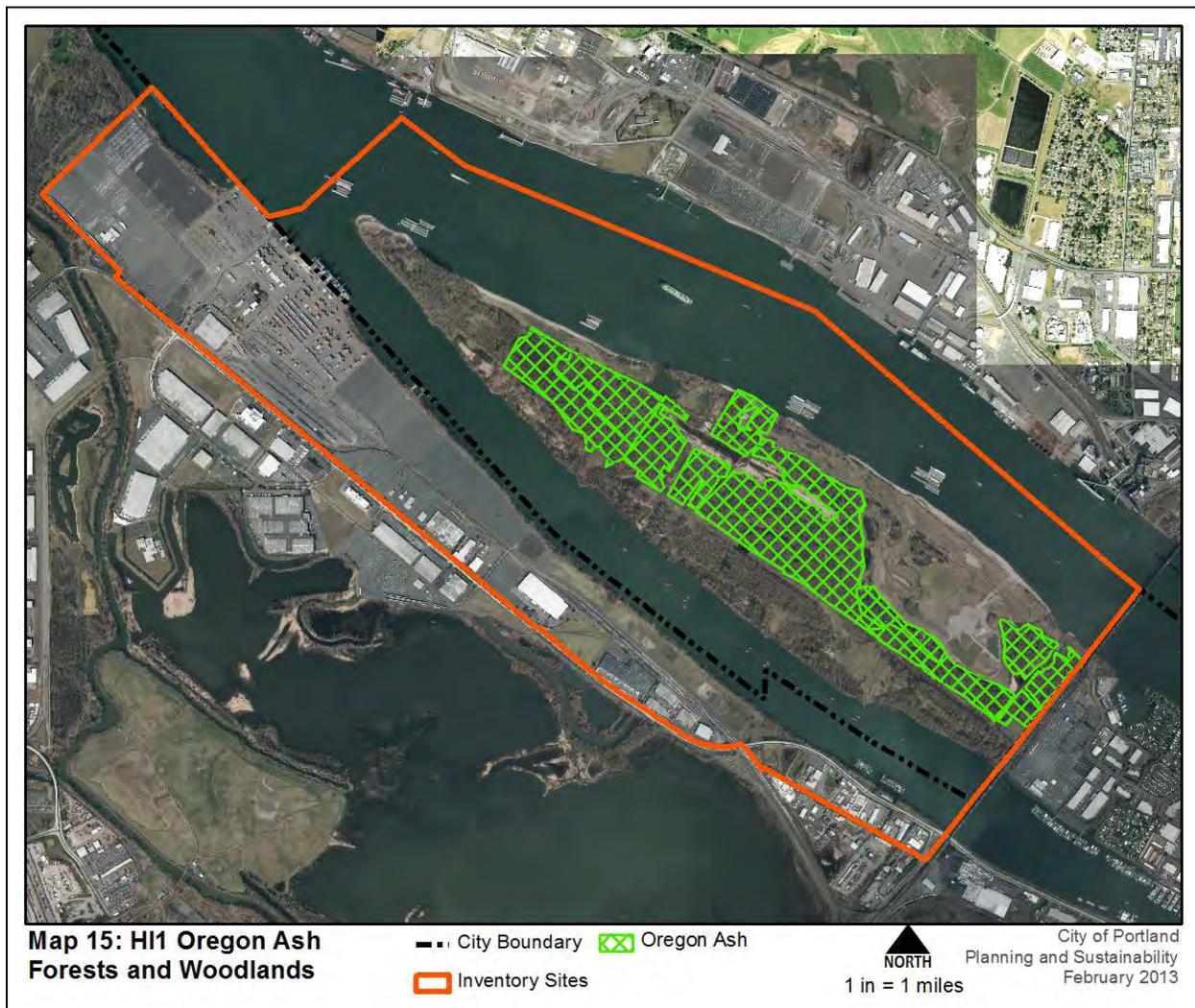


Establishment of new cottonwood forests is different than the long term survival of existing cottonwood forests. Existing cottonwood forests have a natural regeneration mechanism that does not depend on newly formed sediment and intense flooding. Cottonwoods have a strong ability to re-sprout, recruit from runners (or root sprouts) and easily propagate from cuttings. Cottonwoods also grow quickly and roots seek moisture. On WHI, cottonwoods, including young cottonwood saplings, are growing throughout the entire island. The sandy substrate and low organic content of WHI substrate gives preference to cottonwoods. Existing cottonwood forests on WHI are between 80-90 years old; cottonwoods have an average life span of 150-200 years.

Riparian, cottonwood-ash forests are the dominant habitat type in the inventory site and can be found throughout much of WHI. The riparian forests are characterized by black cottonwood, Oregon ash and Pacific willow as dominant tree species; several mature pacific willow stands are found in wetter areas. The overstory canopy cover ranges between 65-95%. The understory is dominated by several shrub species such as snowberry, gooseberry, dogwood and cottonwood and ash seedlings. The herbaceous layer is diverse and includes stinging nettle, sword fern, miner's lettuce, trailing blackberry, cleavers, and buttercup (*Ranunculus spp.*) among others. Herbaceous species, in addition to those listed for the cottonwood-dogwood-willow association, include lady fern, timber and slender-foot sedge, black hawthorn seedlings, and dove foot geranium. Please see Appendix G: West Hayden Island Vegetation Survey for a full list of plant species observed on the island.

Oregon ash is shade tolerant and often grows in the understory of younger cottonwood forests, and with maturity can become a dominant tree. In the center area of the island's forests, stands of large ash trees dominate the canopy with a dense and diverse native shrub and herb understory. These stands have had less disturbance and exhibit a higher diversity of plant species and more complex habitat structure. The ash communities have become increasingly rare in the Portland-metro area, but the stands that do persist provide good reference sites that exhibit how ash forests are structured in the absence of development and invasive plants (Map 15).

Invasive plant communities are established in areas exposed to more recent, frequent or ongoing disturbance; mainly along roads, trails, utility corridors and grazed areas. However, within the island's forests, the prevalence of Armenian blackberry and other invasive plant species quickly diminishes past the edge of habitat units; there are very few invasive plant species found within the interior of the forest habitat. This condition is unique in Portland. Many natural areas in the vicinity of Hayden Island have heavy and persistent infestations of English ivy, clematis, and English holly; these species are rare on WHI.



A narrow riparian corridor dominated by bottomland hardwood forest species extends for 3.2 miles along the southern bank of the Oregon Slough. This strip of forest, adjacent to WHI, provides a total of 46 acres of forest and woodland habitat that hang over the river's shoreline. This riparian area is typically 50 feet in width (1-4 trees), but a few locations of canopy are up to 400 feet wide. The dominant tree species in this mainland forest are black cottonwood, Oregon ash and pacific willow. All six species of willow that are native to Portland are found on this beach. Common understory shrubs include red osier dogwood, snowberry, red elderberry and Armenian blackberry. Although it is a narrow riparian corridor, it provides important functions for the beach, shallow water areas and open water. The overhanging vegetation helps maintain cool water temperatures in the slough through provision of shade and the creation of a cool and humid microclimate. It also provides food resources for the aquatic ecosystem in the form of leaves, branches, and terrestrial insects.



**Undercut bank along Oregon Slough**

This riparian corridor also provides resources that maintain bank functions, such as undercut rootwads, downed trees, large wood recruitment, and wildlife passage. These riparian corridor functions are provided by both native and non-native vegetation; however, native vegetation provides more varied food sources and structural diversity, which supports a broader diversity of native wildlife species.

Forest and woodland habitats in the inventory site help mitigate water quality impacts by providing absorption and transpiration services. Forests absorb nitrogen in both surface and shallow groundwater, trap phosphorous-laden sediment, induce groundwater recharge, minimize flood hazards, and filter sediment, chemicals, and nutrients upslope and atmospheric sources.

Riparian forests also provide important habitat for birds, amphibians, mammals and bats, and supply near shore aquatic communities with food and cover. Breeding and migratory bird densities in area riparian cottonwood forests are high. Large trees provide quality nesting habitat for larger birds that need big trees for their nests such as bald eagles, great-horned owls, and a number of colonial nesters including great blue herons. The combination of forest canopy along both banks of the Oregon Slough from the railroad bridge downstream to the end of WHI and the large stands of cottonwood-ash on WHI creates a unique habitat corridor in the Portland-Vancouver metropolitan area. Table 10 provides a list of indicator species that use forest and woodland habitats in the WHI/Oregon Slough inventory site. This is not a comprehensive list; it focuses on species that are indicators of functioning bottomland hardwood forests and/or unique, rare or declining species.

<b>Species Group</b>	<b>Species</b>	<b>Habitat Description</b>	<b>Life History Functions Served</b>	<b>Threats, Stressors and Sensitivities</b>
Bird	Pileated Woodpecker	Strongly associated with interior and riparian forests. Requires large diameter trees, snags and downed wood. Forages on both standing and fallen trees, and will use younger forests if a few large-diameter trees are present or if mature stands are present nearby. Feeds extensively on carpenter ants. Oregon territory range is between 659-2608 acres.	<ul style="list-style-type: none"> <li>• Feeding, foraging</li> <li>• Breeding (nesting)</li> <li>• Roosting</li> <li>• Overwintering</li> <li>• Dispersal</li> </ul>	Threats include conversion of forests to non-forest habitats; shift to shorter-rotation even-aged forests; and removal of downed wood (for fuels reduction) that's important as a foraging substrate. Feed extensively on the ground, so are vulnerable to several mammalian predators and vehicles.
	Bald Eagle	<p>Associated with large bodies of water, shoreline is an important element of nesting habitat. Requires large diameter cottonwood and conifers along Columbia River for nest sites, ranging 42-97.2 inch dbh. Nest trees typically prominent with views of surrounding territory. Prefers forest canopy with openings and varied canopy heights, and/or forest discontinuity or edge for nest sites. Some may nest less than 100m from human development, however most nest more than 500m from human development.</p> <p>Perch sites often on tallest trees available, above surrounding canopy and along shorelines. Snags often preferred over live trees for perching. Live trees with dead limbs also used. Wind sheltered stands of large trees needed for winter roosts; selects super-canopy trees for roost site, near or some distance from prey base. Winters on major rivers and other water bodies, require winter prey base, tall perch trees adjacent to food source, isolation from humans, and suitable roost trees are all part of winter habitat. Columbia River average home range is 8.38 square miles.</p>	<ul style="list-style-type: none"> <li>• Feeding, foraging</li> <li>• Breeding (nesting)</li> <li>• Roosting?</li> <li>• Overwintering</li> <li>• Movement corridor</li> </ul>	Highly sensitive to human disturbance at all times: hunting, nesting, roosting, and feeding young. Sensitive to wide range of human activity (construction, recreation, noise etc); people of foot elicit strongest reaction. Actively avoids area of high human use. Requires isolation from human activity, buffers required around active nests. Disturbance often results in abandonment of nest and roost sites. Development limits carry capacity of populations. Direct loss and degradation of habitat including nest trees, foraging sites, roost sites is most significant threat. Human persecution (shooting, poisoning), pesticides (i.e. DDT) and other contaminants. Ingestion of plastics and lead, collision with powerlines and motor vehicles.
	White-breasted Nuthatch	Uses extensive stands of ash/cottonwood on Columbia River floodplain. Requires large diameter trees for nest cavities. Territories range from 25-98 acres.	<ul style="list-style-type: none"> <li>• Feeding, foraging</li> <li>• Breeding (nesting)</li> <li>• Overwintering</li> <li>• Dispersal</li> </ul>	Vulnerable to lack of large diameter oak, cottonwood and ash trees, including snags and associated cavities. Shows area sensitivity in some studies, avoiding smaller stands. Altered fire regimes in oak woodlands allow for encroachment by conifers, making habitat unsuitable.

	Swainson's Thrush	Prefers interior habitat, not edge. Riparian woodland, dense shrub understory. Where the understory has become a dense shrubby thicket from fire suppression and encroachment, species are fairly common. Relies on closed canopy forest with dense shrub component, more abundant in riparian habitat. Average territory size 2.5-12 acres.	<ul style="list-style-type: none"> <li>• Feeding, foraging</li> <li>• Breeding (nesting)?</li> <li>• Migratory stopover</li> </ul>	Suffers high mortality from strikes with structures, towers, building and windows on migration. Susceptible to nest predation, especially in reduced buffers or fragmented forest habitat. Declines in response to logging in OR. In CA, declines linked to degradation and loss of riparian habitat due to grazing, development, and invasion of non-native plant species. Vulnerable to habitat impacts on wintering range in Cen. America.
	Yellow Warbler	Contiguous, heterogeneous stands of cottonwood, ash, and willow. Extensive sub-canopy and tall shrub layer are key structural elements. Insect prey base. Breeding territories average 0.75 acres	<ul style="list-style-type: none"> <li>• Feeding, foraging</li> <li>• Breeding (nesting)</li> <li>• Migratory stopover</li> </ul>	Riparian forest habitat fragmentation and adjacent agricultural use will both increase cowbird parasitism, which is a major threat. Nest predators also increase with fragmentation. Any management actions that reduce density of shrub layer will have adverse effect. Susceptible to elimination of riparian forest habitat. Vulnerable to habitat impacts on wintering range in Cen. & S. America
Mammal	Yuma Myotis	Closely associated with riparian habitat and wetlands west of Cascades. Uses caves, mines, loose bark and bark crevices typically close to water. Also uses vacant human structures. Captured in willow and alder habitat in British Columbia. Found locally in Oregon ash and black cottonwood stands on Sauvie Is. Forage over open water (large streams, rivers, lakes, ponds).	unknown for WHI	Prone to abandon roost when disturbed. Susceptible to loss of riparian habitat. Documented predation by domestic cats.
Fish	Chinook, Coho, and Chum Salmon; Steelhead and Cutthroat Trout	Use shoreline habitats around the island's perimeter and along the Oregon Slough banks; areas that are inundated during seasonal and tidal high water. Overhanging vegetation provides leaf litter, insects and large wood recruitment. Roots and logs provide interstitial cover structure.	<ul style="list-style-type: none"> <li>• Feeding, foraging</li> <li>• Resting</li> <li>• Migration</li> <li>• Predator avoidance</li> </ul>	Conversion of shoreline forests to non-forest habitats and removal of functioning floodplain habitat.

Amphib.	Northern red-legged frog	Cool conditions, moist soils, shade trees, ponds and wetlands with shallow areas (0.5 – 2m water depth) and emergent plants. Access to forested riparian habitats with downed logs/forest debris, leaf litter (forested wetland, upland).	foraging/feeding post breeding dispersal overwintering hibernating	Loss of egg-laying wetland habitat and adjacent forested riparian habitat. Require moist soil conditions and on WHI in late summer are restricted to drying wetlands. Predation (herons, garter snakes) and competition by invasive fish and bullfrogs. Roads: direct mortality from contact with vehicles during dispersal to riparian forested habitat. Roads: habitat fragmentation. Vulnerable to impaired water quality.
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Riparian forests and woodlands on WHI support bald eagles for nesting, roosting, overwintering, and hunting. There are currently two eagle nests located on WHI. One is located on the southwest side of the island, in a cottonwood near Oregon Slough (“south nest”). The other is in an isolated stand of cottonwoods in the northwest portion of the Dredge Deposit Management Area (“north nest”). This isolated tree stand is surrounded on all sides by the sparsely vegetated, low-structure herbaceous cover and dredge materials. Staff observed activity at both eagle nests throughout 2010 and 2011.

The north nest was a new nest first constructed and used by eagles in 2011; the pair took over an existing Red-tailed hawk nest. Eagles were observed building, defending and maintaining the north nest; staff observed courtship, copulation, refuge to feed fish caught in the Columbia River, and territorial defense from December 2010 through June of 2011. Eagles were observed using the nest as a feeding location. Incubation behavior (indicating eggs) and young were not observed at the north nest in 2011. The north pair of eagles were routinely observed using preferred perches in cottonwood trees and snags along the north shore of WHI.



**Bald Eagle North Nest**

The south nest has been active since at least 2007. Port of Portland records indicate young were present in 2007, 2008, and likely in 2009. City and Port staff confirmed young in 2010. Fewer observations were made at the south nest than the north nest in 2011 during the course of field work for this inventory. High water prevented visits to that portion of the island, and later in the season the nest was obscured by vegetation at most viewpoints. Breeding activity by adults was observed at this nest early in the 2011 season; however the status of this nest was not determined with certainty for 2011.

A third eagle nest is located on Hayden Island outside of this inventory site at the east tip; please see the next section for additional information.

Another cluster of tall mature cottonwoods (including snags) in the far northwest corner of the dredge site provides day roost sites and hunting perches for falcons. Over the 2010/2011 winter, a local pair of peregrine falcons was routinely observed day roosting on a large cottonwood here, and a merlin was also observed hunting from this perch.

Bat surveys conducted for this Inventory revealed the presence of four at-risk bat species in the cottonwood/ash forests of WHI: California myotis, long-legged myotis, silver-haired bat and Yuma myotis. Little brown bats were also detected. Data collected on bats did not provide information on specific behavior or extent of habitat use.

All species observed using the forest and woodland habitats on WHI and along the south bank of the Oregon Slough include:

American Crow	Hermit Thrush	Varied Thrush
American Goldfinch	House Finch	Violet-green Swallow
American Kestrel	House Wren	Warbling Vireo
American Robin	Lazuli Bunting	Western Scrub-Jay
Anna's Hummingbird	Lesser Goldfinch	Western Tanager
Bald Eagle	Mallard	Western Wood-Pewee
Band-tailed Pigeon	Merlin	White-breasted Nuthatch
Barred Owl	Mourning Dove	White-crowned Sparrow
Bewick's Wren	Northern Flicker	Willow Flycatcher
Black-capped Chickadee	Northern Rough-winged	Wilson's Warbler
Black-headed Grosbeak	Swallow	Winter Wren
Black-throated Gray Warbler	Olive-sided Flycatcher	Wood Duck
Brown Creeper	Orange-crowned Warbler	Yellow Warbler
Brown-headed Cowbird	Oregon Junco	Yellow-rumped Warbler
Bullock's Oriole	Osprey	Spring Azure
Bushtit	Pacific-slope Flycatcher	Western Tiger Swallowtail
Cedar Waxwing	Peregrine Falcon	American Beaver
Chestnut-backed Chickadee	Pileated Woodpecker	Black-tailed Deer
Common Raven	Purple Finch	California Myotis
Common Yellowthroat	Purple Martin	Coyote
Cooper's Hawk	Red-breasted Nuthatch	Deer Mouse
Dark-eyed Junco	Red-breasted Sapsucker	Eastern Cottontail
Downy Woodpecker	Red-tailed Hawk	Little Brown Myotis
Dusky Flycatcher	Ruby-crowned Kinglet	Long-legged Myotis
Eurasian Collared-dove	Rufous Hummingbird	Raccoon
European Starling	Song Sparrow	Shrew (sorex spp)
Fox Sparrow	Spotted Towhee	Silver-haired bat
Golden-crowned Kinglet	Swainson's Thrush	Yuma Myotis
Golden-crowned sparrow	Townsend's Warbler	Northwestern Garter Snake
Great Blue Heron	Tree Swallow	Pacific Chorus Frog
Great Egret	Turkey Vulture	Long-toed Salamander
Great Horned Owl	Unidentified Swallow	Red-legged Frog

The forests and woodlands located in the inventory site are designated as Special Habitat Areas because they meet the following criteria:

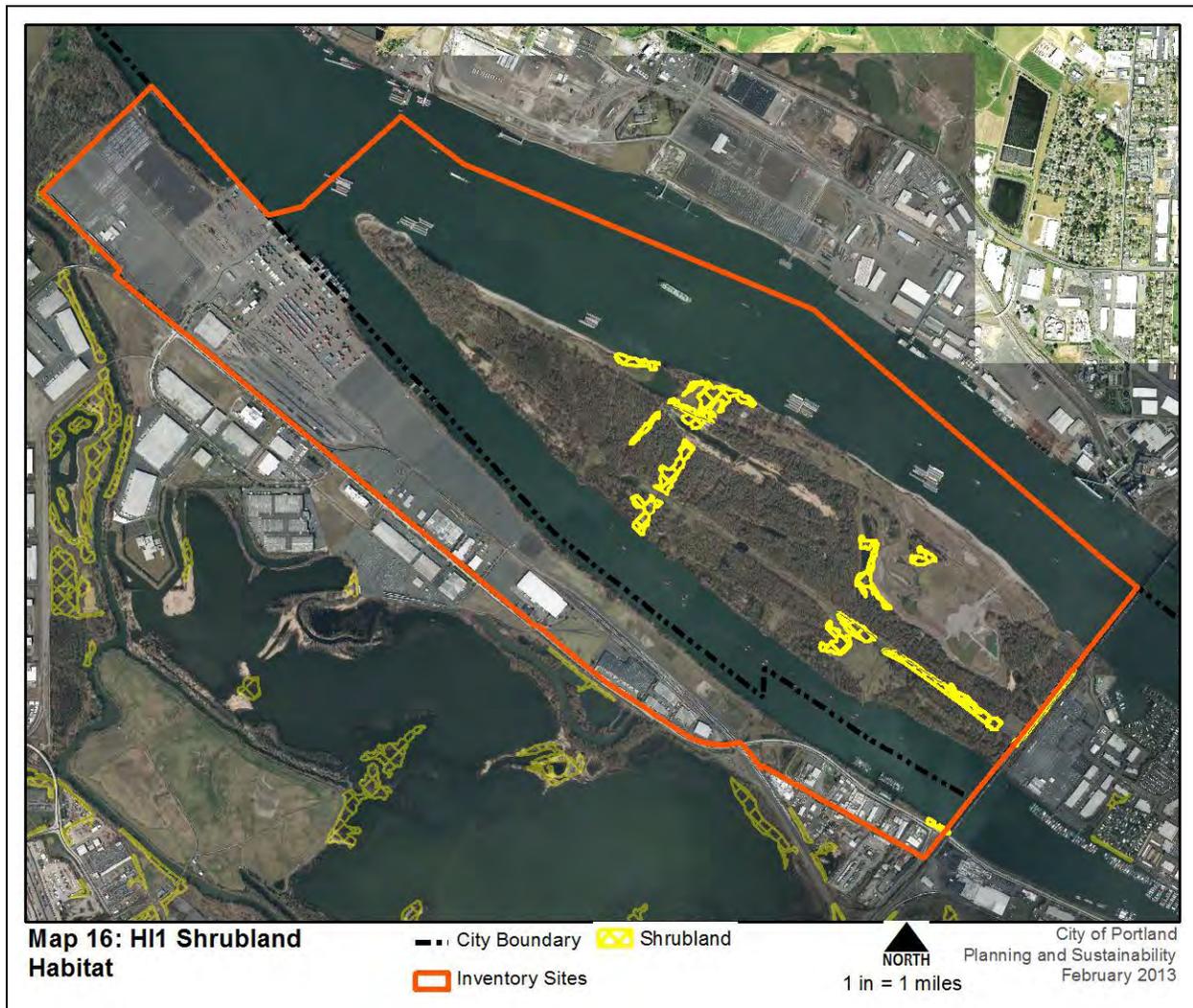
- (B) – Bottomland hardwood forest
- (C) – Wildlife connectivity corridor
- (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species
- (M) – Migratory stopover habitat
- (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

### C.3.b Shrubland

On WHI and the southern bank of the Oregon Slough there are 40 acres of shrubland habitat, most of which is found at the edge of forest and woodland areas, within the power line corridors, or associated with wetlands (scrub-shrub wetlands will be addressed in C.2.e).

Shrubland communities include woody plants typically less than ten feet tall with scattered open patches of grasses and forbs. Shrubland vegetation colonizes soils of many types, often in degraded or simply structured soils such as sand. WHI soil is primarily sand that allows shrubs to serve as pioneer species in

many areas. Roughly half of the shrublands on WHI are dominated by dense thickets of Armenian blackberry (dominant under power line corridors) and the other half is willow dominated, often on the edges of wetlands and the river channel. Shrub thickets dominated by willows, snowberry, red osier dogwood, and Indian plum are common at the edge of wetlands and the nearshore. Some areas on the island contain the rare Columbia River willow. This habitat type is important to birds such as the willow flycatcher, as well as numerous terrestrial insects. Appendix G: West Hayden Island Vegetation Survey for a full list of plant species.



Shrublands provide habitat for many species of wildlife that require early-successional forest and shrub habitat for nesting, breeding, and brood rearing. This habitat also provides a variety of food sources for birds. Bird species in the inventory site, particularly songbird species, are expected to be diverse due to the widespread and well-distributed shrubland habitat. Shrubland-dependent songbirds such as warblers can often successfully nest in small, isolated patches of shrubs within forested openings. Openings contain both herbaceous vegetation and shrubs and are valuable for wildlife because of the community diversity and the amount of food that they produce. Native shrubs are particularly important to migratory songbirds. Insects, reptiles, and mammals also benefit from the cover and food sources shrubs provide.

Species use of shrublands can be enhanced if surrounded by other types of habitats. Adjacent forests and grasslands allow birds and wildlife to forage or hunt in grasslands while retaining nesting, denning, or burrowing habitat within the shrublands. Connectivity to water provides a greater potential for increased species diversity.

In the region, shrubland habitat abundance has been reduced in agricultural and developed areas. One particular threat to native shrubland habitat is the occurrence of invasive species such as Armenian blackberry, knotweed, and reed canary grass. Non-native and invasive vegetation outcompetes and displaces native vegetation. While non-native and invasive vegetation in wetlands does provide natural resource functions such as water storage, filtering of pollutants from overland flows, and food and cover for wildlife species, native vegetation provides more varied food sources and structural diversity, which supports a broader diversity of native wildlife species.

While shrubland habitat also exists as the understory of woodland habitat, some wildlife species prefer open area shrubland habitat, which can contain denser foliage than understory shrubs. Native shrubland habitat disturbed through land use practices often do not colonize with native species but with more opportunistic non-native, invasive plants. With the limits on native shrubland habitat to recover without restoration or management, remaining intact shrubland habitat is important in maintaining regional biodiversity. Shrubland habitat significance is based primarily on its scarcity on WHI, and reduced abundance in the region due to loss of open space.

Table 11 provides a list of indicator species that use shrubland habitats in the WHI/Oregon Slough inventory site. This is not a comprehensive list; it focuses on species that are indicators of functioning riparian shrub communities and/or unique, rare or declining species.

<b>Species Group</b>	<b>Species</b>	<b>Habitat Description</b>	<b>Life History Functions being Served</b>	<b>Threats, Stressors and Sensitivities</b>
Bird	Willow flycatcher	Closely associated with dense, brushy thickets of vegetation adjacent to water. Use native willows, other native shrubs and non-native Armenian blackberry and Scotch broom. Shrub patches sometimes separated by gaps and also use sites with continuous shrub cover. Tall herbaceous plants an important element of shrub habitat.	<ul style="list-style-type: none"> <li>• Foraging</li> <li>• Breeding</li> <li>• Migratory stopover</li> </ul>	Population declines due to loss and degradation/alteration of riparian shrub habitat. Impacts include grazing, damming, draining, channelization, urbanization. Nests susceptible to ground predators. Mortality on migration caused by collision with towers. Vulnerable to habitat impacts on wintering range in Cen. & S. America
	Lincoln's Sparrow	Lowland sites with clumps of shrubs interspersed with taller patches grass/herbaceous plants, often riparian and/or adjacent to wetlands. Breeds in wet montane meadows with herbaceous and shrub components.	<ul style="list-style-type: none"> <li>• Migratory stopover</li> <li>• Overwintering</li> <li>• Foraging</li> </ul>	Adversely impacted by herbicides, grazing, draining wetlands, channelization, logging, changes in hydrology effecting wetlands. Vulnerable to loss of wetland edge, shrubs, and grassy areas. Susceptible to disturbance from recreation in breeding habitat. Mortality on migration caused by collision with towers. Vulnerable to habitat impacts on wintering range in Mexico (also winters on WHI).
	Yellow-breasted Chat	Edges of large, dense thickets in valley bottom riparian areas, swales, floodplains, fringes of ponds and wetlands. In Willamette Valley riparian zones with cottonwood,	<ul style="list-style-type: none"> <li>• Migratory stopover</li> <li>• Breeding</li> </ul>	Greatest threat is loss or modification of river riparian and floodplain habitat. In Willamette Valley reduced habitat due to industrial and

		Oregon ash, willow, red-osier dogwood, Douglas spirea, Armenian blackberry, and smaller trees. Cover 55% shrub, 35% forb, 10% tree.		urban development, as well as farming. Adverse impacts from grazing. Nests susceptible to ground predators. Mortality on migration caused by collision with structures. Vulnerable to habitat impacts on wintering range in Cen. & S. America
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Other species observed using the shrubland habitats on WHI and along the south bank of the Oregon Slough include:

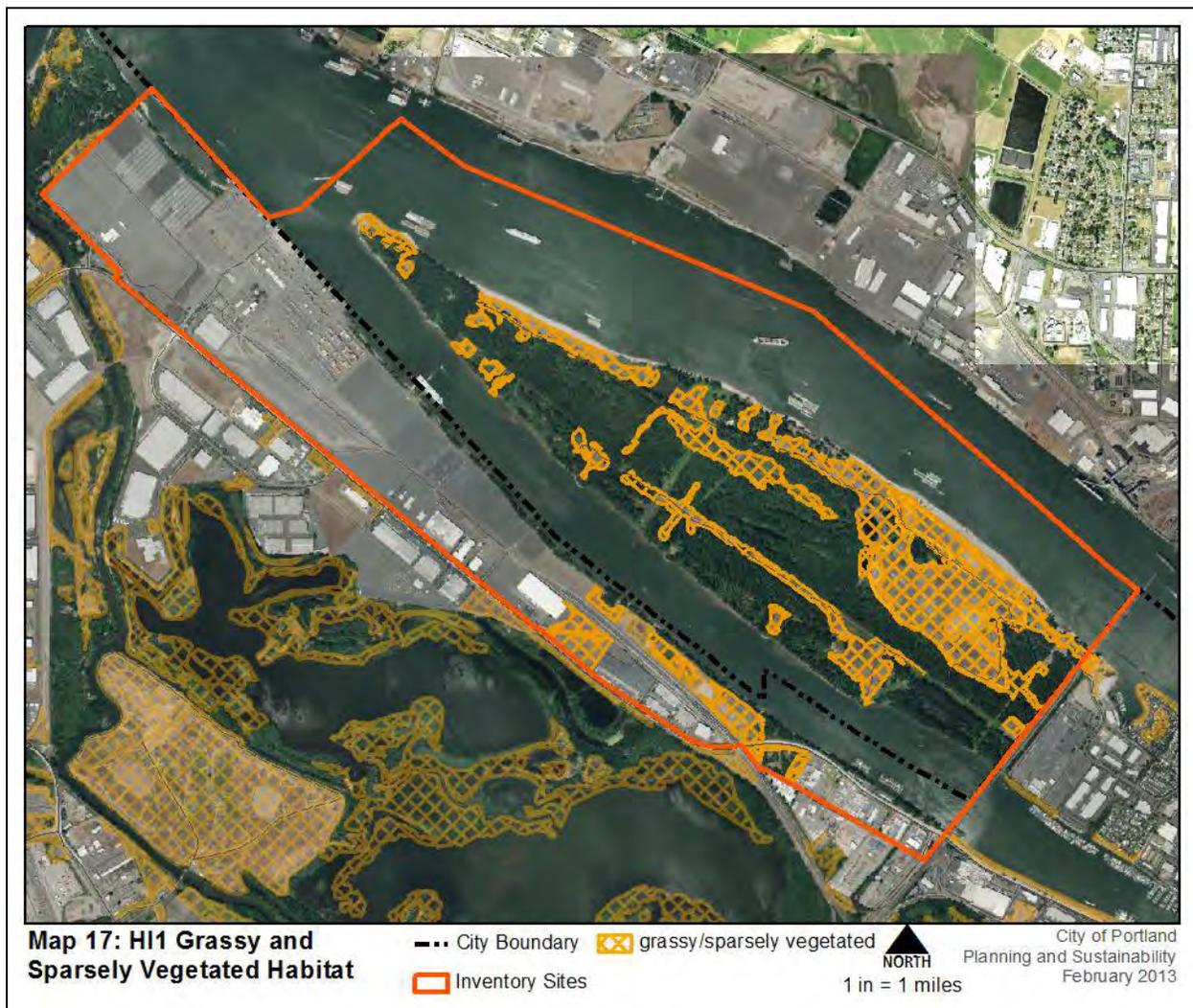
American Crow	Fox Sparrow	Tree Swallow
American Goldfinch	Golden-crowned sparrow	Unidentified Warbler
American Kestrel	Hermit Thrush	Varied Thrush
American Robin	House Finch	Vaux's Swift
Anna's Hummingbird	House Wren	Violet-green Swallow
Barn Swallow	Lesser Goldfinch	Warbling Vireo
Barred Owl	Lincoln's Sparrow	Western Kingbird
Bewick's Wren	Mallard	Western Scrub-Jay
Black Phoebe	Mourning Dove	Western Tanager
Black-capped Chickadee	Northern Flicker	Western Wood-Pewee
Black-crowned Night-Heron	Orange-crowned Warbler	White-crowned Sparrow
Black-headed Grosbeak	Oregon Junco	White-throated Sparrow
Brown-headed Cowbird	Pacific-slope Flycatcher	Willow Flycatcher
Bullock's Oriole	Purple Finch	Wilson's Warbler
Bushtit	Red-tailed Hawk	Winter Wren
Cedar Waxwing	Red-winged Blackbird	Yellow Warbler
Chipping Sparrow	Ruby-crowned Kinglet	Yellow-breasted Chat
Cliff Swallow	Rufous Hummingbird	Yellow-rumped Warbler
Common Yellowthroat	Savannah Sparrow	Black-tailed Deer
Cooper's Hawk	Song Sparrow	Coyote
Downy Woodpecker	Spotted Towhee	Northwestern Garter Snake
European Starling	Swainson's Thrush	

The shrublands located in the inventory site are designated as Special Habitat Areas because they meet the following criteria:

- (C) – Wildlife connectivity corridor
- (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species
- (M) – Migratory stopover habitat
- (S) - An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

C.3.c Grasslands and Sparsely Vegetated Areas

Grasslands and sparsely vegetated areas have a predominance of grasses (in general graminoids), forbs and wildflowers, with woody vegetation comprising less than 25 percent of the area. A few large areas on WHI and upland of the southern bank of the Oregon Slough are grasslands or sparsely vegetated areas. The substratum in these locations is well-drained sandy soil, primarily comprised of materials dredged from the navigation channels of the lower Willamette and Columbia Rivers. The percent cover and species of vegetation varies greatly in these habitats, due to the frequency of disturbance by deposition and maintenance of dredge spoils. The vegetation ranges from areas dominated by tall grasses and forbs, to areas with low dense grasses, to areas with scattered forbs and grasses and bare ground. In the spring there are often dense patches of two colored lupine (*Lupinus bicolor*). These areas provide similar functions found in prairie, meadow or grassland habitats, and some locations support grassland-associated wildlife species.



Invasive plant species can be the biggest threat to grasslands and sparsely vegetated area, as can colonization by woody-stemmed plants and succession into shrubland. Grasslands are more limited in terms of food supply and cover for wildlife; however, several songbirds are known to forage and nest in this habitat type. The grasslands and sparsely vegetated areas function in relationship to adjacent habitats and landscape context. The location of these along the Columbia River creates a unique habitat

association in Portland. Grasslands associated with rivers, streams or wetlands serve as migratory stopovers for north-south and east-west flyways. Red-tailed hawks and owls use perch sites along the forest edge to located and feed on small mammals and ground feeding birds in grasslands

Bat surveys conducted for this Inventory revealed the presence of five At-risk bat species in the open herbaceous habitats of WHI: California myotis, hoary bat, long-legged myotis, silver-haired bat and Yuma myotis. Little brown and big brown bats were also detected. Data collected on bats did not provide information on specific behavior or extent of habitat use.

Table 12 provides a list of grassland-associated indicator species that have been documented to use grassy and sparsely vegetated habitats in the WHI/Oregon Slough inventory site. This is not a comprehensive list of all species; it focuses on species that are indicators of grassland functions and/or unique, rare or declining species.

<b>Species Group</b>	<b>Species</b>	<b>Habitat Description</b>	<b>Life History Functions being Served</b>	<b>Threats, Stressors and Sensitivities</b>
Bird	Western meadowlark	Large patches (>200 acre) of open grass dominated habitat. Variable grass height with shrub cover <10%. Shrubs used as singing perches, fence lines and powerlines also used. Breeding territories 10-20 acres with minimal bare ground.	<ul style="list-style-type: none"> <li>• foraging</li> <li>• breeding</li> <li>• migratory stopover</li> </ul>	Loss of grassland habitat due to conversion to agriculture, development, degradation from grazing. Agricultural practices (mowing, tillage) destroy nests. Susceptible to ground predators and negatively impacted by feral and domestic cats. Area sensitive and require large habitat patches, an estimated 1% of grassland habitat remains in Willamette Valley Ecoregion. Sensitive to human disturbance.
	American kestrel	Open prairies, grasslands, and forest openings. Require high perches for hunting and cavities for nesting. Cavities typically old woodpecker nests in older, large diameter trees. Will also use other cavities if adjacent to appropriate hunting habitat (including nest boxes).	<ul style="list-style-type: none"> <li>• foraging</li> <li>• migratory stopover</li> <li>• overwintering</li> <li>• post breeding dispersal</li> </ul>	Some egg shell thinning due to pesticides DDT and heptachlor. Occasional shooting. Mortality due to collision with vehicles (locally also significant mortality due to collision with aircraft at Portland Airport). Loss or degradation of open habitats a major threat. Availability of nest cavities major limiting factor.
	Northern harrier	Open grasslands, wet and dry prairie, marsh, floodplains, and agricultural fields. Non-breeding roost sites in tall dense grass. Ideal nesting site within a mosaic of wetlands, wet prairie and drier upland grasslands. Breeding habitat patch size >400 acres, nest site >0.25 mile from human activity. Large home range.	<ul style="list-style-type: none"> <li>• foraging</li> <li>• migratory stopover</li> <li>• overwintering</li> </ul>	Declines attributed to loss and conversion of wetland and grassland habitat. Loss of habitat due to reforestation of agricultural lands. Some mortality due to shooting. Very sensitive to human disturbance while nesting. Nests susceptible to ground predators and agricultural activities.

Other wildlife species that have been documented to use grassy and sparsely vegetated habitats in the inventory site include:

American Crow	Killdeer	Western Kingbird
American Goldfinch	Lazuli Bunting	Western Meadowlark
American Kestrel	Lesser Goldfinch	Western Scrub-Jay
American Pipit	Lincoln's Sparrow	Western Wood-Pewee
American Robin	Merlin	White-crowned Sparrow
Anna's Hummingbird	Mourning Dove	White-throated Sparrow
Barn Swallow	Northern Harrier	Willow Flycatcher
Bewick's Wren	Northern Flicker	Wilson's Snipe
Black-capped Chickadee	Orange-crowned Warbler	Wood Duck
Black-headed Grosbeak	Oregon Junco	Yellow-rumped Warbler
Brown-headed Cowbird	Osprey (gathering nest material)	Blue-eyed Darter
Bullock's Oriole	Purple Finch	Common Whitetail dragonfly
Bushtit	Purple Martin	Red Admiral
Cackling Goose	Red-tailed Hawk	American Beaver
Canada Goose (western)	Red-winged Blackbird	Big Brown Bat
Canada Goose (lesser)	Rock Pigeon	Black-tailed Deer
Cedar Waxwing	Ruby-crowned Kinglet	California Myotis
Chipping Sparrow	Rufous Hummingbird	Coyote
Cliff Swallow	Savannah Sparrow	Deer Mouse
Common Yellowthroat	Snow Goose	Eastern Cottontail
Cooper's Hawk	Solitary Sandpiper	Hoary Bat
Eurasian Collared-dove	Song Sparrow	Little Brown Myotis
European Starling	Spotted Sandpiper	Long-legged Myotis
Fox Sparrow	Spotted Towhee	Silver-haired bat
Golden-crowned sparrow	Tree Swallow	Yuma Myotis
House Finch	Vaux's Swift	Long-toed Salamander
House Wren	Violet-green Swallow	Northwestern garter snake



The Dredge Deposit Management Area (right) is approximately 120 acres in size. While the overall habitat of the Dredge Deposit Management Area is sparsely vegetated, there is a mix of vegetation types and densities, throughout, including:

- Areas with recent dredge spoil deposits and little vegetation;
- Areas thickly vegetated with grasses and low structure weeds; and
- Depressions where wetland plants are found.

The Dredge Deposit Management Area (DDMA) is dominated by non-native grasses including cheatgrass, rat-tail fescue and rip-gut brome, and broadleaf plants such as filaree, evening primrose and horseweed. There are patches of taller shrubby vegetation that



include Armenian blackberry and scotch broom. Native grassland plants found in the DDMA include lupine, Canadian goldenrod, Spanish clover, and Oregon sunshine.

Ponds and wetland depressions within the DDMA attract resident and migratory wildlife. The following wildlife species have been observed using these features in the DDMA:

- Great blue heron
- Greater yellowlegs
- Green-winged teal
- Least sandpiper
- Mallard
- Solitary sandpiper
- Pacific chorus frog

The placement of dredge materials and maintenance of the area mimics disturbance that once occurred naturally. The management of the area maintains early succession vegetation and areas of bare soil. This disturbed grassland matrix offers a diversity of vegetation height and density, and provides habitat for various grassland birds including the *at-risk* songbird Western meadowlark.

The Western meadowlark is rare or uncommon in most of the Willamette Valley; however, the species is more numerous in the winter as individuals migrate to the valley from Canada and possibly eastern Oregon (Altman 2003). Western meadowlarks are most closely associated with native prairie communities, fallow fields, and pastures; cultivated grass fields and hayfields offer marginal habitat in the Willamette Valley (Altman 1999; Davis and Lanyon 2008). Between December 2010 and March 2011, biologists made 29 visits to the DDMA and observed a flock of 6-8 Western meadowlarks using the area on 27 (93%) of the visits. The flock was consistently seen singing and foraging in the wide open areas of low herbaceous cover (winter diet is seeds). The Western meadowlark flock also sought shelter in nearby blackberry and cottonwoods when flushed.

The DDMA is attractive to Western meadowlarks because it is a relatively large grassy/sparsely vegetated area surrounded by the Columbia River and other habitats; it is not surrounded by intense urban development. The open acreage of the DDMA is also situated within expansive floodplain setting of the lower Columbia River, a unique landscape context that attracts open country species. There are isolated patches of blackberry available for singing perches (Altman 2003). Western meadowlarks avoid areas dominated by woody vegetation (Davis 2004, reported by Davis and Lanyon 2008). Abundance of habitat to support Western meadowlark is also negatively affected by urbanization (Bock et al. 1999).

Other grassland-associated species that hunt and forage in the DDMA include American kestrel, northern harrier, savannah sparrow and deer mouse.

The Dredge Deposit Management Area is designated a Special Habitat Area because it meets the following criteria:

- (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species
- (C) – Wildlife connectivity corridor habitat
- (G) – Feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis
- (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

The T6 Dredge Material Handling Area is located on the southern side of the Oregon Slough between the river and Marine Drive, just east of Port Terminal 6. The 26-acre site contains a dredge material deposit area and three earthen cells connected by drainage pipes, constructed for the purposes of handling, dewatering and removing dredge material. The cells were constructed to control vegetation encroachment in the cells. There is also a power line corridor that crosses the site.

While not a native grassland, the vegetation structure and density mimic a grassland habitat. The T6 Dredge Material Handling Area is dominated with non-native grasses and mosses, with pockets of blackberry and scotch broom, cottonwood and willow. Bordering the grasslands, adjacent to the Oregon Slough, is a strip of mature cottonwoods, willows and ash with some native understory including snowberry, stinging nettle, red-osier dogwood, and sword fern. The grassy and sparsely vegetated area function in relationship to adjacent habitats. The location along the Columbia River creates a unique habitat association in Portland. Grasslands associated with rivers, streams, or wetlands, serve as migratory stopovers for north-south and east-west flyways.

Grassland-associated wildlife species documented to use the T6 Dredge Material Handling Area include American kestrel, savannah sparrow, and Western meadowlark. Western meadowlark is also an *at-risk* wildlife species. A flock of Western meadowlarks were observed using the area on multiple occasions in 2011. The Western meadowlarks are attracted to grasslands the T6 Dredge Material Handling Area because of its association with the Columbia River and Smith and Bybee Wetlands, its relative isolation from intense urban development, and patches of blackberry and scotch broom that provide singing perches.

Other wildlife observed at the T6 Dredge Material Handling Area include: six osprey nests (all located on structures), red-tailed hawk, varied thrush, yellow rumped warbler, scrub jay, American gold finch, bewick's wren, Lincoln's sparrow and downy woodpecker. Also seen were coyote scat, vole holes, deer mouse and evidence of deer browsing.

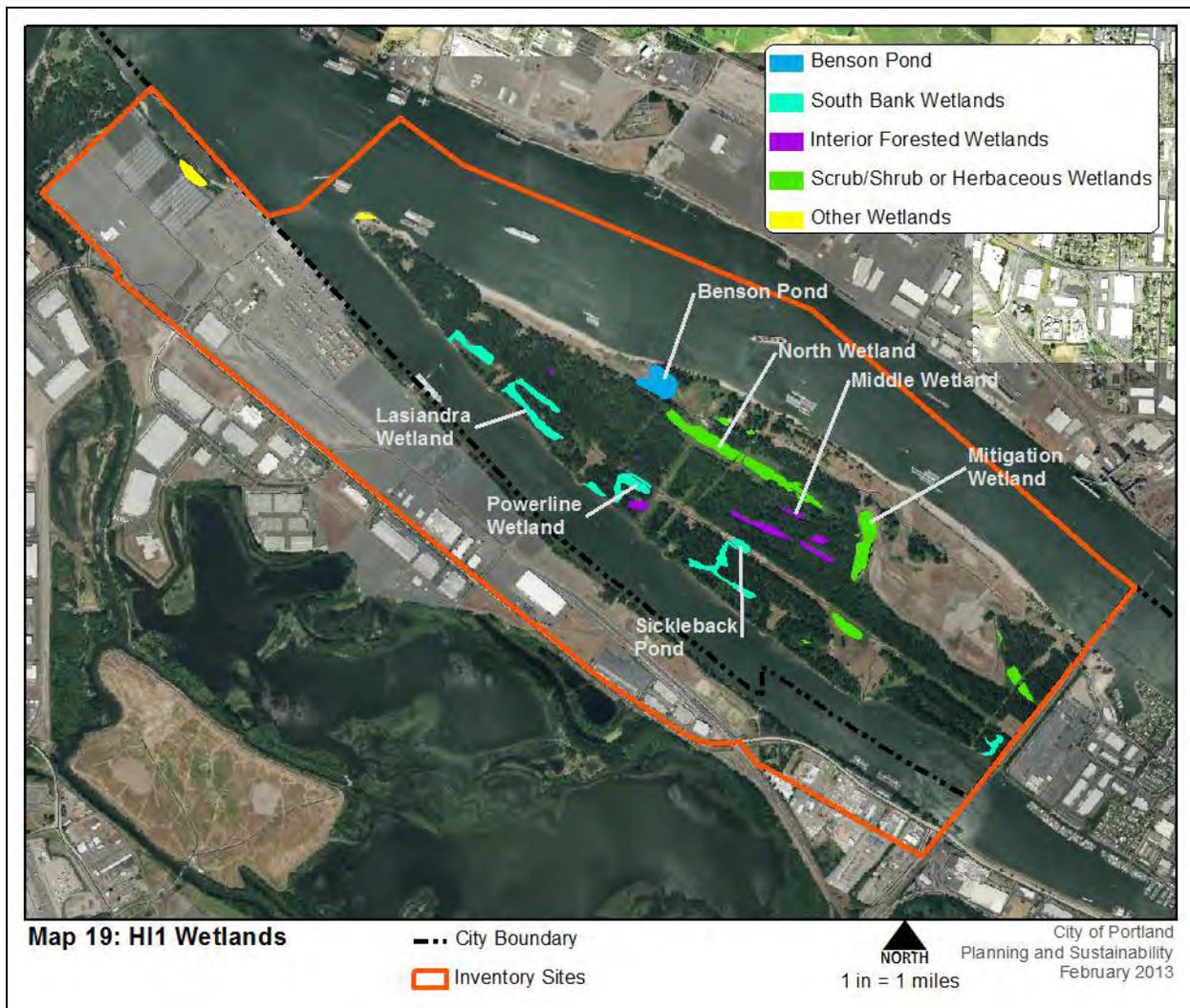


The T6 Dredge Material Handling Area is designated a Special Habitat Area because it meets the following criteria:

- (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species
- (C) – Wildlife connectivity corridor habitat
- (G)- Feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis
- (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

### C.3.d Wetlands

There are 48 acres of wetlands within the inventory site. The wetlands vary in size from approximately 300 square feet to 15+ acres. The wetland data source is primarily the Port of Portland Natural Resources Inventory, please refer to Chapter 3: Methodology for additional explanation. Map 19 shows all wetlands within the inventory site. Some of those wetlands were named for the purposes of data gathering and reporting.



Emergent wetlands have established along the edge of the riverbanks surrounding the island. These areas are productive areas for wildlife and host a diversity of plants. In late summer, common native wildflowers include sneezeweed and western goldenrod. Other species found include flatsedge, cattail, woolly sedge and water plantain. A rare plant, the hairy water fern, has been found on the north and south side of the island. Killdeer and greater yellowlegs were observed foraging in the emergent wetlands in 2011. Sandpipers, neotropical songbirds, amphibians as well as various fish and wildlife (deer and raccoon) depend on wetlands.

Table 13 provides a list of wetland-associated indicator species that have been documented to use wetland habitats in the WHI/Oregon Slough inventory site. This is not a comprehensive list of all species; it focuses on species that are indicators of wetland functions and/or unique, rare or declining species.

<b>Species Group</b>	<b>Species</b>	<b>Habitat Description</b>	<b>Life History Functions being Served</b>	<b>Threats, Stressors and Sensitivities</b>
Amphib.	Red-legged frog	Cool conditions, shade trees, leaf litter, ponds and wetlands with shallow areas (0.5 – 2m water depth) and emergent plants. Access to forested riparian habitats with downed logs/forest debris (forested wetland, upland).	breeding (egg-laying) foraging/feeding	Loss of egg-laying wetland habitat and adjacent forested riparian habitat. Require moist soil conditions and on WHI in late summer are restricted to drying wetlands. Predation (herons, garter snakes) and competition by invasive fish and bullfrogs. Roads: direct mortality from contact with vehicles during dispersal to riparian forested habitat. Roads: habitat fragmentation. Vulnerable to impaired water quality.
Bird	Willow flycatcher	Closely associated with scrub-shrub wetlands. Dense, brushy thickets of vegetation adjacent to water. Use native willows, other native shrubs and non-native Armenian blackberry and Scotch broom. Shrub patches sometimes separated by gaps and also use sites with continuous shrub cover. Tall herbaceous plants an important element of shrub habitat.	<ul style="list-style-type: none"> <li>• foraging</li> <li>• breeding</li> <li>• migratory stopover</li> </ul>	Population declines due to loss and degradation/alteration of riparian shrub habitat. Impacts include grazing, damming, draining, channelization, urbanization. Nests susceptible to ground predators. Mortality on migration caused by collision with towers. Vulnerable to habitat impacts on wintering range in Cen. & S. America
	Yellow-breasted Chat	Closely associated with scrub-shrub wetlands and riparian bottomland thickets. Edges of large, dense thickets in valley bottom riparian areas, swales, floodplains, fringes of ponds and wetlands. In Willamette Valley riparian zones with cottonwood, Oregon ash, willow, red-osier dogwood, Douglas spirea, Armenian blackberry, and smaller trees. Cover 55% shrub, 35% forb, 10% tree.	<ul style="list-style-type: none"> <li>• Migratory stopover</li> <li>• Breeding</li> </ul>	Greatest threat is loss or modification of river riparian and floodplain habitat. In Willamette Valley reduced habitat due to industrial and urban development, as well as farming. Adverse impacts from grazing. Nests susceptible to ground predators. Mortality on migration caused by collision with structures. Vulnerable to habitat impacts on wintering range in Cen. & S. America

All wetlands within this inventory site are designated a Special Habitat Area because they meet the following criteria:

- (C) – wildlife connectivity corridor habitat
- (I) – riverine island
- (W) – wetland

In addition, Benson Pond and the WHI South Bank Wetlands with a surface hydrology connection to the river during seasonal high flows also meet the following Special Habitat Area criterion because the wetlands provide habitat for 14 populations of ESA-listed fish species. The Port mitigation wetland, “middle wetland”, and “stickleback pond” support breeding populations of Northern red-legged frogs (see appendix F for a distribution map for Northern red-legged frogs). Due to documented presence of *at-risk* species, these wetlands meet additional criteria:

- (S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

Below are summaries of the different wetlands types found on West Hayden Island.

#### Benson Pond – Emergent and Scrub/Shrub Wetland

Benson Pond was artificially created in the mid-1900’s as a staging area for log rafts. Located on the northern edge of West Hayden Island, just west of the power line corridor, Benson Pond is maintained by groundwater, surface runoff, and backwater from the Columbia River. The pond now functions as a permanently flooded palustrine aquatic bed that supports both persistent and non-persistent emergent wetland vegetation. Surrounding the aquatic features of the pond is a diverse mix of scrub-shrub wetland vegetation, and there are pockets of mature riparian trees that connect to the flooded wetland during freshets.



During the winter of 2011, heavy rainfall and high Columbia River flows filled the pond to capacity and overflowed into an adjacent wetland. This basin, too, filled to capacity, and flood waters were routed south through two culverts under the access road into a large, open grassy wetland known as “North Wetland” which is fringed by mature cottonwood, ash, and willow. Hairy water fern is found in Benson pond, along with other wetland emergent plants. (See Appendix F: At Risk Species Mapping Project)

With its flood storage capacity, the Benson Pond wetlands complex provides critical habitat for fish, including many species of ESA-listed salmon and trout; foraging habitat and refuge for waterfowl, wading birds, and diving birds; potential habitat for turtles (one painted turtle was observed in 1997); habitat for breeding amphibians; foraging habitat for insectivorous birds; and watering opportunities for wildlife. Wildlife species observed using Benson Pond in 2010/2011 include:

American Goldfinch	Great-horned Owl	Swainson's Thrush
American Kestrel	Hermit Thrush	Tree Swallow
American Robin	Hooded Merganser	Warbling Vireo
Bald Eagle	House Finch	Western Scrub-Jay
Barn Swallow	House Wren	Western Tanager
Belted Kingfisher	Killdeer	Western Wood-Pewee
Bewick's Wren	Lincoln's Sparrow	White-crowned Sparrow
Black-capped Chickadee	Mallard	Willow Flycatcher
Black-crowned Night-Heron	Mourning Dove	Wilson's Warbler
Black-headed Grosbeak	Northern Flicker	Wood Duck
Brown-headed Cowbird	Northern Rough-winged Swallow	Yellow Warbler
Bullock's Oriole	Orange-crowned Warbler	Yellow-breasted Chat
Bushtit	Osprey	Yellow-rumped Warbler
Canada Goose	Pied-billed Grebe	Black Saddlebags
Cedar Waxwing	Purple Finch	Blue-eyed Darter
Cliff Swallow	Red-breasted Sapsucker	Striped Meadowhawk
Common Yellowthroat	Red-tailed Hawk	Western Tiger Swallowtail
Double-crested Cormorant	Red-winged Blackbird	Black-tailed Deer
Downy Woodpecker	Ruby-crowned Kinglet	Common garter snake
European Starling	Rufous Hummingbird	American Bullfrog
Golden-crowned sparrow	Song Sparrow	Long-toed Salamander
Great Blue Heron	Spotted Sandpiper	Pacific Chorus Frog
Great Egret	Spotted Towhee	
Green Heron		

#### WHI South Bank Wetlands – Forested Wetlands

There are multiple forested palustrine wetland areas on the south-central side of the island. The wetlands are seasonally inundated to a large extent during peak flow events that backwater the Oregon Slough onto the island. These wetlands support persistent emergent wetland vegetation, such as nettles and Pacific willow, but are dominated by reed canary grass in open areas. The wetlands provide a variety of food, cover, nesting, and denning opportunities for many aquatic and terrestrial wildlife species. Wildlife species observed using the WHI South Bank Wetlands during 2010/2011 include:

Bald Eagle	Hooded Merganser	Western Wood-Pewee
Band-tailed Pigeon	House Wren	White-breasted Nuthatch
Barred Owl	Mallard	White-crowned Sparrow
Belted Kingfisher	Mourning Dove	Willow Flycatcher
Bewick's Wren	Northern Flicker	Winter Wren
Black-capped Chickadee	Northern Rough-winged Swallow	Wood Duck
Black-headed Grosbeak	Osprey	Yellow Warbler
Brown Creeper	Pacific-slope Flycatcher	American Beaver
Brown-headed Cowbird	Pileated Woodpecker	Black-tailed Deer
Bullock's Oriole	Purple Finch	River otter
Bushtit	Ruby-crowned Kinglet	Red-eared Slider
Canada Goose	Rufous Hummingbird	Western Painted Turtle
Cedar Waxwing	Song Sparrow	Common garter snake
Downy Woodpecker	Spotted Towhee	Long-toed Salamander
Fox Sparrow	Swainson's Thrush	Pacific Chorus Frog
Golden-crowned Kinglet	Tree Swallow	Northern Red-legged Frog
Great Blue Heron	Warbling Vireo	
Hermit Thrush	Western Scrub-Jay	

The wetlands also provide direct export of organic materials to the riverine system; groundwater recharge; flood storage; and sediment, chemical, and nutrient filtering services. The south bank wetlands are inundated by the Columbia River seasonally and during flood events. This inundation provides off-channel habitat for aquatic fish and wildlife, most notably, ESA-protected salmon and trout..

**WHI Forested Interior Wetlands**

Several patches of forested palustrine wetlands are found in the interior of the island. These wetlands support persistent emergent wetland vegetation, such as nettles and cottonwoods, but are dominated by reed canary grass areas around the fringe. The wetlands are seasonally flooded after the groundwater table reaches the surface, usually between November and July. These forested wetlands provide a variety of food, cover, nesting, and denning opportunities for many aquatic and terrestrial wildlife species, as well as groundwater recharge; flood storage; and sediment, chemical, and nutrient filtering services. Generally, these wetlands provide higher quality amphibian breeding habitat due to their isolation from river driven fluctuation in water levels (stable hydropereiod) and from increased turbidity from river flows. Wildlife species observed using the WHI's forested interior wetlands during 2010/2011 include:



Bewick's Wren  
 Black-capped Chickadee  
 Black-headed Grosbeak  
 Brown Creeper  
 Brown-headed Cowbird  
 Bushtit  
 Common Yellowthroat  
 Downy Woodpecker  
 Great Blue Heron  
 Hermit Thrush  
 House Wren  
 Mallard  
 Northern Flicker  
 Orange-crowned Warbler

Pacific-slope Flycatcher  
 Pileated Woodpecker  
 Purple Finch  
 Red-breasted Sapsucker  
 Red-tailed Hawk  
 Ruby-crowned Kinglet  
 Rufous Hummingbird  
 Song Sparrow  
 Spotted Towhee  
 Steller's Jay  
 Swainson's Thrush  
 Townsend's Warbler  
 Tree Swallow  
 Varied Thrush

Warbling Vireo  
 Western Tanager  
 White-breasted Nuthatch  
 Wilson's Warbler  
 Winter Wren  
 Wood Duck  
 Yellow Warbler  
 Yellow-rumped Warbler  
 Muskrat  
 Common garter snake  
 Long-toed Salamander  
 Pacific Chorus Frog  
 Northern Red-legged Frog

**Interior Scrub/Shrub and Herbaceous Wetlands**

Several patches of various sized scrub/shrub and herbaceous wetlands are found in the interior of the island. These wetlands support persistent emergent wetland vegetation types, as well as wetland shrubs around the fringe. The wetlands are seasonally flooded after the groundwater table reaches the surface, usually between November and June. These wetlands provide a variety of food, cover and nesting for many aquatic and terrestrial wildlife species, as well as groundwater recharge; flood storage; and sediment, chemical, and nutrient filtering services. Hairy water fern, a rare aquatic plant, has been found in an open wetland.



Long-toed salamander egg mass (right) and adult (forest) in interior scrub/shrub wetland

Wildlife species observed using the WHI herbaceous wetlands during 2010/2011 include:

- |                        |                               |                          |
|------------------------|-------------------------------|--------------------------|
| Bald Eagle             | Lincoln's Sparrow             | Western Tanager          |
| Barn Swallow           | Mallard                       | Western Wood-Pewee       |
| Belted Kingfisher      | Mourning Dove                 | White-crowned Sparrow    |
| Bewick's Wren          | Northern Flicker              | Willow Flycatcher        |
| Black Phoebe           | Northern Rough-winged Swallow | Wilson's Warbler         |
| Black-capped Chickadee | Orange-crowned Warbler        | Wood Duck                |
| Black-headed Grosbeak  | Oregon Junco                  | Yellow Warbler           |
| Brown-headed Cowbird   | Osprey                        | Yellow-rumped Warbler    |
| Bufflehead             | Pied-billed Grebe             | Pacific Clubtail         |
| Bushtit                | Purple Finch                  | Paddle-tailed Darner     |
| Canada Goose           | Purple Martin                 | Big Brown Bat            |
| Cedar Waxwing          | Red-tailed Hawk               | Black-tailed Deer        |
| Common Yellowthroat    | Red-winged Blackbird          | California Myotis        |
| Downy Woodpecker       | Ring-necked Duck              | Hoary Bat                |
| European Starling      | Ruby-crowned Kinglet          | Little Brown Myotis      |
| Gadwall                | Rufous Hummingbird            | Long-legged Myotis       |
| Golden-crowned sparrow | Song Sparrow                  | Muskrat                  |
| Great Blue Heron       | Spotted Sandpiper             | Raccoon                  |
| Great Egret            | Spotted Towhee                | Silver-haired bat        |
| Great horned owl       | Swainson's Thrush             | Yuma Myotis              |
| Greater Yellowlegs     | Tree Swallow                  | Western Painted Turtle   |
| Hooded Merganser       | Varied Thrush                 | Common garter snake      |
| House Finch            | Vaux's Swift                  | Long-toed Salamander     |
| House Wren             | Violet-green Swallow          | Pacific Chorus Frog      |
| Killdeer               | Warbling Vireo                | Northern Red-legged Frog |

### C.3.e River Bank and Upper Beach

The WHI river bank is a mix of primarily beach and vegetated banks. The northern river bank along WHI is a gently sloped, sand beach that transitions up into a mature cottonwood riparian buffer along the western tip and the middle of the island. As the elevation rises, the beach transitions from seasonally and tidally inundated shallow water habitat into vegetated riparian areas. Areas with intact riparian forest on the river bank supply the river with woody debris. The forests often recruit large pieces of wood creating complex wood structures that provide habitat for native fish.

Much of the northern river bank has been impacted by dredge material placement over the past century. In areas of older placements, cottonwood trees have reestablished. Where newer dredge placement has occurred, particularly in the Dredge Deposit Management Area, the upper beach meets an artificially steep sandy berm with sparse vegetation and small pockets of shrubs and trees. Recruitment of woody debris is lower in this area of beach than where there is a forest buffer. However, the energy dissipation and large wood recruitment capacity of the large beach continues to provide habitat. Large wood is constantly recruited from elsewhere in the watershed and deposited on this beach. The logs and rootwads settle out of the river's water column and are left behind as water recedes, providing habitat structure for fish, bugs, and wildlife. The large wood also provides shoreline stabilization and food web (detritus and invertebrates) input for nearshore plant and animal species.



**West Hayden Island North Beach**

The north beach and riparian area provides habitat for foraging birds such as swallows, fox sparrows and white-crowned sparrows, as well as potential nesting areas for turtles. Raptors and insectivore birds, such as warblers and chickadees, also use the cottonwood transition zone in this area for foraging and resting.



**West Hayden Island South Beach**

The south bank of WHI, along Oregon Slough, is primarily vegetated with mature forest and woodland habitat that provides and recruits large wood to the channel. Most of the riparian area transition down to gently sloped sand and mud beaches. During high water (November through June), the river inundates the beaches and up the roots and lower branches of the riparian forests along the shoreline. Along these areas an intricately undercut matrix of tree trunks and roots has formed that provides rearing habitat for juvenile salmon and trout. In some locations there are inlets to the south bank wetlands that provide refugia for salmon and trout during high water. This complex of habitats is unique in the Portland-Metro area.

The river banks and upper beaches around the perimeter of the island and along the south shoreline of Oregon Slough near Port Terminal 6 are designated a Special Habitat Area because they meet the following criteria:

(C) – wildlife connectivity corridor habitat

(I) – riverine island

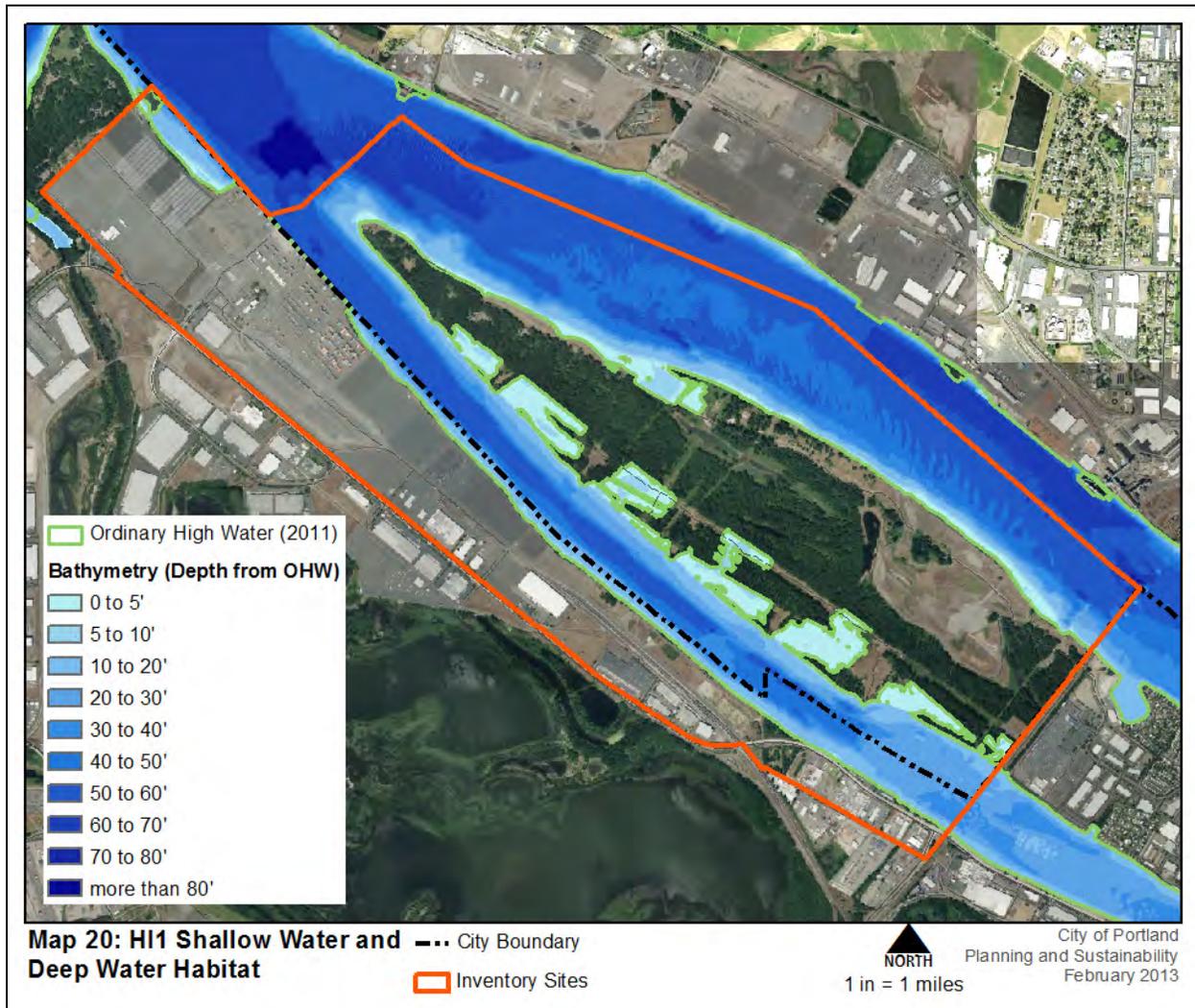
(S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

#### C.3.f Shallow Water and Open Water

Columbia River hydrology, water quality and fish and wildlife use in the study area are addressed in detail in Chapter 4.A and is summarized here. Please refer to Chapter 4.A for additional information.

Shallow water habitat in the Lower Columbia River is characterized by shallow grade, sand and mudflat beaches that unite with undercut banks and vegetated riparian areas. This shallow water area provides important habitat functions such as velocity moderation and food production that support aquatic

organisms. The shallow water habitat of the Lower Columbia River has been designated as *critical habitat* for federally-listed ESA species. Critical habitat is defined as the area between ordinary high water (OHW) to 34 feet below ordinary high water (NAVD88 vertical datum), and includes river banks, side channels, sloughs, wetlands and floodplains that maintain depths from 0.3 to 6.6 feet during lower river's the tidal cycle. The elevation of ordinary high water around Hayden Island is approximately 20-feet in NAVD88.



For salmonid juveniles migrating out of the Columbia River system, shallow water habitat is where they begin experiencing a lower energy and wider channel shaped by tidal action as they transition into the marine environment. These fish can have extended rearing and outmigration periods in the lower river prior to transitioning into their marine life history phase, both of which are advantageous to marine survival and life history diversity (Myers et al. 1998). The longer these fish reside in and feed on the estuary's diverse food web, the larger and more robust they become, increasing their ability to escape predators and fend off parasites and bacteria that commonly impact their health in the ocean environment. For the eulachon, shallow water habitat is where spawning, incubation and rearing life stages are completed before these fish pass onto their ocean life phase.

Columbia River fish are known to use shallow water habitat for several survival strategies during their juvenile life stages. For instance, juvenile salmon and trout forage for prey in sand, gravel, woody debris,

and submerged vegetation, as well as on the river’s surface and in its water column for floating or swimming prey. Juveniles also seek refuge from high flow events and predators by hiding in woody debris, undercut banks, and both overhanging and submerged vegetation, all vital requirements of functioning shallow water habitat. Shallow water habitat also plays an integral role in building and maintaining the aquatic food web by providing substrate on which detritus develops. The detritus supports invertebrates that hatch year-round and feed fish, amphibians, birds, and mammals.



Adult fish use shallow water habitats for several survival strategies as well. Although most anadromous species are not actively foraging during this life stage (salmon and eulachon in particular), they utilize shallow water habitat features such as woody debris, undercut banks, overhanging vegetation, and submerged vegetation to rest and recharge energy needed for long upstream migrations, and to avoid predators such as raptors, pinnipeds, and humans.

The distance between shallow water refugia is important to the health and survival of salmonids. Long periods of sustained swimming between refugia habitats deplete energy reserves. Fish with low energy resources caught migrating between refugia areas are more vulnerable to predation, as their flight response diminishes with a reduction in stamina. The more “pit stops” fish can make along their way up and downstream, the more likely they will complete migrations in good health. Therefore, salmonid productivity and survival is expected to be greater in locations with the shortest distance between refugia where the fish can rest, feed, and rebuild their energy supplies (C.L. Groot, 1995; M.B. Foreman, 1990; R.C. Eaton, 1991; Sauter, 2001; Sedell, 1990).

Fish abundance in rivers is correlated with the abundance and quality of riparian cover (Bjornn and Reiser 1991). While cover is an important aspect of salmonid habitat it is hard to define. Cover is vegetation and woody debris that is periodically inundated with water. The reduced abundance of high quality cover in the lower river, adequately spaced to facilitate predator avoidance and resting regimes, limits salmon and trout production.

In 2010/2011, nearshore cover was inventoried around West Hayden Island. Eight categories of wood were surveyed throughout 14 reaches around the island and along the beach below the Port’s Terminal 6. Wood classes and nearshore reaches are described below:

<b>Wood Class</b>	<b>Field Code</b>	<b>Description</b>
Large wood with intact rootwad	LWD w/ RW	Logs measuring 12+” DBH, at least 10-feet long, with trunk flare and surface roots still attached.
Large wood without rootwad	LWD w/o RW	Logs measuring 12+” DBH, at least 10-feet long, but lacking trunk flare or root structure.
Key piece	Key	Large, branched stems, with or without rootwad, capable of recruiting other large wood and stabilizing complex habitat structure.
Rootwad	RW	Large trunks roughly 10-feet long or less, with trunk flare and surface roots still attached.
Small woody debris	SWD	Logs measuring between 6-12” DBH, with or without rootwad attached.
Snag	Snag	Deceased, yet upright tree trunks on or near the top of streambank.
Overhanging vegetation	OHV	Percent length of shoreline that provides tree/shrub limb cover extension over wetted channel surface.
Undercut bank	UCB	Percent length of shoreline that provides complex riparian tree/shrub root cover throughout wetted channel column.



The condition and function of the nearshore environment around the island varies depending on geography. The north shore beach (units NB1-NB6 in Figure Xw below) is largely sand and gravel with slopes that gently roll up to patches of riparian habitat. It buffers the island's interior from Columbia River shipping lanes and Port of Vancouver traffic; subsequently, wind and wave energy are high and habitat complexity is low. However, because it serves the mainstem of the Columbia River, the north beach has great capacity to recruit and retain large pieces of wood. Conversely, the exposure of the island's south shore beach and that under T6 along the Oregon Slough side channel to a lower volume of shipping traffic and wave energy helps maintain a smaller/softer substrate and deeper undercut bank features. Large wood is mostly recruited from the local shoreline's riparian zone than elsewhere in the Columbia Basin; however, several very large pieces (48"+ DBH) were inventoried recently, and were obvious transplants to the slough's beaches.

The five top-ranked beach inventory units (Table 15) that averaged the highest overall wood count (pieces/mile), in descending order, are: SB4, NB3, SB3, NB4, and SB5. Other wood count statistics are ranked and summarized in Table 15, below.

**Table 15: Site Rank by Wood Debris Inventory.**

Unit	Pieces Per Mile						Percent Unit Length	
	<i>LWD w/RW</i>	<i>LWD w/o RW</i>	<i>Keys</i>	<i>RW</i>	<i>SWD (6-12")</i>	<i>Snags</i>	<i>OHV</i>	<i>UCB</i>
NB1	11	2	10	3	2	8	11	14
NB2	7	5	7	6	7	11	12	13
NB3	2	1	9	1	9	9	10	2
NB4	4	3	10	5	8	5	8	1
NB5	6	9	10	4	13	13	14	12
NB6	8	8	10	12	12	12	9	11
T6	14	7	3	7	5	7	6	10
SB1	9	13	1	13	10	4	1	7
SB2	5	14	5	8	14	2	2	8
SB3	3	6	4	9	3	6	3	3
SB4	1	4	2	2	1	14	13	5
SB5	10	10	10	10	4	10	7	9
SB6	12	11	8	14	6	1	4	4
SB7	13	12	6	11	11	3	5	6

The nearshore, shallow-water areas with sandy substrate in the Lower Columbia River are also important for Pacific and river lamprey. Adult lamprey spend up to one year in the Columbia River after returning from the ocean to overwinter. Adults use the channel margin and pool habitats to utilize cover from predators. Spawning takes place in low gradient river habitats with gravel and sand-dominant substrate. After broadcast dispersion, eggs incubate for two to three weeks on the substrate they attach to; thereafter, the young swim into low velocity habitats and burrow in muddy substrate for the next four to six years. Shallow water habitat in the Columbia River is characterized by low gradient, low velocity conditions and is likely used by Pacific lamprey in all life stages (PSMRC, 1997).



Waterfowl and shorebirds feed on exposed mudflats of shallow water habitat as they migrate along the river channel during periods of low tide and/or low flow. Soft substrate beaches are highly productive for invertebrates, a primary food source for large numbers of shore and songbirds. Birds observed foraging or resting in shallow water habitat during 2010-2011 site visits include:

- |                                   |                            |
|-----------------------------------|----------------------------|
| American wigeon                   | Least sandpiper            |
| Bald eagle (courting and hunting) | Lesser scaup               |
| California gull                   | Mew gull                   |
| Caspian tern                      | Osprey                     |
| Eared grebe                       | Peregrine falcon (hunting) |
| Common goldeneye                  | Red-necked grebe           |
| Common merganser                  | Red-necked Phalarope       |
| Double-crested cormorant          | Ring-billed gull           |
| Spotted sandpiper                 | Ring-necked duck           |
| Horned grebe                      | Surf scoter                |
| Gadwall                           | Western grebe              |
| Glaucous-winged gull              |                            |

Fish species collected in shallow water habitat around the perimeter of West Hayden Island include:

Chinook salmon  
Coho salmon  
Columbia eulachon  
Chum salmon  
Cutthroat trout  
Mountain whitefish  
Pacific lamprey  
Redside shiner  
Sockeye salmon  
Starry flounder  
Steelhead trout  
Three-spine stickleback  
White sturgeon

The shallow and open water habitats within the inventory site are designated as a Special Habitat Area because they meet the following criteria:

- (C) – Wildlife connectivity corridor
- (M) – Migratory stopover habitat
- (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

## Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 16). The relative ranks are produced using GIS models and information on Special Habitat Areas. The model criteria are not sensitive to the species of vegetation present or whether vegetation is native or non-native. However, the model criteria do assign different riparian functional values to cultivated, heavily manicured and managed landscapes and semi-natural and natural vegetation. The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter 3: Methodology Overview of this report and Appendix K: *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning programs, design of development or redevelopment projects, mitigation and restoration activities.

### Riparian Areas

The site contains West Hayden Island, portions of the Columbia River, Oregon Slough and river bank, vegetated and non-vegetated flood area, riparian forests and woodlands, as well as other types of vegetation, that contribute to the riparian functions as detailed in the natural resource description. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank functions, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are generally assigned to the Columbia River, Oregon Slough, vegetated river banks and forest and woodland vegetation. Medium relative functional ranks are generally assigned to flood area vegetated with shrubs or grasses. Low relative ranks are generally assigned to non-vegetated flood area and hardened, non-vegetated river banks (HI1 Map 4).

### Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as forest and/or wetland areas two acres in size or greater, and including adjacent woodland vegetation (note Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features).

The site contains vegetated forested patches, wetlands and corridors that provide wildlife habitat and connectivity between habitat patches. Forested areas and wetlands provide nesting, breeding and foraging habitats for a diverse range of bird and mammal species, as well as amphibians, reptiles, and invertebrate species.

Special Habitat Areas contain unique features and provide critical wildlife habitat as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model. All of WHI is designated Special Habitat Area for a variety of criteria, as described below; therefore, all WHI receives a high relative rank for wildlife habitat (HI1 Map 5).

- Columbia River, Oregon Slough and Shallow Water Habitat are designated SHA because they meet the following criteria:
  - (C) – Wildlife connectivity corridor
  - (M) – Migratory stopover habitat

(S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

- The T6 Vacant Industrial Lands is designated SHA because it meets the following criteria:
  - (C) – Wildlife connectivity corridor habitat
  - (G) – Feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis
  - (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- All of West Hayden Island (WHI) is designated a SHA because it meets the following criteria:
  - (C) – Wildlife connectivity corridor habitat
  - (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species

In addition to meeting the (C) and (I) criteria, specific features on WHI meet other SHA criteria as well:

- All wetlands are designated SHA because they meet the following criteria:
  - (W) – Wetlands
- Benson Pond, South Bank Wetlands, Mitigation Wetland, Middle Wetland and Stickleback Pond are designated SHA because they meet the following criteria (see Map 19):
  - (S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
  - (W) – Wetlands
- Forest and woodland vegetation is designated SHA because it meets the following criteria:
  - (B) – Bottomland hardwood forests
  - (M) – Migratory stopover habitat
  - (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- The Dredge Deposit Management Area is designated SHA because it meets the following criteria:
  - (G) – Feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis
  - (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

### Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank (HI1 Map 6).

**Table 16: Summary of Ranked Resources in HI1: West Hayden Island and Oregon Slough**

<b>Total Inventory Site = 2,429</b>				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>				
acres	1,448	287	176	1,909
percent total inventory site area	60	12	7	79
<b>Wildlife Habitat</b>				
<b>Wildlife Habitat*</b>				
acres	0	538	4	541
percent total inventory site area	0	22	<1	22
<b>Special Habitat Areas**</b>				
acres	1,826			
percent total inventory site area	75			
<b>Wildlife Habitat - adjusted by Special Habitat Areas ***</b>				
acres	1,826	<1	0	1,826
percent total inventory site area	75	0	0	75
<b>Combined Total***</b>				
acres	1,827	11	84	1,922
percent total inventory site area	75	<1	4	79
*High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Columbia River.				
** Special Habitat Areas rank high for wildlife habitat.				
***Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				



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# HI1: West Hayden Island and Oregon Slough

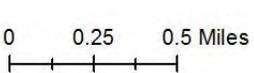
Map 1: 2011 Aerial Photography

**Legend:**

- NRI Inventory Sites
- City Boundary

Updated April 2013

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# HI1: West Hayden Island and Oregon Slough

## Map 2: Water Features

### Legend:

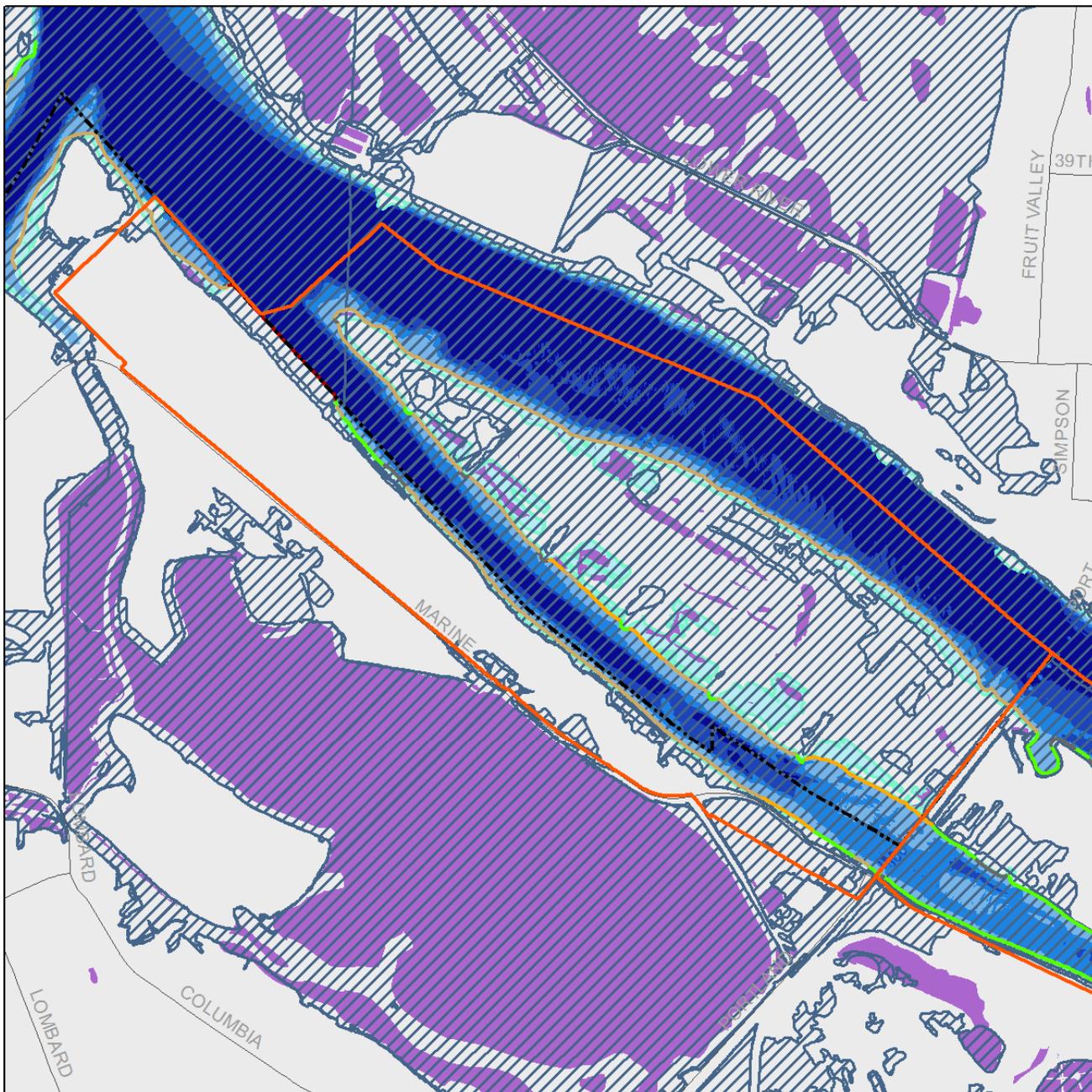
- wetland
- 100-year floodplain
- River Bathymetry (2011 update)  
depth from ordinary high water
  - 0 - 10 ft
  - 10 - 23 ft
  - 23 - 36 ft
  - 36 - 48 ft
  - 48 - 113 ft

- River Bank Treatments
  - Beach
  - Bio-Engineered
  - Vegetated Rip Rap
  - Rock Outcrop
  - Non-Vegetated Rip Rap
  - Seawall
  - Pilings
  - Unclassified Fill

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0 0.25 0.5 Miles





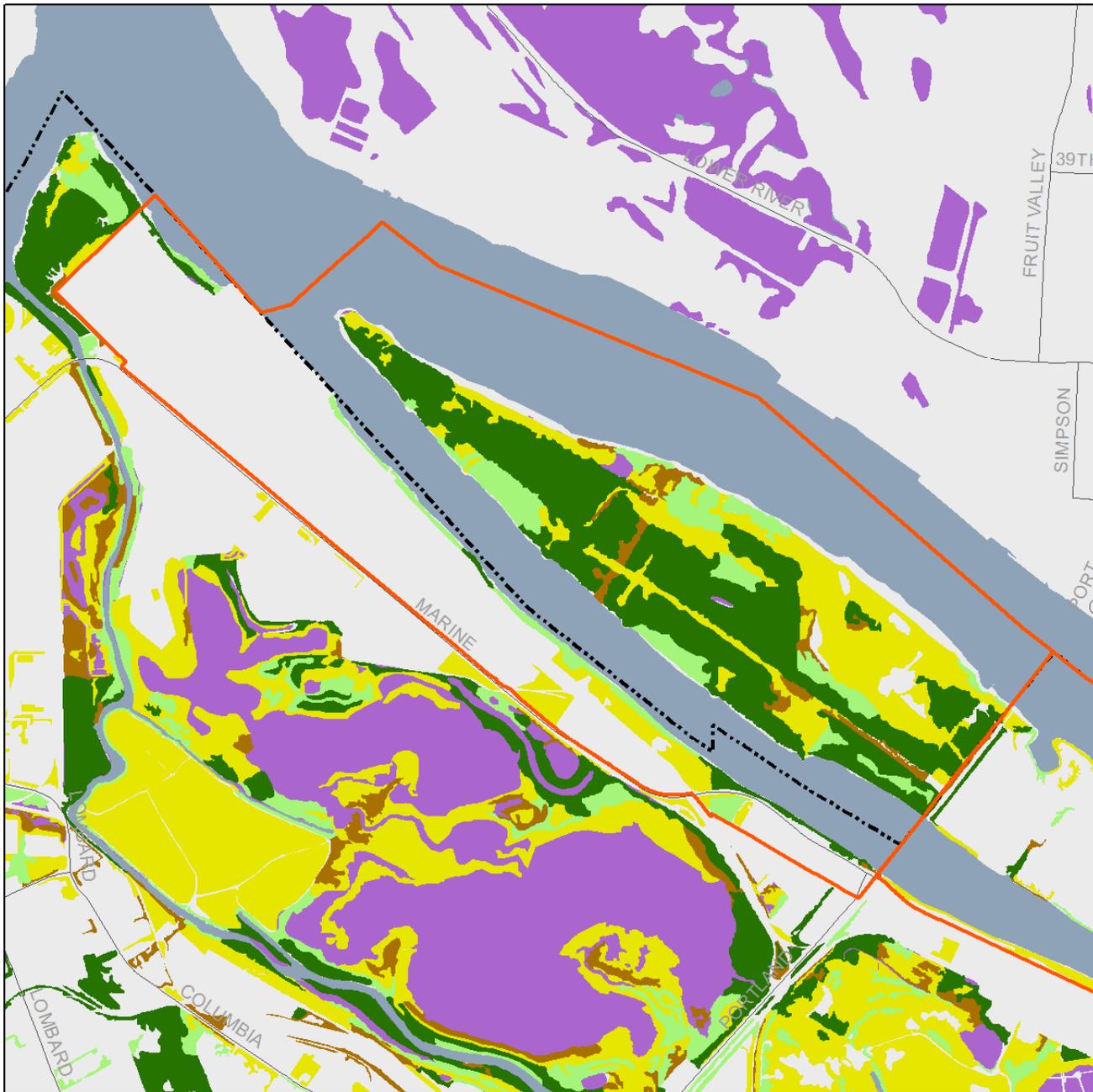
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# HI1: West Hayden Island and Oregon Slough

## Map 3: Vegetation Features

### Legend:

- forests (> 60% canopy cover)
- woodland (25-60% canopy cover)
- shrubland (shrubby veg dominated)
- herbaceous (grass/form dominated)
- wetlands
- Inventory Sites
- City Boundary



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0 0.25 0.5 Miles





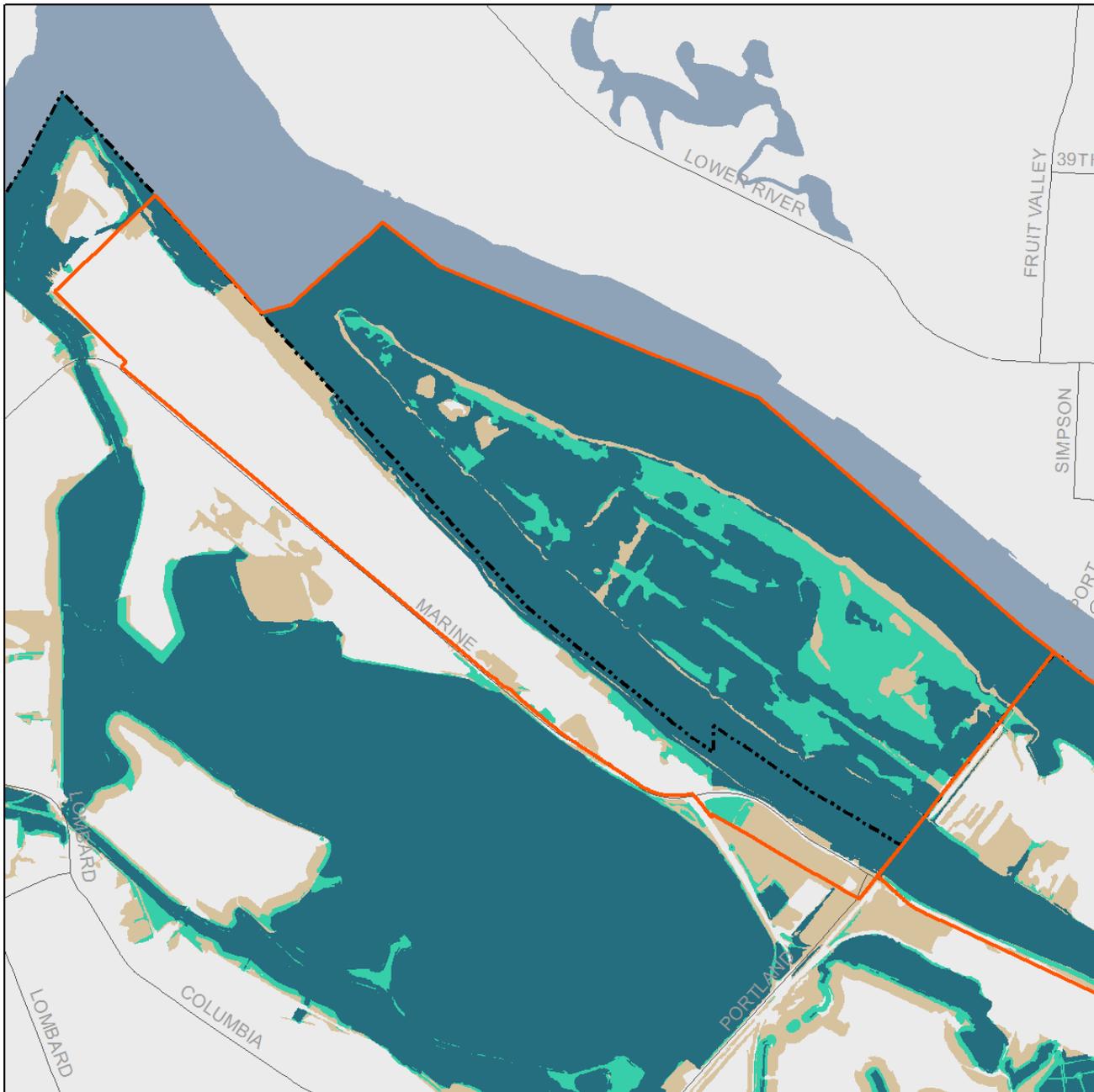
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# HI1: West Hayden Island and Oregon Slough

## Map 4: Riparian Corridor Resources

### Legend:

- high relative rank
- medium relative ranks
- low relative rank
- Inventory Sites
- City Boundary



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0 0.25 0.5 Miles





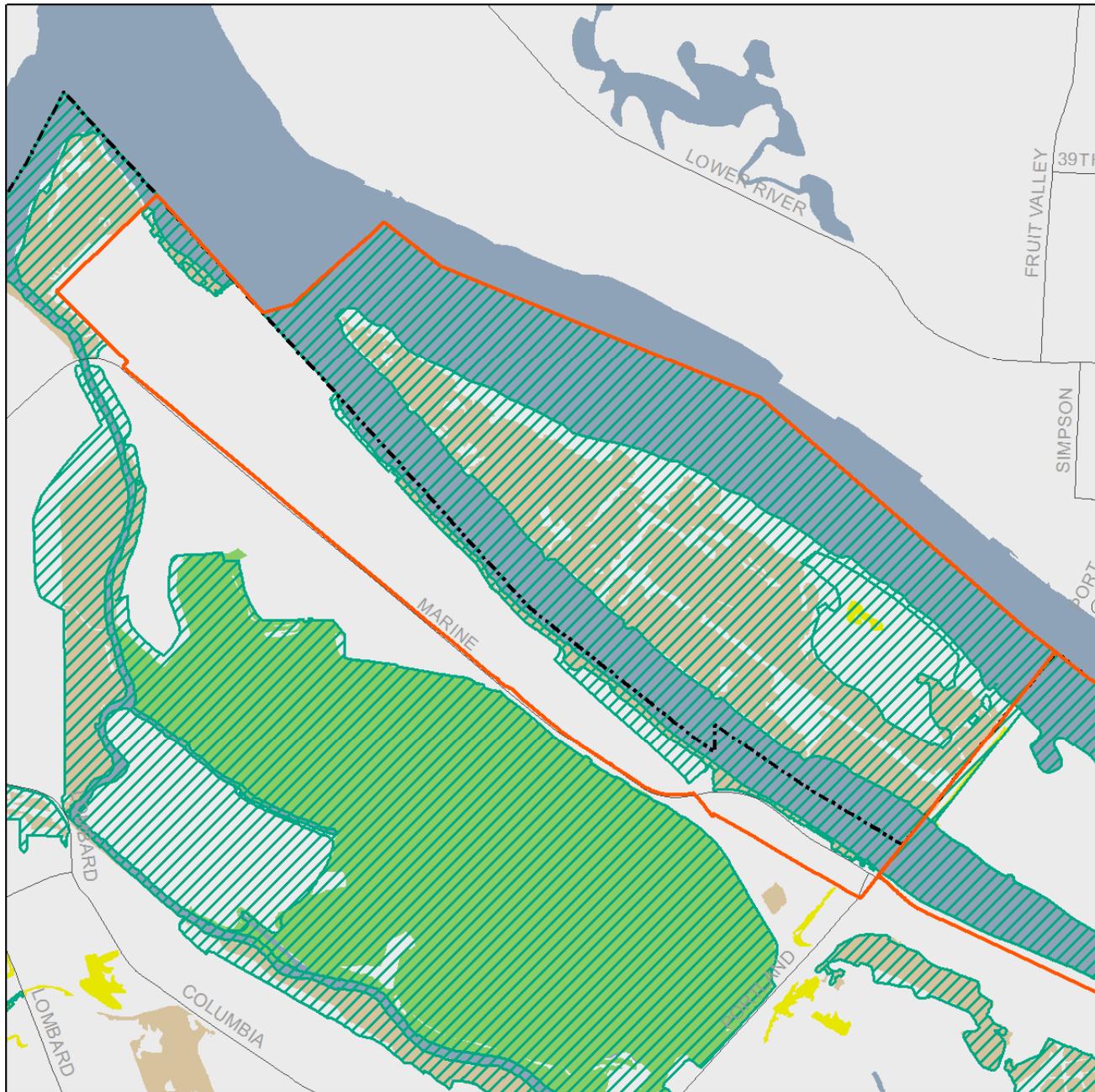
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# HI1: West Hayden Island and Oregon Slough

## Map 5: Wildlife Habitat

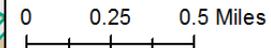
### Legend:

- high relative rank
- medium relative rank
- low relative rank
- Special Habitat Areas (high rank)
- Inventory Sites
- City Boundary



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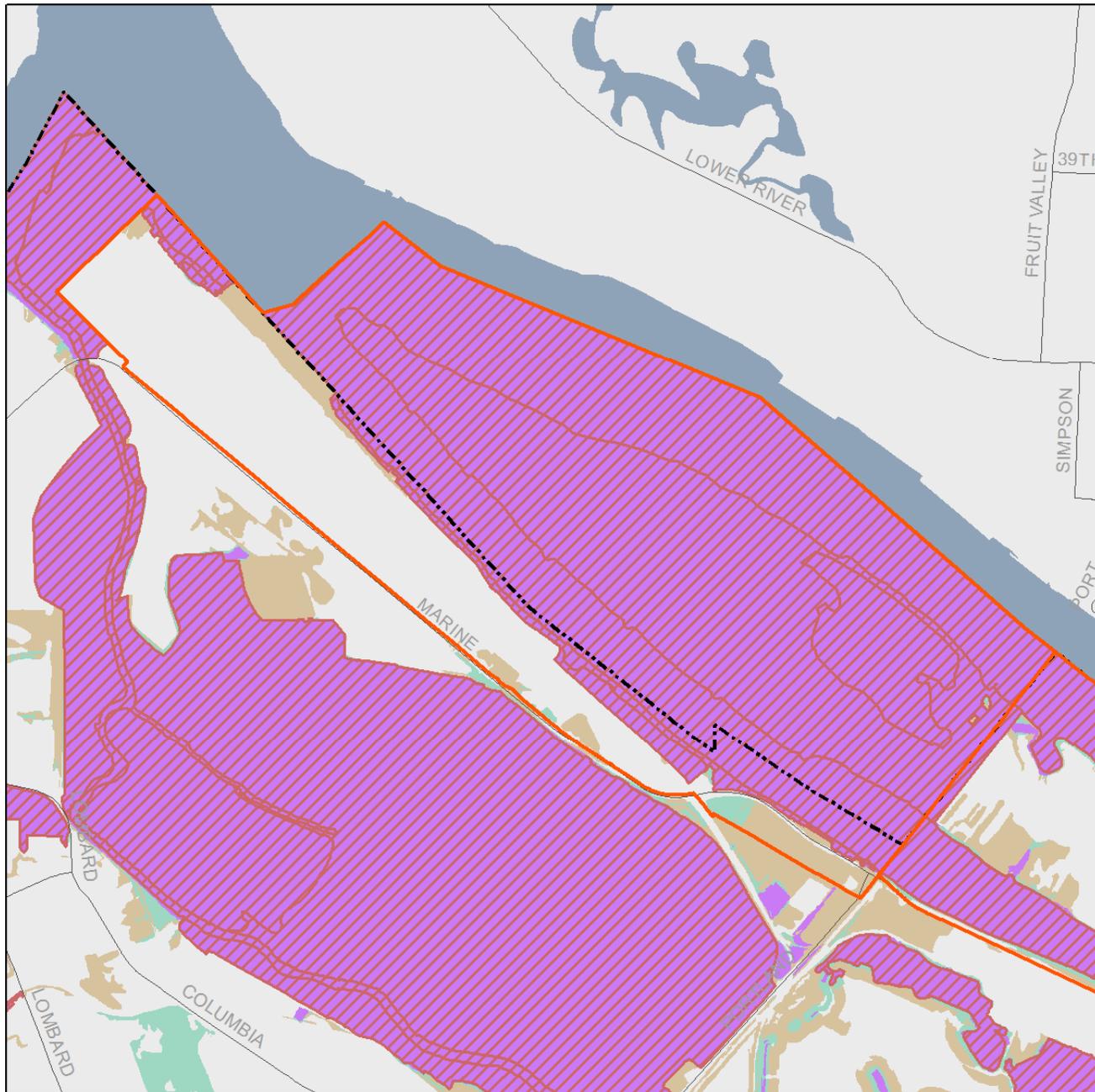
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# HI1: West Hayden Island and Oregon Slough

## Map 6: Combined Relative Ranks

### Legend:

- high relative rank
- medium relative rank
- low relative rank
- Special Habitat Areas (high rank)
- Inventory Sites
- City Boundary



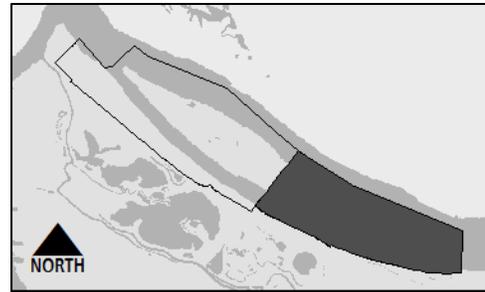
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0 0.25 0.5 Miles



# INVENTORY SITE HI2: East Hayden Island and Oregon Slough



## A. Summary Information

Watershed: Columbia River

Neighborhood: Hayden Island, Kenton, Bridgeton, East Columbia

USGS quadrangle and quarter section maps: 2N1E28, 2N1E33, 2N1E34, 2N1E35, 1N1E2, 1N1E3

River Mile: 105.6-108.2

Site Size: 1,582 acres

Previous Inventories: Inventory and Analysis of Wetlands, Water Bodies and Wildlife Habitat Areas for the Columbia Corridor: Industrial/Environmental Mapping Project (City of Portland January 1989).

Zoning: Industrial (IH, IG2)  
Commercial (CN1, CG)  
Multi Dwelling Residential (R1, R2, R3)  
Single Dwelling Residential (R7, R10, RF)  
Open Space (OS)  
Aircraft Landing height overlay (h)  
Airport Noise overlay (x)  
Design overlay (d)  
Environmental Conservation overlay (c)

Existing Land Use: Industrial; commercial; residential; moorage; open space.

General Description: This site includes the eastern half of Hayden Island and part of the Lower Columbia River and Oregon Slough.

Resource Features: open water, shallow water, vegetated and non-vegetated river bank; vegetated flood area; bottomland hardwood forest; woodland, shrubland and grass lands

Functional Values: microclimate and shade; stream flow moderation and water storage; bank function, and sediment, pollution and nutrient control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; wildlife habitat; habitat connectivity/movement corridor

### Special Habitat Area(s):

- Columbia River, Oregon Slough and Shallow Water Habitat are designated SHA because they meet the following criteria:  
(C) – Wildlife connectivity corridor  
(M) – Migratory stopover habitat  
(S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

- The eastern forested tip of East Hayden Island is designated SHA because it meets the following criteria:
  - (B) – bottomland hardwood forest
  - (I) – riverine island
  - (M) – migratory stopover habitat
- EHI shoals and mudflats are designated a SHA because they meets the following criteria:
  - (B) – bottomland hardwood forest
  - (I) – riverine island
  - (M) – migratory stopover habitat
  - (S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

Special Status Species:

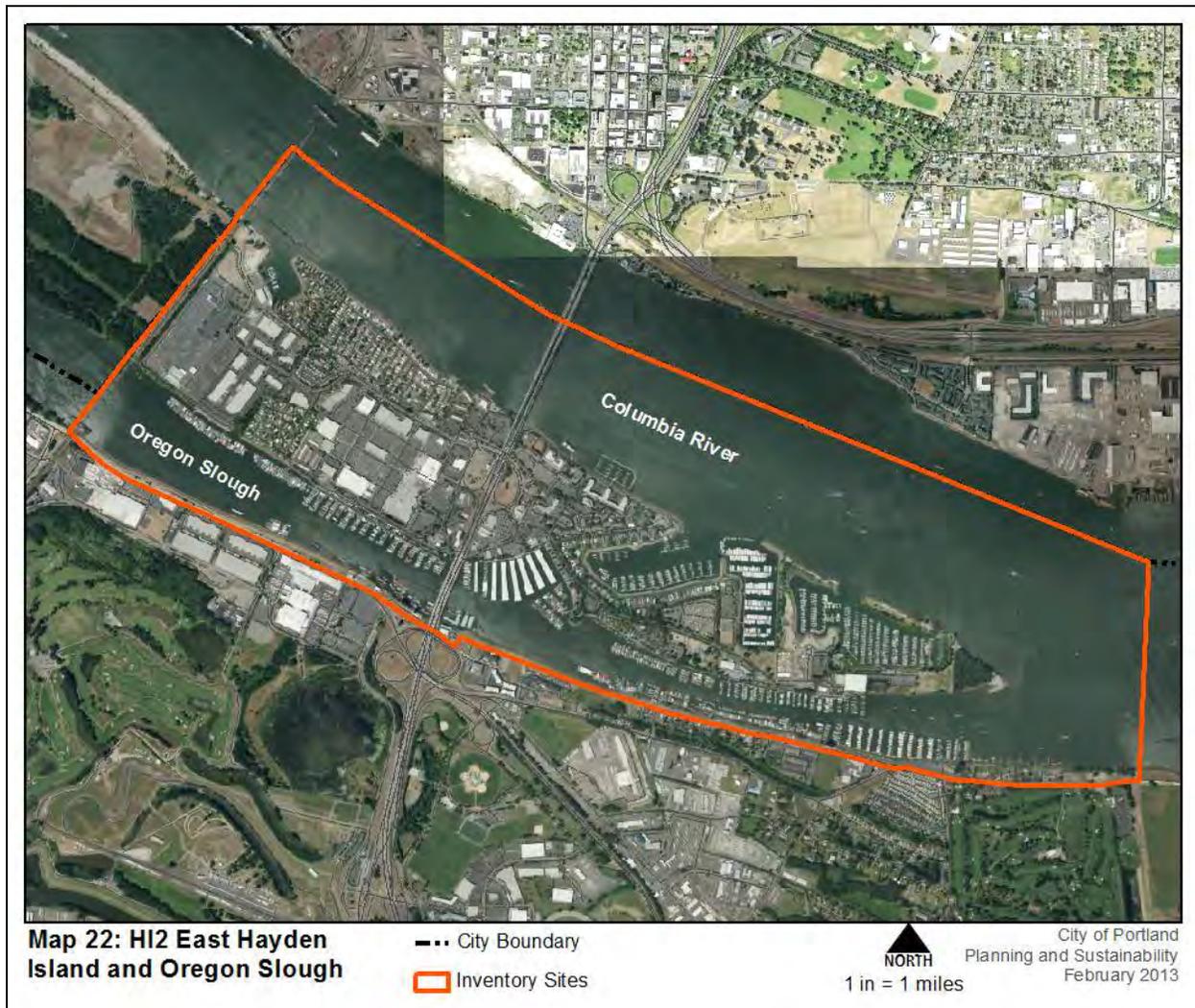
- *Fish:* Chinook salmon, chum salmon, coho salmon, sockeye salmon, steelhead trout, bull trout, eulachon, pacific lamprey, white sturgeon
- *Birds:* American kestrel, bald eagle, brown creeper, bufflehead, bushtit, downy woodpecker, great blue heron, peregrine falcon, red-necked grebe

Natural Hazards: Flood area

Contamination: Yes

## B. Site Description

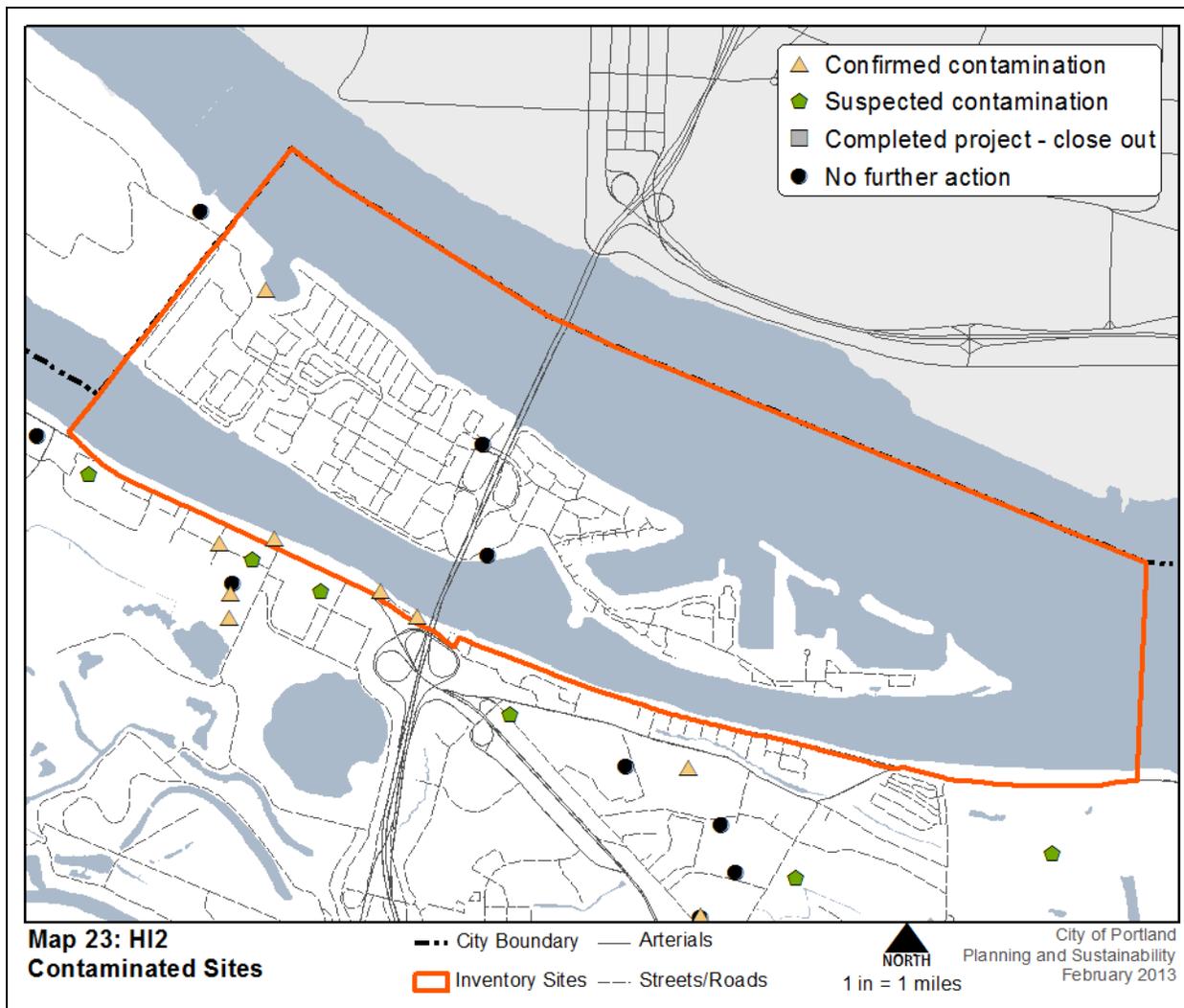
The East Hayden Island inventory site is 1,658 acres in size. The site has commercial, residential and industrial land uses including Janzen Beach Mall, auto auction mall, manufactured home community, floating home and boat moorages, condos, and one public park. The site contains approximately 1,006 acres of impervious area, including 25 miles of roads. Site HI1 Map 1 shows an aerial view of East Hayden Island inventory site.



The site contains 1,071 acres of open water, including the Columbia River and a roughly 2.5 mile long section of the Columbia River southern arm, known as the Oregon Slough. The 1,273-acre flood area includes 1,071 acres of open water, 82 acres of vegetated flood area and 120 acres of non-vegetated flood area (HI1 Map 2). Vegetated areas at least ½ acre include approximately 18 acres of forest or dense tree canopy, 27 acres of woodland, 15 acres of shrubland and 67 acres of herbaceous cover (HI1 Map 2). There is a 1.5 acre wetland located along the northern shoreline near the railroad bridge.

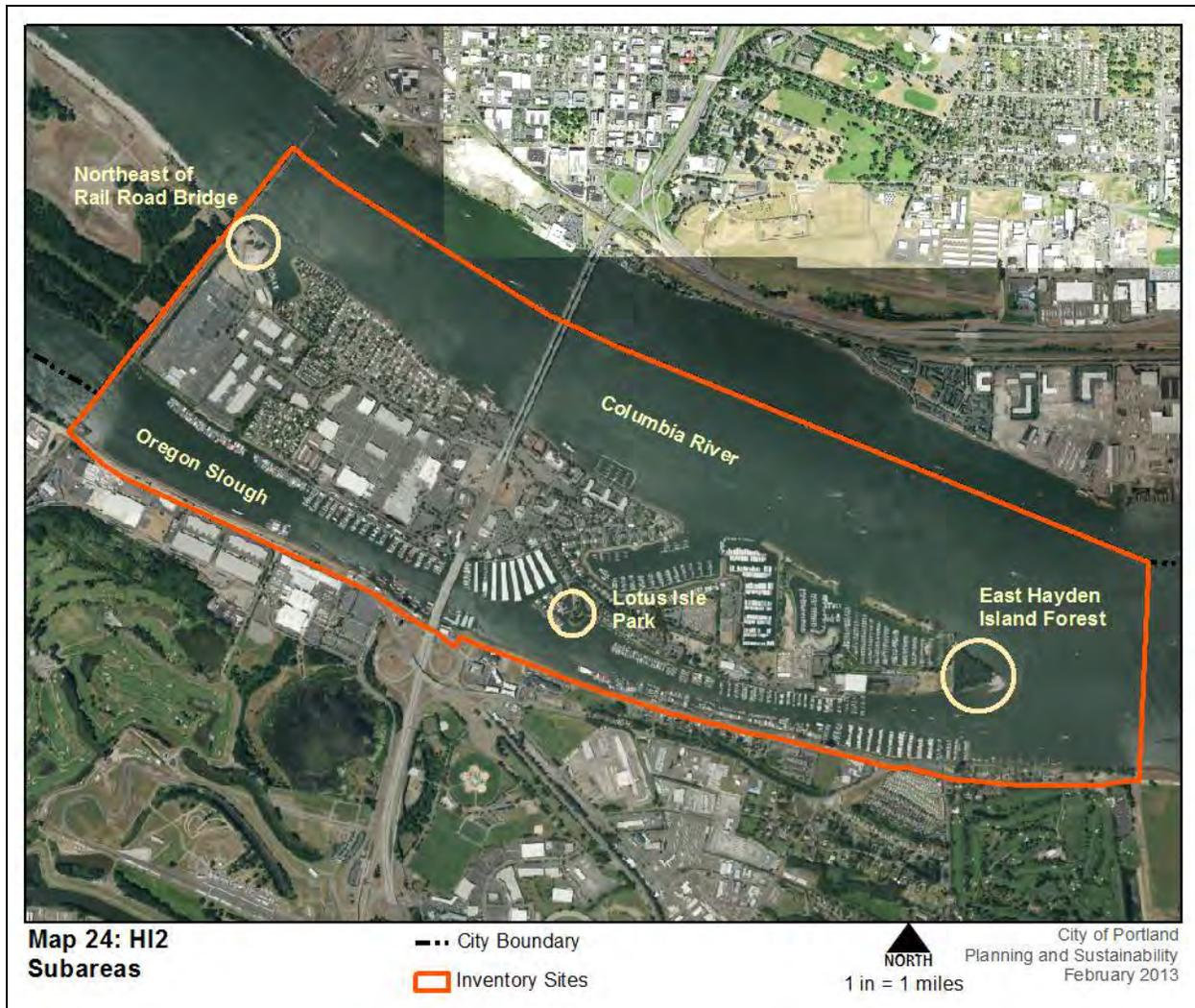
<b>Table 17: Summary of Natural Resource Features in HI2: East Hayden Island and Oregon Slough</b>	
	<b>Study Area</b> (miles / acres)
<b>River (miles/acres)</b>	2.5 / 1,071
<b>Stream/Drainageway (miles)</b>	0
<b>Wetlands (acres)</b>	1.5
<b>Flood Area (acres)*</b>	1,273
Vegetated (acres)	82
Non-vegetated (acres)	120
Open Water** (acres)	1,071
<b>Vegetated Areas &gt;= ½ acre (acres)+</b>	128
Forest (acres)	18
Woodland (acres)	27
Shrubland (acres)	15
Herbaceous (acres)	67
<b>Impervious Surfaces (acres)</b>	1,006
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the Columbia River	
+ The vegetation classifications are applied in accordance with the National Vegetation Classification System specifications developed by The Nature Conservancy. The data within the primary study area and within 300 feet of all open water bodies in Portland is draft and is currently being updated based 2011 aerial photography.	

The Oregon Department of Environmental Quality (DEQ) has identified confirmed and suspected contaminated areas within the site (Map 23). Soil, groundwater and surface water within the site contain contamination resulting from past and current activities. Historic industrial uses and agricultural runoff may have contributed over the past 50 years to contamination on the island. More recent contamination is the result of boat and barge building, repair, sandblasting, painting, machine shop, bilge removal, and boat and equipment refueling; abandoned oil drums; auto storage and dumping. Types of pollutants found in the site included PCBs, polynuclear aromatic hydrocarbons (PAHs), phthalates, PCP, phenols, DDTs, chlordane, metals (arsenic, cadmium, copper, selenium, zinc, lead, chromium, mercury), copper oxide, organotins, petroleum constituents (benzene, toluene, ethylbenzene, toluene), pentachlorophenol and chlorinated solvents. Contaminated sediments could represent a significant threat to sensitive populations of Threatened anadromous fish in the Columbia River and to food supplies for protected populations of migratory waterfowl and migratory songbirds. Depending on the full distribution of contaminants, local residents could also be exposed. Contaminants could also affect community drinking water wells. Recent stormwater management practices by the business located on Canoe Bay have reduced pollutant discharge from the site. For more information regarding contamination, visit the DEQ website at <http://www.deq.state.or.us/lq/ecsi/ecsi.htm>.



## C. Natural Resource Description

The natural resources are described for sub areas of the inventory site (Map 24).



In the presence of the heavy development that defines the eastern half of Hayden Island, there are few natural resources remaining. There are roughly 8 miles of shoreline around the East Hayden Island (EHI), of which approximately 1 mile is unmodified sand beach or vegetated backwater shoreline. The majority of shoreline around EHI is developed with houseboats (including docks, planks, and utilities), harbor facilities for resident and transient moorage slips, and rip rap to prevent erosion and protect developed infrastructure that includes residential houses, condominiums, and commercial area. A significant portion of this development includes the 250-acre shopping complex known as Jantzen Beach, which includes a large shopping mall and a dozen big-box stores.

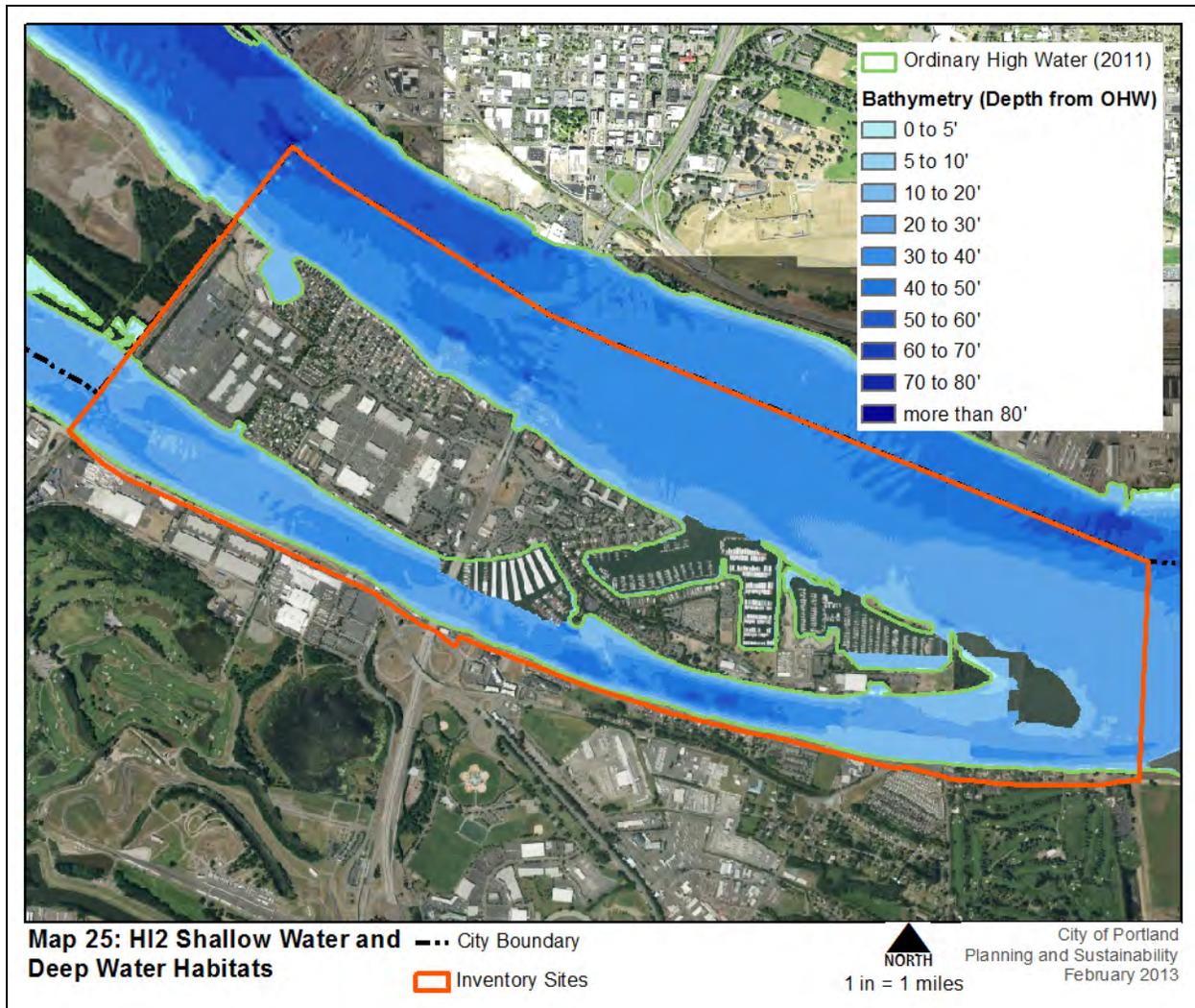
The remaining natural resources include: open water, shallow water habitat, flood areas, river bank, and two forested/woodland riparian areas. Wildlife species that have been observed using these habitats include:

American coot	Double-crested	Parasitic jaeger
American crow	Cormorant	Peregrine falcon
American goldfinch	Downy woodpecker	Pied-billed grebe
American kestrel	Eastern gray squirrel	Red-breasted Merganser
American robin	European starling	Raccoon
Anna's hummingbird	Glaucous-winged gull	Red-necked grebe
bald eagle	Golden-crowned Kinglet	Red-tailed hawk
barn swallow	Golden-crowned Sparrow	Red-winged blackbird
bewick's wren	Great blue heron	Ring-billed gull
back-capped chickadee	Great horned owl	Rock dove
Black-tailed deer	Greater scaup	Ruby-crowned kinglet
Brewer's blackbird	Green-winged teal	Song sparrow
Brown creeper	Horned grebe	Spotted towhee
Bufflehead	House finch	Surf scoter
Bushtit	House sparrow	Tree swallow
California gull	Killdeer	Tufted duck
Canada goose	Lesser scaup	Turkey vulture
Canvasback	Long-tailed duck	Violet-green swallow
Cedar waxwing	Mallard	Western grebe
Common goldeneye	Mew gull	Western scrub jay
Common loon	Mourning dove	White-crowned Sparrow
Common merganser	Northern flicker	White-winged scoter
Coyote	Oregon junco	Yellow-rumped warbler
	Osprey	

### Columbia River Open Water and Shallow Water

The Columbia River flows through the study area. The Columbia River hydrology, water quality and fish and wildlife habitat is addressed in detail in Chapter 4.A and is summarized here. Please refer to Chapter 4.A for additional information.

Shallow water habitat in the Lower Columbia River is characterized by shallow grade, sand and mudflat beaches that unite with undercut banks and vegetated riparian areas. This shallow water area provides important habitat functions such as velocity moderation and food production that support aquatic organisms. The shallow water habitat of the Lower Columbia River has been designated as *critical habitat* for federally-listed ESA species. Critical habitat is defined as the area between ordinary high water (OHW) to 34 feet below ordinary high water (NAVD88 vertical datum), and includes river banks, side channels, sloughs, wetlands and floodplains that maintain depths from 0.3 to 6.6 feet during lower river's the tidal cycle. The elevation of ordinary high water around Hayden Island is approximately 20-feet in NAVD88.



For salmonid juveniles migrating out of the Columbia River system, shallow water habitat is where they begin experiencing a lower energy and wider channel shaped by tidal action as they transition into the marine environment. These fish can have extended rearing and outmigration periods in the lower river prior to transitioning into their marine life history phase, both of which are advantageous to marine survival and life history diversity (Myers et.al. 1998). The longer these fish reside in and feed on the estuary’s diverse food web, the larger and more robust they become, increasing their ability to escape predators and fend off parasites and bacteria that commonly impact their health in the ocean environment. For the eulachon, shallow water habitat is where spawning, incubation and rearing life stages are completed before these fish pass onto their ocean life phase.

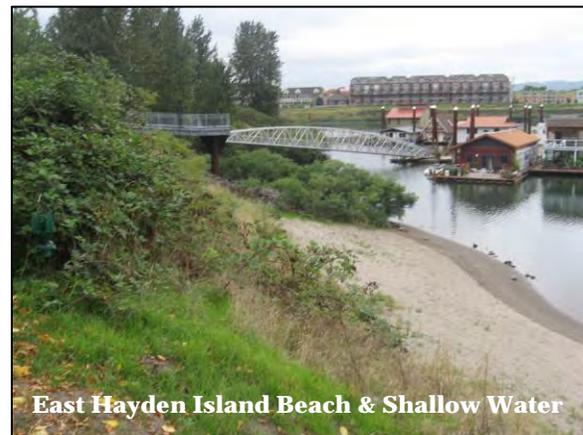
Columbia River fish are known to use shallow water habitat for several survival strategies during their juvenile life stages. For instance, juvenile salmon and trout forage for prey in sand, gravel, woody debris, and submerged vegetation, as well as on the river’s surface and in its water column for floating or swimming prey. Juveniles also seek refuge from high flow events and predators by hiding in woody debris, undercut banks, and both overhanging and submerged vegetation, all vital requirements of functioning shallow water habitat. Shallow water habitat also plays an integral role in building and maintaining the aquatic food web by providing substrate on which detritus develops. The detritus supports invertebrates that hatch year-round and feed fish, amphibians, birds, and mammals.

Adult fish use shallow water habitats for several survival strategies as well. Although most anadromous species are not actively foraging during this life stage (salmon and eulachon in particular), they utilize shallow water habitat features such as woody debris, undercut banks, overhanging vegetation, and submerged vegetation to rest and recharge energy needed for long upstream migrations, and to avoid predators such as raptors, pinnipeds, and humans. The shallow water areas around Hayden Island that serve these survival strategies are referred to as *refugia*.

The distance between shallow water refugia is important to the health and survival of salmonids. Long periods of sustained swimming between refugia habitats deplete energy reserves. Fish with low energy resources caught migrating between refugia areas are more vulnerable to predation, as their flight response diminishes with a reduction in stamina. The more “pit stops” fish can make along their way up and downstream, the more likely they will complete migrations in good health. Therefore, salmonid productivity and survival is expected to be greater in locations with the shortest distance between refugia where the fish can rest, feed, and rebuild their energy supplies (C.L. Groot, 1995; M.B. Foreman, 1990; R.C. Eaton, 1991; Sauter, 2001; Sedell, 1990).

Fish abundance in rivers is correlated with the abundance and quality of riparian cover (Bjornn and Reiser 1991). While cover is an important aspect of salmonid habitat it is hard to define. Cover is vegetation and woody debris that is periodically inundated with water. The reduced abundance of high quality cover in the lower river, adequately spaced to facilitate predator avoidance and resting regimes, limits salmon and trout production.

The nearshore, shallow-water areas with sandy substrate in the Lower Columbia River are also important for Pacific lamprey. Adult lamprey spend up to one year in the Columbia River after returning from the ocean to overwinter. Adults use the channel margin and pool habitats to utilize cover from predators. Spawning takes place in low gradient river habitats with gravel and sand-dominant substrate. After broadcast dispersion, eggs incubate for two to three weeks on the substrate they attach to; thereafter, the young swim into low velocity habitats and burrow in muddy substrate for the next four to six years. Shallow water habitat in the Columbia River is characterized by low gradient, low velocity conditions and is likely used by Pacific lamprey in all life stages (PSMRC, 1997).



Harbor seals, as well as the endangered Stellar and California sea lions are regular salmon and sturgeon predators in the Columbia River. These aquatic mammals pool at the base of Bonneville Dam largely because the dam hinders upstream passage of adult salmon and trout, effectively trapping the prey at the bottleneck.

The beaches, shoals, mudflats, and shallow and open water of the Columbia river adjacent to EHI supports a wide variety of aquatic bird species. A large, and highly diverse flock of foraging species was observed throughout the 2010/2011 winter season, see list below:

Bald eagle  
Bufflehead  
California gull  
Canada goose  
Canvasback  
Common goldeneye  
Common loon  
Common merganser  
Double-crested cormorant  
Glaucous-winged gull  
Greater scaup  
Green-winged teal  
Horned grebe

Lesser scaup  
Long-tailed duck  
Mallard  
Mew gull  
Parasitic jaeger  
Pied-billed grebe  
Red-breasted merganser  
Red-necked grebe  
Ring-billed gull  
Surf scoter  
Tufted duck  
Western grebe  
White-winged scoter

The beaches, shoals, mudflats, shallow water habitat and open water within the inventory site are designated a Special Habitat Area because they meet the following criteria:

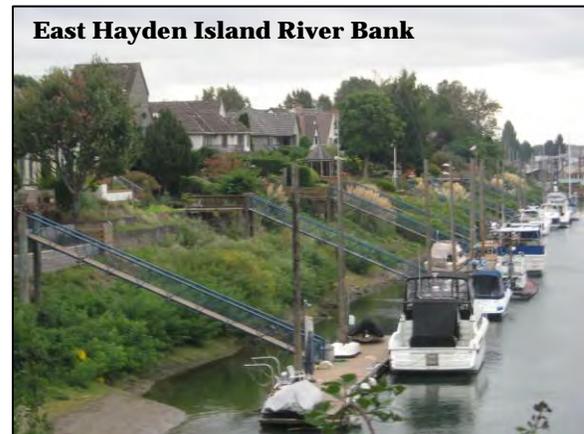
(C) – Wildlife connectivity corridor

(M) – Migratory stopover habitat

(S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

#### Flood Area and River Bank

Over the last century, EHI has been developed for multiple land uses. Land was filled in areas and the river banks were hardened to reduce flooding and erosion. The results are steep river banks with a range of vegetation from none to Himalayan blackberries to native shrubs and trees. While nearly all of the river banks within the inventory site impaired to some extent, areas with vegetation continue to provide natural resource functions including capturing water, filtering overland flow and stabilizing banks. Trees and overhanging shrubs along the river bank provide leaf litter, insects and potentially structure to shallow water areas. These riparian corridor functions are provided by both native and non-native vegetation. Both native and non-native vegetation also provide food and cover for wildlife; however, native vegetation provides more varied food sources and structural diversity, which supports a broader diversity of native wildlife species.



Portions of East Hayden Island are still within the flood area and during the 1996 flood, portions of EHI were submerged. Impacts from the flood event were intensified by extensive disconnection of river channels from their floodplains all up and down the river. Without overflow routes to dampen water surface elevations, floodwaters were largely confined to the Lower Columbia River channel. This reduced flow conveyance capacity in the Columbia River created flood-magnitude surface waters which, when combined with the tidal influences, backed water upstream. Because of Hayden Island's proximity to the Willamette River confluence, the island is subject to extensive flooding when the Willamette River experiences high flood levels as well. This hydraulic effect, along with other regional storm activity, was a contributor to the Willamette River flood event of 1996.

#### East Hayden Island Forest

The furthest eastern tip of Hayden Island supports a 6-acre mature cottonwood forest that includes pockets of mature willow. Adjacent to the forest is a shoal with mudflats and sandy, shallow water habitat. The land is managed under multiple private ownerships; therefore, getting access to document

vegetation composition and wildlife use was not possible for this assessment. However, aerial photography and sightlining from watercraft allowed for visual estimation of habitat types from afar. The shallow water beach is gently sloped and sand dominant. Its riparian forest is largely intact, and we do know that great horned owls (recently) have used this forest for nesting and a great heron rookery has also been active in past years. A bald eagle nest is also located in the cottonwood stand. A summary of Port of Portland data describes bald eagle nesting activity in 2006, no activity in 2007, and activity in 2008 including nest construction into April. No activity was observed at the eagle nest by the Port in 2009, 2010 or 2011. Extrapolating data from nearby Hayden Island bottomland hardwood forests, the following bird species are expected to use the forest: Anna's and rufous hummingbirds, black-headed grosbeak, Bullock's oriole, cedar waxwing, downy woodpecker, hermit thrush, house wren, merlin, orange-crowned warbler, pacific-slope flycatcher, peregrine falcon, red-breasted sapsucker, Swainson's thrush, Townsend's warbler, varied thrush, warbling vireo, white-breasted nuthatch, willow flycatcher, yellow warbler, and yellow rumped warbler plus more common species. The sandbar at the eastern tip of EHI provides a roosting site for migratory flocks of gulls (and other species) of over 500 individuals.



**East Hayden Island Riparian Forest**

The shoreline of the eastern tip of Hayden Island was sampled during the NWFSC's most recent fish study (Sol, S., et.al., 2009a; Sol, S., et.al., 2009b). See Maps 6 and 7 and Tables 6 and 7 for sites and results of the fish sampling. This site consistently produced juvenile salmon; one haulback in March 2009 yielded 480 individual Chinook and five chum salmon. Coho salmon were also captured at this site at various times over the two sampling trials.

The eastern forested tip of EHI is designated SHA because it meets the following criteria:

- (B) – bottomland hardwood forest
- (I) – riverine island
- (M) – migratory stopover habitat

The shoals and mudflats of WHI are designated a SHA because they meet the following criteria:

- (I) – riverine island
- (M) – migratory stopover habitat
- (S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

### Lotus Isle Park

Lotus Isle Park is primarily an active park dominated by turf grass. There are trees present including cottonwood, willow, eastern ash and red maple. Understory vegetation includes arctic willow, indigo bush, red osier dogwood, Pacific ninebark and Oregon grape. Pacific ninebark provides a mid-to-late season food source for migratory birds, as do the dogwood and Oregon grape. During a fall 2010 site visit one snag was documented. There is some Himalayan blackberry present, particularly on the eastern bank, which also provides food and cover for native birds. The eastern side of the park extends down to the river, where there is shallow water habitat, shoals and mudflats. Birds observed using the park include: bewicks wren, cedar waxwing (flock), gold crown



**Lotus Isle Park**

sparrows, mew gull, black-capped chickadee, yellow-rumped warbler, northern flicker, spotted towhee, Anna's hummingbird and western scrub jay. Birds observed using the open water, shoals and mudflats around the park include: American coot, mallards, great blue heron, cormorant, pied-billed grebe (fishing), and gulls.

#### Northeast of Rail Road Bridge

Located on the north side of EHI, just east of the rail road bridge, is an undeveloped area at the end of Hayden Island Drive. Most of the area is vegetated with low structure vegetation including weeds and turf grasses; however, there is a stand of cottonwood trees with an understory of invasive blackberries and Scotch broom. Some pacific willow, snowberry, Pursh's lotus and goldenrod are present; also non-native oaks. The vegetation has minimal structure and food variability, however it provides wildlife access to the river. The cottonwood stand provides good migratory stopover habitat and nesting opportunities for birds. Birds observed: yellow-rumped warbler, rufous-sided towhee, golden-crowned sparrow, Cooper's hawk. During a fall 2010 site visit there were deer tracks and evidence of browsing.

The river bank is receding, which provides sandy substrate to the beach. To the west there is more beach and to the east it is more cobble substrate transitioning to artificial riprap. The adjacent shallow water is gradually sloping with little cover or large wood, although there is recruitment potential for large wood to catch on this beach. There is one large piece of wood embedded into the beach that provides cover when engaged during higher flows. The beach's shallow water areas are likely used by juvenile salmonids and other small fishes.

The grassy area is used as a vehicle turnaround and parking. During site visits, vehicles were frequently seen here and people were using the beach.

#### Street and Landscape Trees

There are also street trees and trees in landscaped areas that provide migratory stopover habitat. These trees include maples, non-native oaks and pine. Generally there are no understory shrubs and the herbaceous layer, where present, is turf grass. The trees on East Hayden Island are in close proximity to water and serve as migratory stopover habitat. Birds observed using street and landscape trees include evening grosbeak, northern flicker, yellow-rumped warbler, red-winged blackbird, mourning dove, Oregon junco, American goldfinch, western scrub-jay, American kestrel and American crows.

## Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 18). The relative ranks are produced using GIS models and information on Special Habitat Areas. The model criteria are not sensitive to the species of vegetation present or whether vegetation is native or non-native. However, the model criteria do assign different riparian functional values to cultivated, heavily manicured and managed landscapes and semi-natural and natural vegetation. The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter 3: Methodology Overview of this report and Appendix K: *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning programs, design of development or redevelopment projects, mitigation and restoration activities.

### Riparian Areas

The site contains East Hayden Island, portions of the Columbia River, Oregon Slough and river bank, vegetated and non-vegetated flood area, riparian forests and woodlands, as well as other types of vegetation, that contribute to the riparian functions as detailed in the natural resource description. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank stability, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are generally assigned to the Columbia River, Oregon Slough, vegetated river banks and forest and woodland vegetation. Medium relative functional ranks are generally assigned to flood area vegetated with shrubs or grasses. Low relative ranks are generally assigned to non-vegetated flood area and hardened, non-vegetated river banks (HI2 Map 4).

### Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as forest and/or wetland areas two acres in size or greater, and including adjacent woodland vegetation (note Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features).

The site contains vegetated forested patches, wetlands and corridors that provide wildlife habitat and connectivity between habitat patches. Forested areas and wetlands provide nesting, breeding and foraging habitats for a diverse range of bird and mammal species, as well as amphibians, reptiles, and invertebrate species

Special Habitat Areas contain unique features and provide critical wildlife habitat as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model. Therefore, all SHAs within the site rank high for wildlife habitat (HI2 Map 5).

- Columbia River, Oregon Slough and Shallow Water Habitat are designated SHA because they meet the following criteria:
  - (C) – Wildlife connectivity corridor
  - (M) – Migratory stopover habitat

(S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

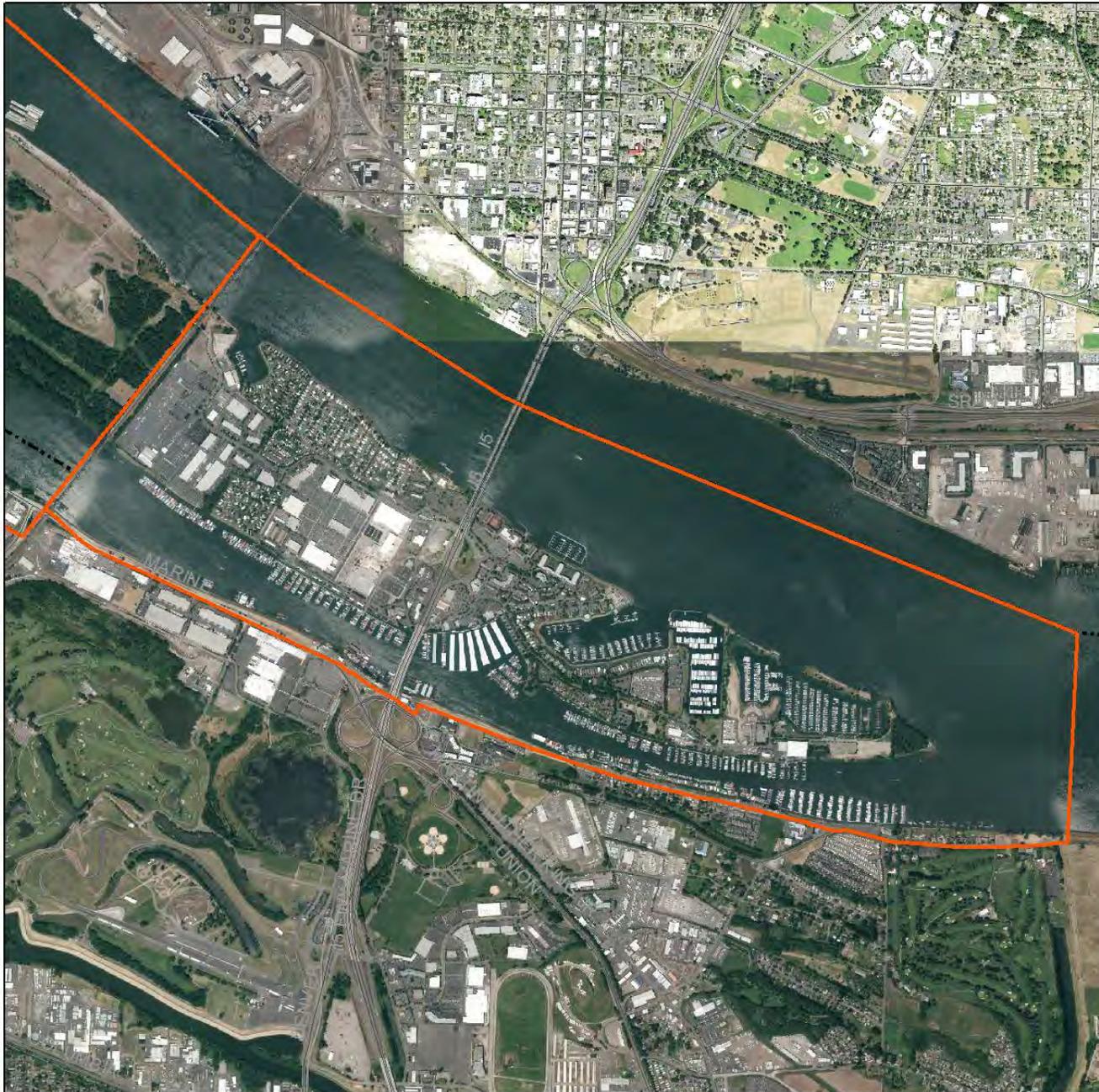
- East Hayden Island (EHI) forest and woodland vegetation is designated SHA because it meets the following criteria:
  - (B) – bottomland hardwood forest
  - (I) – riverine island
  - (M) – migratory stopover habitat
- EHI shoals and mudflats are designated a SHA because they meets the following criteria:
  - (B) – bottomland hardwood forest
  - (I) – riverine island
  - (M) – migratory stopover habitat
  - (S) – an *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

### Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank (HI2 Map 6).

**Table 18: Summary of Ranked Resources in HI2: East Hayden Island and Oregon Slough**

<b>Total Inventory Site = 1,658</b>				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>				
acres	1,106	52	125	1,283
percent total inventory site area	66	3	8	77
<b>159W5.9 Wildlife Habitat</b>				
<b>Wildlife Habitat*</b>				
acres	0	12	4	16
percent total inventory site area	0	1	<1	1
<b>Special Habitat Areas**</b>				
acres	1,097			
percent total inventory site area	66			
<b>Wildlife Habitat - adjusted by Special Habitat Areas ***</b>				
acres	1,097	3	1	1,025
percent total inventory site area	66	<1	<1	66
<b>Combined Total***</b>				
acres	1,119	49	119	1,287
percent total inventory site area	68	3	7	78
*High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Columbia River				
** Special Habitat Areas rank high for wildlife habitat				
***Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				



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## HI2: East Hayden Island and Oregon Slough

Map 1: 2011 Aerial Photography

### Legend:

- Inventory Sites
- City Boundary

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## HI2: East Hayden Island and Oregon Slough

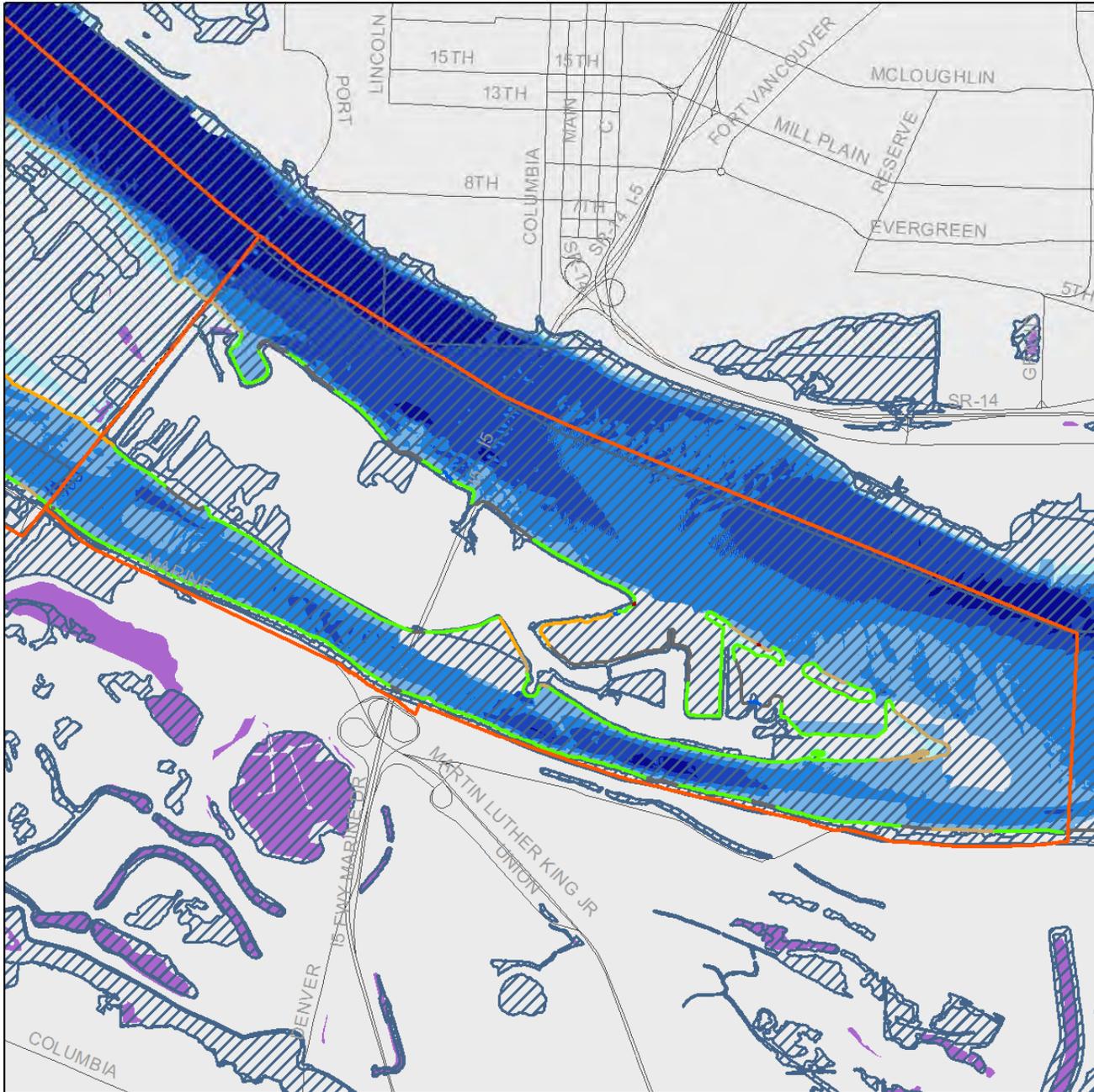
### Map 2: Water Features

#### Legend:

- wetlands
  - 100-year floodplain
  - River Bathymetry (2011 update)  
depth from ordinary high water
  - 0 - 10 ft
  - 10 - 23 ft
  - 23 - 36 ft
  - 36 - 48 ft
  - 48 - 113 ft
  - River Bank Treatments
  - Beach
  - Bio-Engineered
  - Vegetated Rip Rap
  - Rock Outcrop
  - Non-Vegetated Rip Rap
  - Seawall
  - Pilings
  - Unclassified Fill
- Updated April 2013

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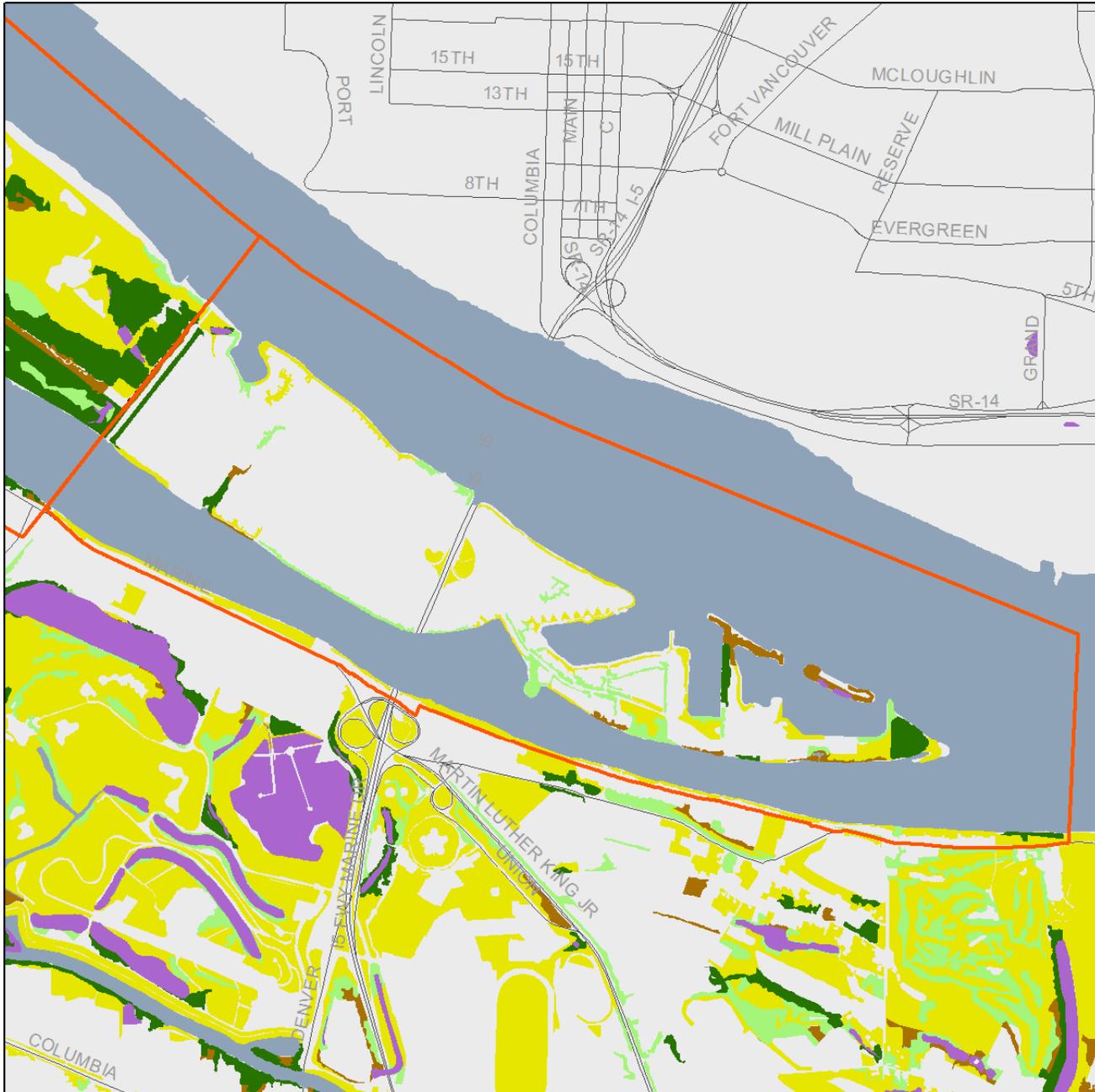
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## HI2: East Hayden Island and Oregon Slough

### Map 3: Vegetation Features

#### Legend:

-  forests (> 60% canopy cover)
-  woodland (25-60% canopy cover)
-  shrubland (shrubby veg dominated)
-  herbaceous (grass/foram dominated)
-  wetlands
-  Inventory Sites
-  City Boundary



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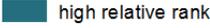
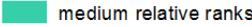
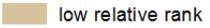
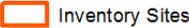
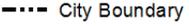


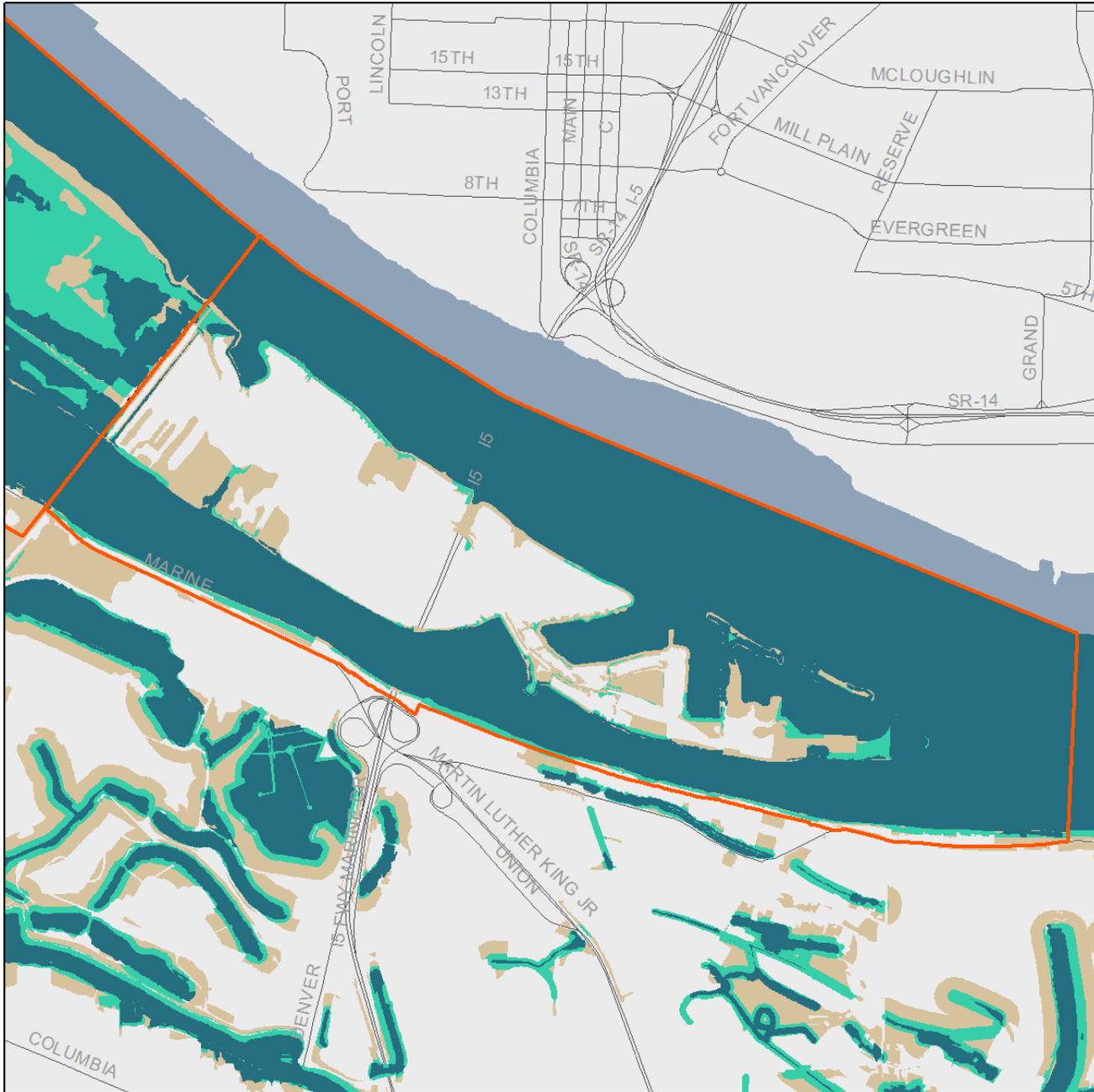
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## HI2: East Hayden Island and Oregon Slough

### Map 4: Riparian Corridor Resources

#### Legend:

-  high relative rank
-  medium relative ranks
-  low relative rank
-  Inventory Sites
-  City Boundary



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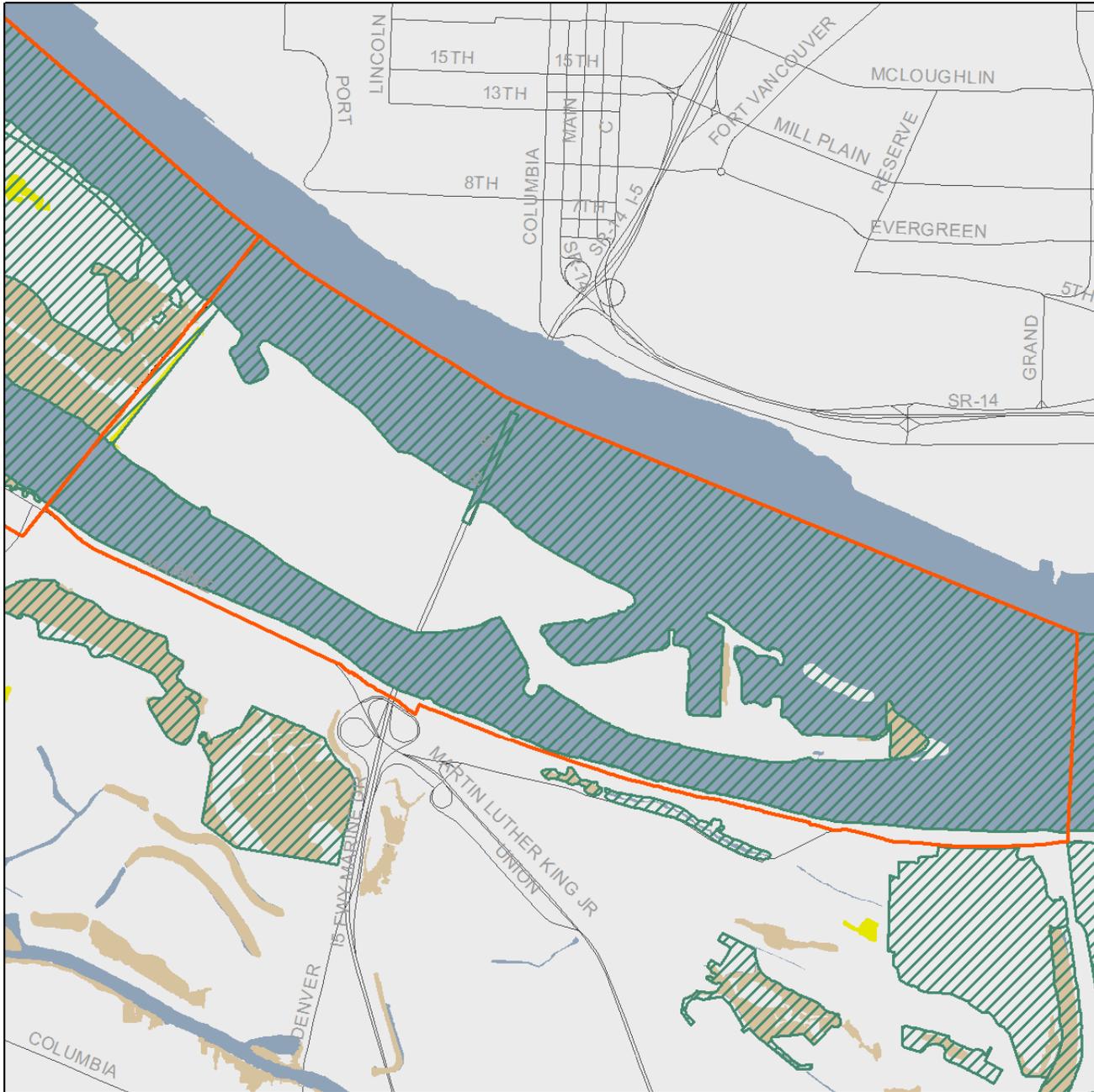
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## HI2: East Hayden Island and Oregon Slough

### Map 5: Wildlife Habitat

#### Legend:

- high relative rank
- medium relative rank
- low relative rank
- Special Habitat Areas (high rank)
- Inventory Sites
- City Boundary



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## HI2: East Hayden Island and Oregon Slough

Map 6: Combined Relative Ranks

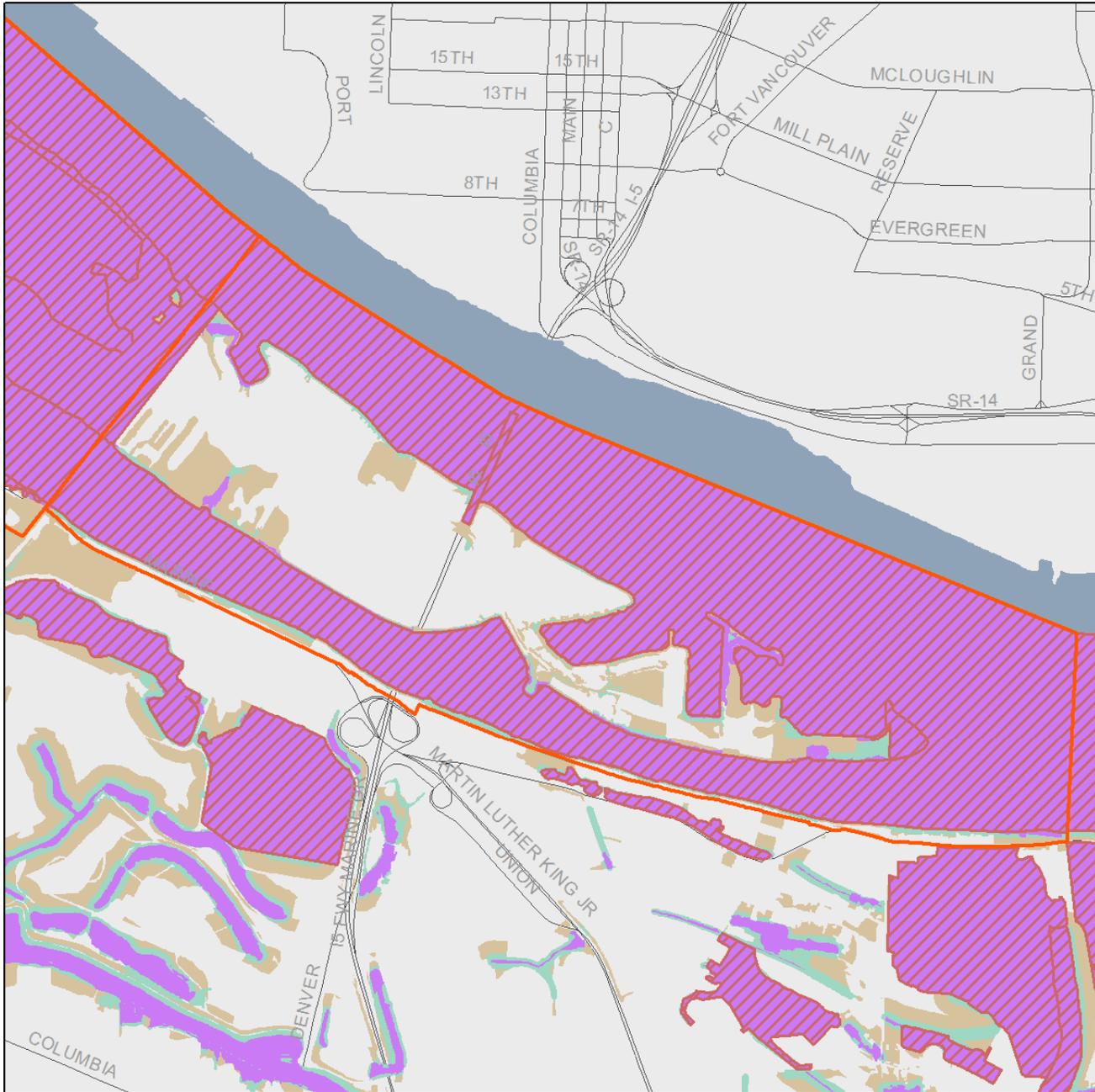
**Legend:**

- high relative rank
- medium relative rank
- low relative rank
- Special Habitat Areas (high rank)
- Inventory Sites
- City Boundary

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