

# Acknowledgments

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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 the current relative condition of riparian corridors and wildlife habitat located in the Middle Columbia Slough watershed, including areas within and surrounding the Portland International Airport (here after referred to as the airport), and the portion of the Columbia River adjacent to the airport.

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 the Middle Columbia Slough watershed and the airport. The following is a brief summary of the material contained in each chapter of this document:

**Chapter 2: Relationship to Federal, State and Regional Regulations** - This chapter describes the regulatory context for the inventory.

**Chapter 3: Project Approach and Methodology Overview** - This chapter provides an overview of the citywide inventory project approach and the methodology used to evaluate riparian corridor functions and wildlife habitat attributes. Following the citywide information, there is a section describing additional work done specifically for the Middle Columbia Corridor/Airport Natural Resources Inventory.

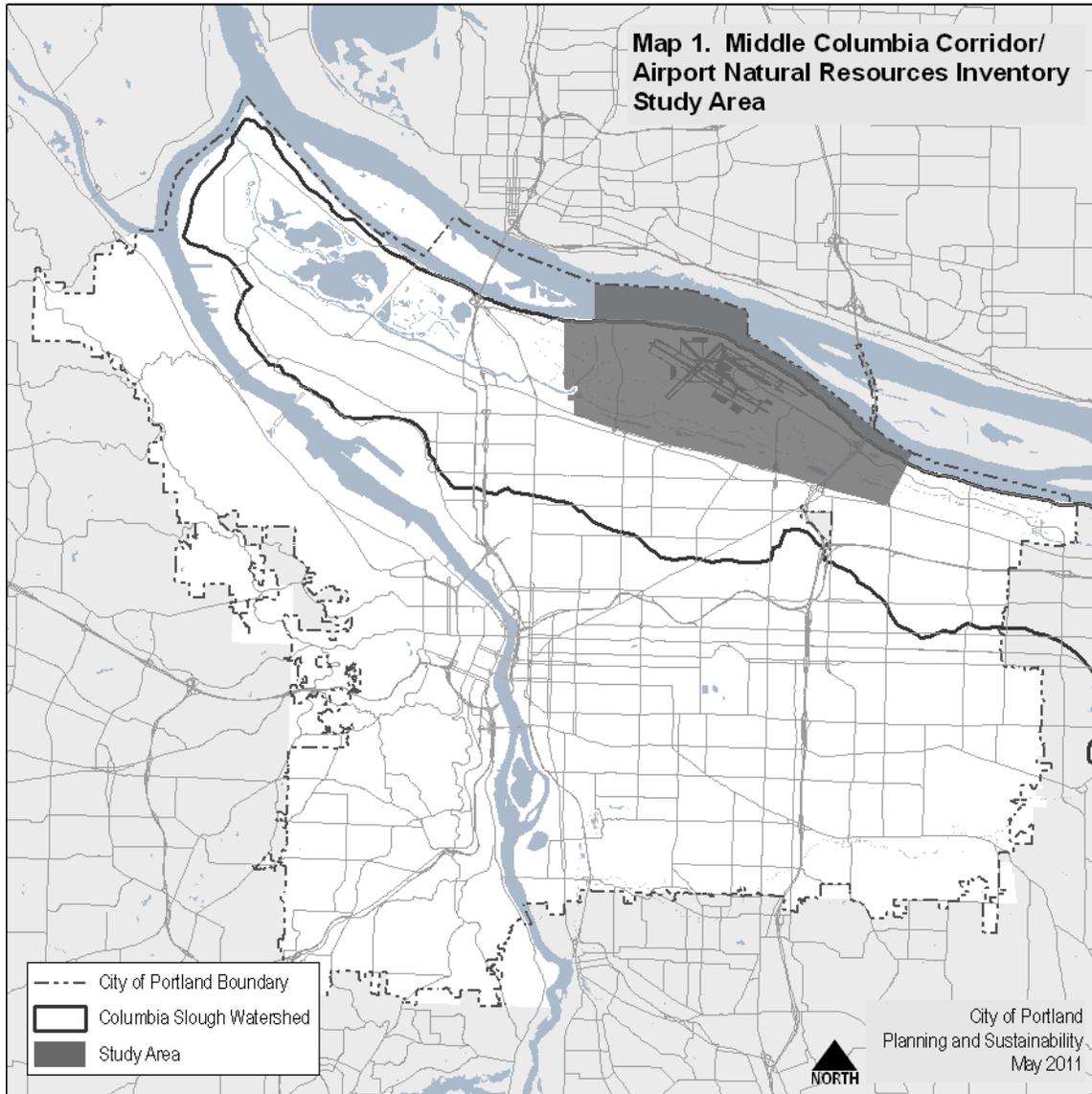
**Chapter 4: The Middle Columbia Corridor/Airport Natural Resources Inventory** - This chapter begins with a general overview of the Columbia River basin. Following the overview, a summary of Columbia Slough watershed characteristics in Portland are presented; the summary includes general land uses, transportation, and commerce as well as existing natural resources. More specific information is provided for the resources within Middle Columbia Slough watershed, including the area surrounding the Portland International Airport. Finally, the study area is split into inventory sites. For each inventory site a natural resources description is presented. Descriptions include the presence, type and extent of existing waterways, flood areas, wetlands, vegetation, and fish and wildlife habitats and species. Information about disturbances, such as flood control and invasive species, is also discussed. An evaluation of current riparian corridor functions and wildlife habitat is presented for each inventory site, followed by a series of maps: aerial photographs, water-related features, vegetation features, riparian corridor relative ranks, wildlife habitat relative ranks and combine riparian/wildlife habitat relative ranks.

The inventory is intended to inform and support a broad array of City and community activities relating within the Middle Columbia Slough watershed, including the Portland International Airport. 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, managing for aviation wildlife hazards and meeting regional, state, and federal regulatory requirements.

Over the long term, this inventory can help the City achieve its River Renaissance Vision for a clean and healthy Willamette River, and meet its watershed health goals. The inventory will inform the development of regulatory and non-regulatory tools through the City's Airport Land Use Plan. The City also intends to submit this inventory to Metro as part of the City's compliance with the Title 13 Nature in Neighborhoods Program.

## Study Area

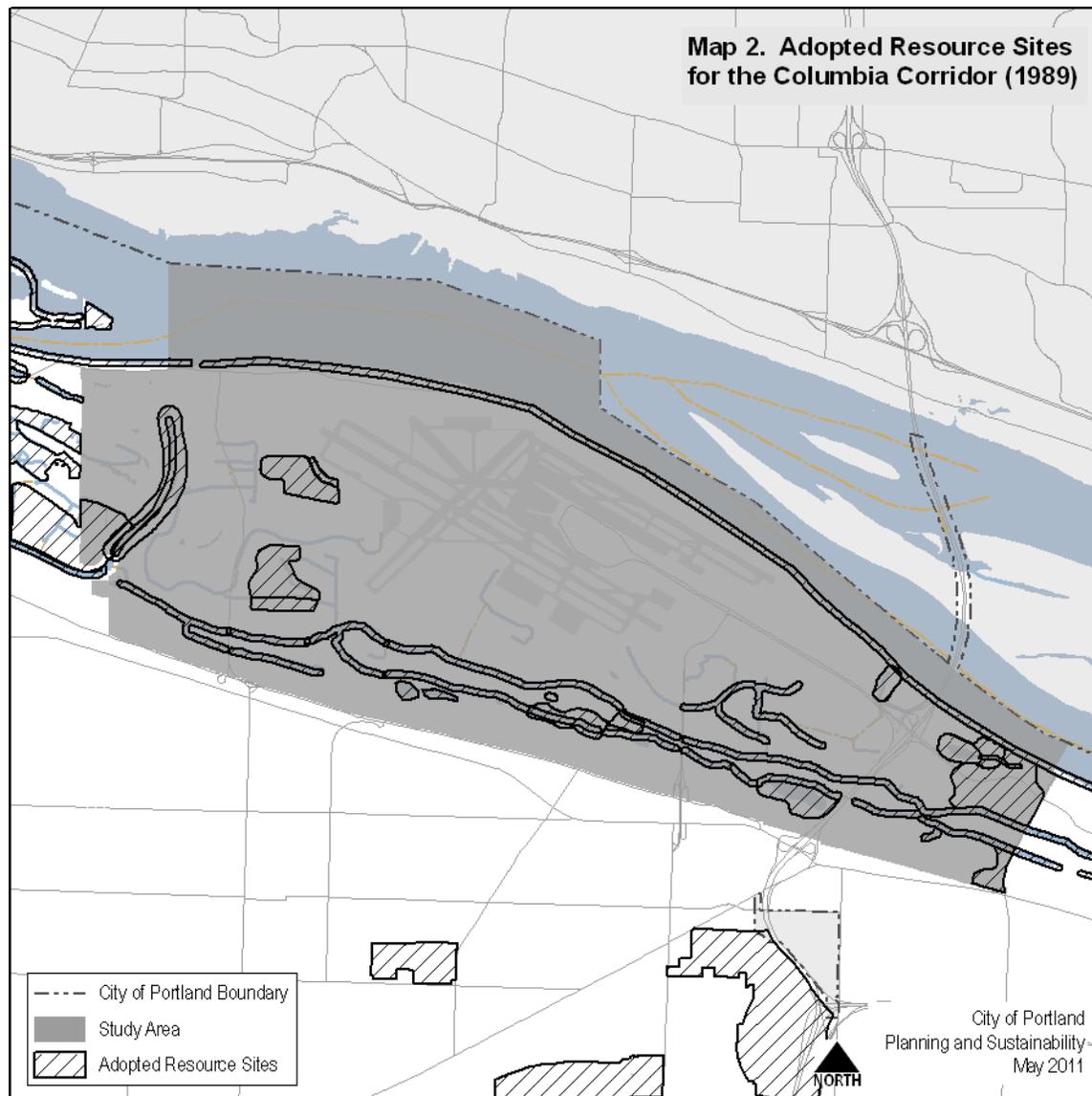
The study area for this inventory includes the Columbia River as it flows through Portland, the Middle Columbia Slough main channel and southern channels, the Buffalo and Whitaker Sloughs, numerous drainageways and wetlands, riparian corridors and upland habitat at and surrounding the Portland International Airport. The inventory also includes developed lands adjacent to the natural resource features. The boundary of the inventory study area is shown on Map 1. The study area is generally coincident with the boundaries of the Airport Futures land use planning study area.



## Background

Starting more than 30 years ago, the City began developing inventories of natural resources in Portland to meet state land use planning goals. The first inventory addressed the Willamette River and was completed in 1975. Between 1989 and 2002, the City completed 10 inventories citywide including the *Inventory and Analysis of Wetlands, Water Bodies and Wildlife Habitat Areas for the Columbia Corridor* (1989) which encompasses entire study area to be addressed in this inventory.

For the 1989 inventory the City used a Wildlife Habitat Assessment (WHA) methodology to document and rank existing conditions in the Columbia Slough watershed. The inventory was divided into five segments, the fourth segment called the “Central Columbia Corridor” included the airport and surrounding lands between the Peninsula Drainage Canal and I-205. Each segment contained anywhere from seven to 15 resource sites depending on the complexity of the zone (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. The 1989 inventory provided a basis for the application of environmental overlay zones to identified natural resources. The inventory has continued to provide guidance for protection and restoration opportunities in the watershed.



In 1999, the City updated the natural resources inventory for lands east of NE 82<sup>nd</sup> Avenue as part of the *Natural Resources Protection Plan for the Columbia South Shore Plan* (2000). The inventory focused on sloughs, drainageways, wetlands and riparian areas including Middle Columbia Slough and Whitaker Slough east of NE 82<sup>nd</sup> Avenue, PIC Ditches, Economy Parking Forested Wetland, Johnson Lake, Little Four Corners, Prison Pond and Mays Lake. The functions identified for these features included groundwater recharge/discharge, drainage, flood storage/desynchronization, erosion control/sediment trapping, pollution/nutrient retention/removal and wildlife habitat. Many of the features were also identified as a visual amenity and having recreation potential.

The Middle Columbia Corridor/Airport Natural Resources Inventory is an update of the *Inventory and Analysis of Wetlands, Water Bodies and Wildlife Habitat Areas for the Columbia Corridor* (1989) and *Columbia South Shore Plan* (2000) inventories. The information presented in this report incorporates updated information including new natural resource 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 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.

## CHAPTER 2. RELATIONSHIP TO STATE, REGIONAL AND FEDERAL REGULATIONS

The updated Middle Columbia Corridor/Airport Natural Resources Inventory will inform City strategies to achieve and maintain compliance with specific state, regional, and federal regulatory requirements.

### State and Regional Regulations

#### State Land Use Planning Program

Comprehensive land use planning was mandated by the 1973 Legislature, primarily in response to growth pressures on valuable resource land. Since 1975, cities and counties in Oregon have been required to comply with Statewide Planning Goals. Nineteen goals were developed and cities and counties were directed to comply with the goals by developing or updating their comprehensive plans. Portland adopted its first comprehensive plan in 1981 to satisfy the requirements of the state planning program.

There are multiple State planning goals that apply to the study area including Goal 9: Economy of the State and Goal 12: Transportation. State planning goals that relate most directly to natural resources surrounding the Portland International Airport are:

- **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 has three policy choices: to preserve the resource, allow proposed uses that conflict with the resources, or establish a balance between protecting and allowing uses that conflict with the resources.
- **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 7, Areas Subject to Natural Hazards** – Goal 7 deals with development in places subject to natural hazards such as floods or landslides. It requires that jurisdictions apply “appropriate safeguards” (floodplain zoning, for example) when planning for development

To address Goals 5, 6, 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 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 important, it may be excluded from further consideration. The remaining resources are then subject to a “conflicting use” analysis, with the final step being development of a protection program for significant resources.

The City of Portland addressed these inventory requirements when developing the Environmental Overlay Zoning program that now applies to the inventory study area. This inventory report is an updated of the 1989 and 2000 inventories for the Columbia Corridor and Columbia South Shore.

This inventory focuses on riparian corridors and wildlife habitat areas and contains general information pertaining to water quality; natural hazards including landslide and wildlife hazard areas and flood areas; hydrological conditions; ecologically fragile areas; significant natural areas; and vegetative cover. Thus, this inventory may be used to inform and support future updates to the City’s programs relating to portions of Goals 5, 6, and 7. However, because the inventory focuses on riparian corridors and wildlife habitat areas and not cultural resources, it can be used to update only those parts of the City’s Goal 5 program.

## **Metro’s Urban Growth Management Functional Plan and Title 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 3 counties within the Urban Growth Boundary.

Metro’s Urban Growth Management Functional Plan was acknowledged by the Oregon Department of Land Conservation and Development and became law. Metro area cities and counties achieve compliance by updating comprehensive plans and land use ordinances to meet regional requirements. Cities and counties within the Metro Urban Growth Boundary must have comprehensive plans and ordinances that also comply with remaining state goals not covered by the Urban Growth Management Functional Plan.

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 Goals 6 and 7, and establishes regional requirements relating to water quality, erosion control, and flood hazard management. In September 2002, the City 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 overly 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. 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 high-value riparian corridors identified in Metro's inventory of regionally significant riparian corridors and wildlife habitat. 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 have until January 2009 to show that their local programs meet the requirements of the regional program. In November 2009, Metro granted the City of Portland's request for an extension to meet Title 13 requirements. The city outlined an approach, including area specific plans such as Airport Futures and River Plan/North Reach, and other elements that will be achieved during a two-year period and will contribute towards meeting Title 13. Part of the approach is completing an update to the natural resources inventory for the Middle Columbia Corridor.

Many of the natural resource areas addressed in this inventory were also identified by Metro as providing important water quality, riparian and wildlife habitat functions during development of Titles 3 and 13. As noted above, this inventory is intended to replace a portion of the regional inventory that Metro produced to inform the Nature in Neighborhoods Program. This inventory is expected to inform any future updates to existing City programs that were, or will be established, in part, to comply with these Metro titles.

## **The Oregon Conservation Strategy**

The Conservation Strategy is an effort to use best available science to create a broad vision and conceptual framework for long-term conservation of Oregon's native fish and wildlife, as well as various invertebrate and plant, species. The Conservation Strategy outlines priorities and opportunities for residents, agencies and organization. The Conservation Strategy is non-regulatory and focuses on voluntary actions to improve the efficiency and effectiveness of conservation in Oregon. Within the Willamette Valley, actions include maintaining and restoring fish and wildlife habitat in urban centers and conserving, restoring and reconnecting high value habitats. This inventory supports the efforts of the Conservation Strategy by providing additional natural resource information within the study area.

## **Federal Regulations**

### **Clean Water Act**

The Water Pollution Control Act Amendments of 1972 and subsequent amendments, now known as the Clean Water Act (CWA), regulate discharges of pollutants to waters of the United States. The CWA calls for restoration and maintenance of the quality of the nation's water, where attainable, to promote a range of beneficial uses.

Section 303 of the CWA establishes water quality standards and Total Maximum Daily Loads (TMDL) that limit the amount of pollutants that a particular body of water is allowed to receive from all sources. States are required to develop lists of water bodies that are "water quality limited" because they do not meet certain water quality standards. In Portland, major rivers, streams and drainageways are water quality limited with the exception of Balch Creek. Most of Portland's waterways, including the Columbia Slough, do not meet water quality standards for temperature and bacteria. The Columbia Slough also does not meet standards for biological oxygen demand, nutrients, pH, pesticides and heavy metals.

The City has developed a draft Local Implementation Plan to meet TMDL requirements for the Columbia Slough and other waterways in Portland. This inventory is being used to help identify priorities for resource protection, restoration, and ecologically-friendly development approaches that support compliance with TMDL requirements.

## Endangered Species Act

Beginning in 1998, National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) listed a number of Pacific Northwest salmon and steelhead as either threatened or endangered in Washington, Oregon, Idaho, and California. Fish species listed for the Lower Columbia River Evolutionary Significant Unit (ESU) include steelhead trout, Chinook salmon, Coho salmon, chum salmon and green sturgeon<sup>1</sup>. Portland's Willamette and Columbia rivers, Columbia Slough, Johnson, Tryon and Fanno creeks, and several smaller tributary streams are inhabited by several of these species. Other fish species that spend critical portions of their life cycles in the Lower Columbia River have been proposed to be listed and are under consideration: Pacific lamprey, coastal cutthroat and eucalon.

A number of other terrestrial plant and animal species found in Portland are identified under the Endangered Species Act (Table 1).

	<b>Common Name</b>	<b>Federal Status</b>
Amphibian	Northern Red-legged Frog	Species of Concern
Bird	Band-tailed Pigeon	Species of Concern
	Olive-sided Flycatcher	Vulnerable
	Peregrine Falcon	Vulnerable
	Purple Martin	Species of Concern
	Streaked Horned Lark	Candidate
	Vesper Sparrow	Species of Concern
	Yellow-breasted Chat	Species of Concern
Mammal	Camas Pocket Gopher	Species of Concern
	Fringed Myotis	Species of Concern
	Long-eared Myotis	Species of Concern
	Long-legged Myotis	Species of Concern
	Red Tree Vole	Species of Concern
	Silver-haired Bat	Species of Concern
	Townsend's Big-eared Bat	Species of Concern
	White-footed Vole	Species of Concern
	Yuma Myotis	Species of Concern
Reptile	Northwestern Pond Turtle	Species of Concern
Plants	Water Howellia	Listed Threatened
	Sullivantia oregana	Species of Concern

After the 1998 listing of steelhead trout in the Lower Columbia River ESU the City of Portland began developing a comprehensive, coordinated citywide response for City Council adoption (Resolution No. 35715). The City Council established an intent to avoid "take" of a listed species (i.e., harming individuals

<sup>1</sup> Green sturgeon are listed as threatened, with proposed critical habitat in the Lower Columbia River.

or populations or their habitat), and to assist with recovery of listed salmonids. The City has since taken actions such as identifying and prioritizing City programs that could affect listed species, providing technical support to bureaus, providing oversight for activities involving federal permitting or funding, and developing a watershed management plan to help guide city actions.

This inventory can help inform City activities intended to address threatened and endangered species and meet City goals to prevent harm and promote recovery. For example, the information in this report can support efforts to prioritize areas and actions to protect and restore critical habitat in the study area.

The inventory may also help inform City activities to conserve at-risk species that are not currently listed under the Endangered Species Act (e.g., Pacific lamprey, coastal cutthroat trout, several bird species and others). Efforts to conserve at-risk species could reduce further decline and potentially help prevent future listings.

## **Federal Emergency Management Agency (FEMA)**

The Federal Emergency Management Agency (FEMA) maintains and updates flood information for most major waterways in the nation, including the Columbia River and Columbia Slough. For the major waterways in Portland, FEMA maps the area that has a 1% chance of being flooded each year; this area is used to establish the 100-year floodplain. The 100-year floodplain is the standard used by most Federal and state agencies for floodplain management and to determine the need for flood insurance. Within Portland, FEMA updated the Flood Insurance Rate Maps (FIRM), which depicts the 100-year floodplain, in 2004. This inventory uses the 2004 FIRM 100-year floodplain plus the 1996 flood inundation area (as mapped by the US Army Corps of Engineers) as the flood area.

In general, development must be built above elevation that has a 1% of being flood each year. This could be achieved many different ways including placing fill within the 100-year floodplain to raise the elevation. Fill activities within the 100-year floodplain must be balanced with an excavation within the same 100-year floodplain; this is often referred to as *balanced cut and fill*. In most of Portland, balanced cut and fill is triggered when an applicant applies for a site development permit to place fill within the 100-year floodplain.

Within the area managed by the Multnomah County Drainage District (MCDD), the floodplain is controlled through a system of levees and pumps. Development within the managed floodplain does not have to demonstrate balanced cut and fill.

## **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund)**

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980. Superfund:

- establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites;
- assigns liability to persons responsible for releases of hazardous waste at identified sites; and
- establishes a trust fund to provide for cleanup when no responsible party can be identified.

In Oregon, the Department of Environmental Quality (DEQ) implements Superfund. The Superfund cleanup process is complex. It involves the steps taken to assess potentially contaminated sites, place them on the National Priorities List, and establish and implement appropriate cleanup plans. Within the Middle Columbia Corridor/Airport Natural Resources Inventory study area are 17 confirmed contaminated sites, 29 suspected contaminated sites, and 27 cleanup or no further action sites (data updated in January 2008).

Contamination is addressed in this report for each inventory site. Information presented includes a summary of hazardous substances, waste types and environmental and health risks. A map indicating the general location and status of contamination is also included for each inventory site. More information is available through DEQ (<http://www.deq.state.or.us/lq/ECSI/ecsi.htm>). It is important to note that many areas along the Columbia River and Columbia Slough have some level of contamination and also have natural resources that provide important functions.

## **Federal Aviation Administration (FAA)**

The FAA requires that Part 139 airports that receive federal grant funding to operate in accordance with the current FAA Advisory Circulars through grant assurances. The Port receives funding from the FAA and is therefore obligated to comply with the Advisory Circulars including provisions that address hazard removal and mitigation, and compatible land uses. These requirements are the basis for the Wildlife Hazard Management Plan and program at the airport. A wildlife hazard assessment must be conducted including observation of species, their movements, numbers and locations, habitat attractants and recommended actions for reducing wildlife hazards to air carrier operations, including habitat modification and direct wildlife control measures.

This inventory and the Port's Natural Resources Inventory help inform the Port of Portland efforts by providing information about habitats and species use surrounding the airport. Both inventories can inform future evaluations of habitat management alternatives.

## **Migratory Bird Treaty Act**

The Migratory Bird Treaty Act (MBTA), originally passed in 1918, established the United States' commitment to implement four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The MBTA conserves over 800 species of birds and prohibits take of federally and state protected species. Portland joined four other U.S. cities in 2003 in establishing a local commitment to help protect migratory birds and enhance their habitats within urban environments by participating in the Urban Conservation Treaty for Migratory Birds. The U.S. Fish and Wildlife Service selected Portland as a pilot project city due to its location along the Pacific Flyway. As such, habitats in Portland provide critical resting, feeding and nesting habitat for numerous types of migratory and resident birds. Over 200 bird species migrate through Portland every year.

This inventory can help inform efforts to conserve and manage migratory bird stopover habitat. Information about migratory bird habitat and species observations can be found in the natural resources description for each inventory site.

## CHAPTER 3. 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 new (draft) citywide inventory of riparian corridors and wildlife habitat. Other key information was produced specifically for the airport inventory study area, including the delineation of inventory sites and observations from field visits. 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 has recently produced substantial new inventory information for riparian corridors and wildlife habitat in Portland. Products include new natural resources descriptions, Geographic Information System (GIS) data, GIS models, maps, and a report documenting the project approach.

The Bureau used Metro's inventory of regionally significant riparian corridors and wildlife habitat as a starting point for citywide inventory development. By basing the new City inventory on Metro's approach, the Bureau was able to incorporate and build 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. The Council directed Metro staff to develop a regional program to protect, conserve, and restore regionally significant riparian corridors and wildlife habitat. The inventory was adopted as part of the Title 13 Nature in Neighborhoods program in September 2005.

The Nature in Neighborhoods Program establishes new regional requirements that Metro area cities and counties must meet to achieve compliance with State Planning Goals 5 & 6. 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).

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. Riparian corridors also include areas that provide the transition between the stream banks and upland areas. Watershed functions provided by natural resources located in riparian corridors include:

- Microclimate and shade - Open water bodies, wetlands, 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 – Rivers, streams, drainageways, 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.

- Streamflow moderation and flood storage – Waterways and floodplains provide for conveyance and storage of streamflows and floodwaters; 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 and nearby vegetation provide food for aquatic and terrestrial species (e.g., plants, leaves, twigs, insects) and are part of an ongoing chemical, physical and biological nutrient cycling system.
- Large wood and channel dynamics – Rivers, streams, drainageways, riparian wetlands, floodplains and large trees and woody vegetation contribute to changes in location and configuration of the waterway channel over time.
- Wildlife movement corridors – Rivers, streams, draiangeways and vegetated corridors along waterways allow wildlife to migrate and disperse among different habitat areas and provide access to water.

Wildlife habitats provide food, cover, and roosting and nesting 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, 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 and nesting opportunities for multiple wildlife species.
- Interior habitat area (edge effect) – Rounder-shaped habitat patches experience less “edge effect” (disturbance from urban land uses, predation and invasive 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 sties, and reproduction opportunities.
- Connectivity/proximity to water – Access to water is vital to wildlife survival.
- Special habitat areas – Specific habitat types or features that provides critical 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.

## City's Inventory Methodology

Below is a summary of the steps the Bureau 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 can be found in Appendix F: *City of Portland Natural Resource Inventory Update: Project Report – Discussion Draft November 2009*.

- 1. Compiled GIS Data and mapping key natural resource 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 improved the regional natural resource feature GIS data by:
  - Remapping more than 160 miles of stream/drainageway centerlines; adding 70 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>2</sup>
  - Updating the City's flood area data for use in the inventory, including incorporation of the 2004 FEMA 100-year floodplain.
  - Utilizing Light Detection and Ranging (LiDAR) is a method for precisely measuring the elevation of the Earth's surface, and objects on the surface (trees, buildings, etc.)
- 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 method and represent a simple ordinal scale depicting the relative number and distribution of functions provided by 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.

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. More detailed information on natural resources and disturbances (e.g. development, contamination and invasive species) are provided in the inventory site descriptions.

The City's inventory models apply the same general sets of mapping criteria that Metro developed. However, the Bureau refined some of the regional criteria to reflect additional detail, more recent studies, and local conditions. For example, the City's model criteria reflect differences in how riparian areas function within local drainage districts which manage the levee system, drainage channels, and flows to prevent flooding in the Columbia Slough watershed. The refinements result in the flood area receiving a lower rank for criteria related to bank function, large wood recruitment and channel dynamics in the Columbia Slough watershed than in the rest of the City's watersheds.

The City's wildlife habitat model was also 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.

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<sup>2</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.

The Bureau of Planning and Sustainability worked closely with Metro and the Bureau of Environmental Services to ensure that refinements to the regional inventory would be consistent with Metro's work and would support the City's watershed health goals. The Bureau of Planning and Sustainability coordinated a technical review process in 2006 to address potential refinements to the regional methodology. For more detail see Appendix F - *City of Portland Natural Resource Inventory Update: Project Report – City Council Draft November 2009*.

#### 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, riparian functions. The predominance of riparian 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.

Table 2 presents the riparian corridor GIS model criteria.

The criteria summarized in Table 2 reflect some refinements to the criteria Metro used to map riparian corridors across the region. The criteria refinements are explained in the *City of Portland Natural Resource Inventory Update: Project Report – City Council Draft November 2009* (Appendix F). One particular refinements addresses natural resource functions of drainageways managed by local drainage districts. The Multnomah County Drainage District (MCDD) manages an extensive system of pumps and levees to control the rates and the elevations of water in the upper and middle Columbia Slough and associated waterways. Without pumping, the area would be flooded causing extensive damage to local industries, businesses and residents. The drainage district also routinely removes large wood to maintain channel conveyance capacity. While riparian corridors within drainage districts continue to provide important water quality and fish and wildlife habitat functions, these management activities eliminate floodplain functions and restrict natural channel dynamics. The City inventory reflects these impacts by assigning lower relative ranks to riparian corridors within a drainage district for functions relating to flood storage and channel dynamics. The proposed mapping criteria refinements more accurately reflect MCDD's management of flow levels to prevent flooding and also of the channels themselves to maintain conveyance, including the regular removal of large wood to maintain adequate flow conveyance capacity. MCDD agrees with the City's proposal to modify criteria relating to hydrology and channel dynamics without modifying criteria relating to other riparian functions (e.g., pollution and sediment control, microclimate and shade, wildlife habitat).

**Table 2: Riparian Corridor GIS Model Criteria**

Riparian Function	Landscape Feature	Features Assigned a Primary Score	Footnotes	Features Assigned a Secondary Score	Footnotes
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	5
	Land	Land within 50 feet of a river, stream/drainageway or wetland (except hardened, non-vegetated river banks in the Willamette River North and Central Reach)	1, 2, 7	Land within 50 feet of a hardened, non-vegetated river bank in the Willamette River North and Central Reach	7
	Vegetation	Forest, woodland or shrubland vegetation within the flood area (except within a drainage district)	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 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 Reach)	1, 4			
	Vegetation	Forest vegetation within 50 feet of a river in the Willamette River North or Central Reach			Woodland, shrubland, herbaceous or non-vegetated land within 50' of the river within the Willamette River North and Central Reach	
		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			

Riparian Function	Landscape Feature	Features Assigned a Primary Score	Footnotes	Features Assigned a Secondary Score	Footnotes
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) 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 rights-of-way 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 that Metro used for the regional inventory and also reflects the distribution of primary scores assigned to features in the city (table 3).

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 significant 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<sup>3</sup>

#### 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 4 below. For purposes of the inventory, habitat patches are defined as areas of forest vegetation and wetland that are at least two acres in size, plus adjacent woodland vegetation.<sup>4</sup>

<sup>3</sup> Hardened, non-vegetated river banks include seawalls, pilings and non-vegetated riprap.

<sup>4</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 model.

<b>Table 4: 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 5).

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

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 through out the city.

Combined Riparian Corridor/Wildlife Habitat Relative Ranks

Once the aggregated riparian corridor and wildlife habitat ranks are generated, 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.

It is important to note 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.

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

The Bureau of Planning and Sustainability worked with the Bureaus of Environmental Services and Parks and Recreation to update Metro’s designation, documentation and mapping of regional Habitats of Concern. Habitats of Concern are areas with 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).

Habitat of Concern are referred to as Special Habitat Areas (SHAs) in the citywide inventory. Like the Habitats of Concern, SHAs are mapped more generally than the landscape feature data used in the riparian and wildlife GIS models. The SHA boundaries correspond to broader areas, and the boundaries may extend beyond the specific landscape features.



The City has updated the SHA criteria to include areas that National Oceanic and Atmospheric Administration (NOAA) designated as Critical Habitat for anadromous salmonids. Within this inventory study area the Columbia River is designated as Critical Habitat. The City has also designated certain urban structures as SHAs, including chimney roosting sites for Vaux's Swifts and 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 B.

All Special Habitat Areas receive a high relative rank for wildlife habitat, which would supersede a medium or low rank if 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, but instead include species identified as "special status" by the city. "Special status species" 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 as well as species that have been identified by entities or programs including:

- Oregon Natural Heritage 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 such as the species is:

- 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)
- a keystone species (a species that physically alters environments and whose absence is detrimental to ecosystem function)

The City uses these listings and rankings to track species trends at different scales and to provide context for 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 identifies *at risk* wildlife species, which 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 Fisheries
  - d. PT Proposed Threatened
  - e. SoC Species of Concern
  - f. C Candidate

2. Listed by ODFW as:
  - a. LE Listed Endangered
  - b. LT Listed Threatened
  - c. SC Critical
  - d. SV Vulnerable
3. Received an Oregon Natural Heritage rank or list 1, 2 or 3.

These *at risk* species are the most vulnerable of the Special Status Species. Areas that provide important habitat for *at risk* species are designated in this inventory as Special Habitat Areas. The full Special Status Species list and a list of *at risk* species is identified in Appendix C.

4. **Produced resource ranking maps based on GIS model results and information on Special Habitat Areas.**

The Bureau produced maps showing the inventory 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**

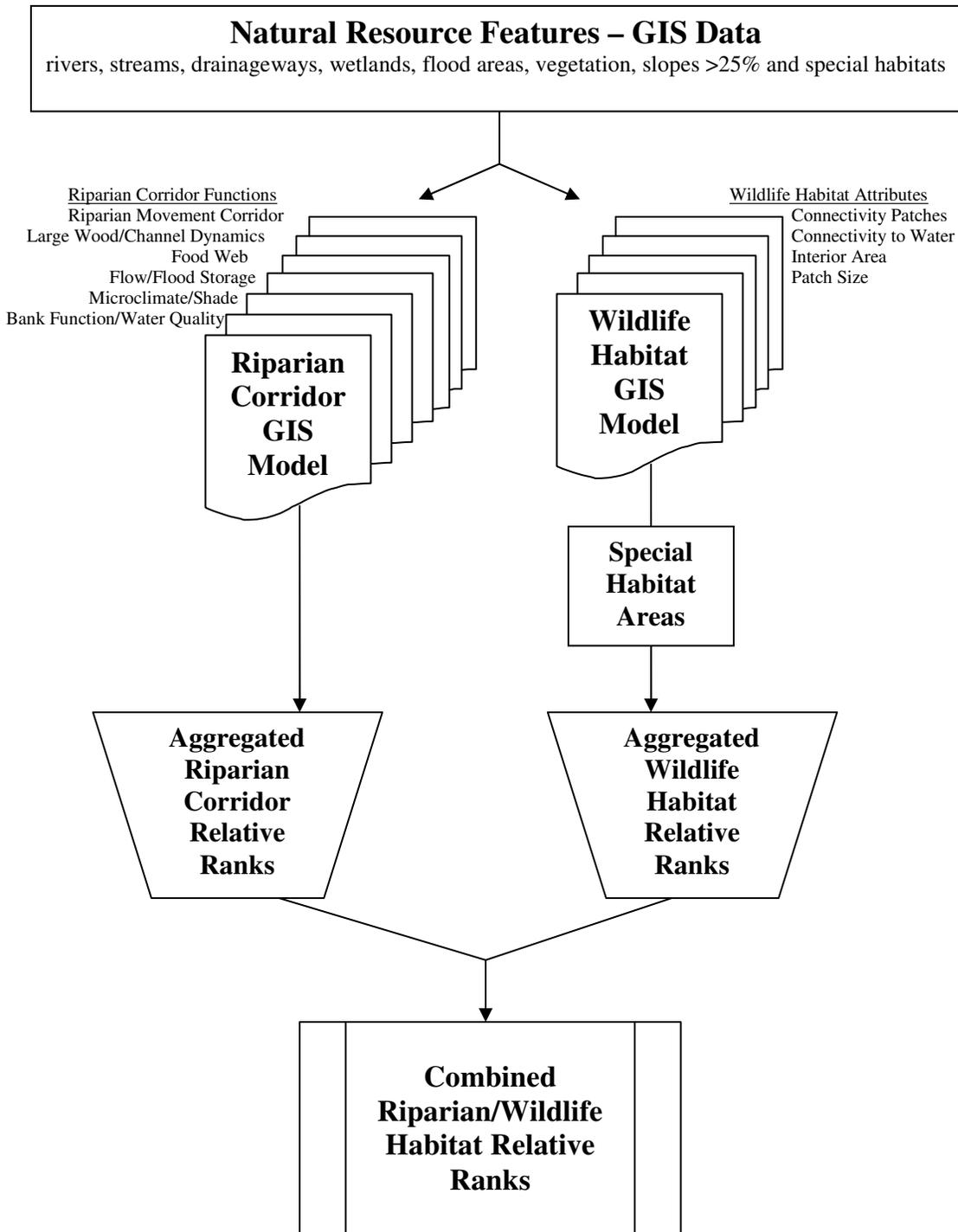
To comply with the Goal 5 rule, local jurisdictions must assess inventoried natural resources to determine if the resources are “significant” based on location, and relative quantity and quality. Resources that have been deemed significant must then be evaluated to determine if and how those resources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

Metro determined the ecological significance of inventoried regional riparian corridors and wildlife habitat based on the science literature. For riparian corridors, Metro determined that all natural resources that receive 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.

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.

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

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

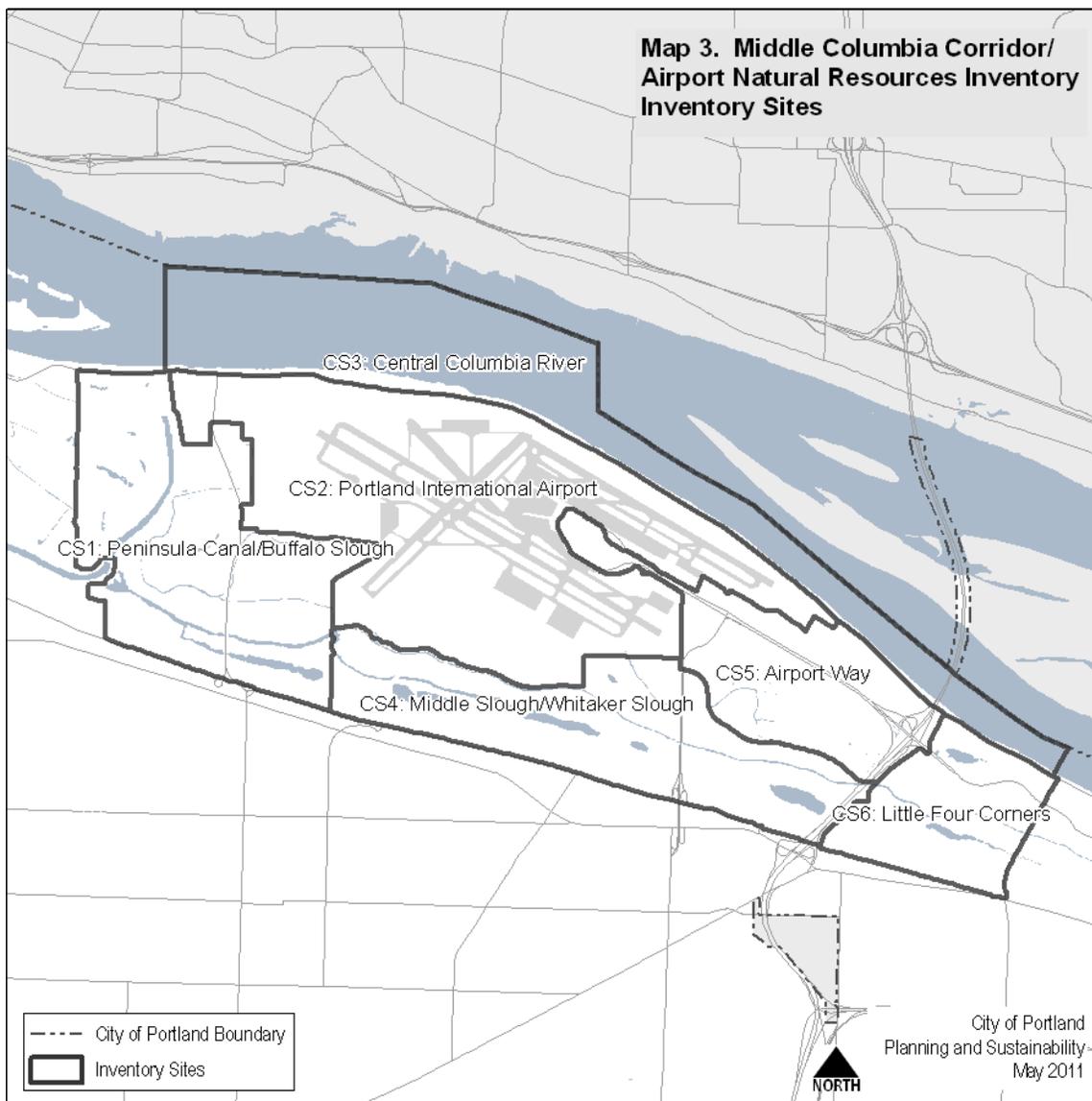


## Work Conducted for the Middle Columbia Corridor/Airport Natural Resources Inventory

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

### Delineation of Inventory Sites

The Bureau of Planning and Sustainability delineated six new inventory sites for the airport 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, the resource 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 were possible.
- Topography – The intent is to use topography as a boundary where it forms a natural break between inventory sites. An example in the Middle Columbia Corridor/Airport study area are the levees
- 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 is used in other City inventories, including the 1989 inventory produced for the Columbia Corridor. This is primarily because many of the inventory sites are predominantly developed with remnant areas of remaining natural resources.

### ***Incorporating information from the discussion draft *Inventory of Significant Riparian and Wetland Resources: Columbia Corridor Resource Sites (October 2001)****

The Bureau of Planning produced a draft updated inventory for the Columbia Corridor in 2001 that includes the study area. The draft inventory includes a general description of natural resources in the Columbia Slough watershed: geology, topography, soils, vegetation and fish and wildlife. For each of the 26 resource sites included in the 2001 draft inventory, a narrative of the existing natural resources is provided include information about water quality, riparian vegetation, wildlife use and habitat connectivity, and disturbance impacts. Unique or rare occurrences of plant and animals were also noted. The data and information from the draft inventory has been incorporated into the inventory site descriptions presented later in this report.

### ***Incorporating information from the Port of Portland *Strategic Environmental Evaluation and Wildlife Hazard Management Plan****

In 2000 the Port of Portland completed an update of the Portland International Airport Master Plan. The master plan called for completion of a Strategic Environmental Evaluation (SEE) to review potential natural resource impacts of the proposed the airport development scenarios. In 2002, the Port

inventoried natural resources on Port-owned property on and around the airport, and limited adjacent non-Port owned properties, in order to evaluate impacts on natural resources. 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 6). The Port updated the land cover inventory in 2007 and provided the data to the City in electronic form. The City utilized the Port's inventory, along with 2007 aerial photography, to update the City's vegetation data within the study area.

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

The Wildlife Hazard Management Plan (WHMP) was first prepared in 1998 to address hazards associated with wildlife on and around the airport. The WHMP was updated in 2009. The objective of the WHMP is to develop an integrated and adaptive program to manage risk at the airport by reducing the probability of occurrence of wildlife/aircraft collisions. While terrestrial wildlife can pose a risk to aircraft, exclusion fencing has reduced the risk to a manageable level. Certain specific avian species continue to pose a risk to aircraft and are the focus of the current WHMP. There are a number of management tools the Port uses to reduce risk at the airport including short-term (intensive hazing) and long-term (habitat modifications) approaches.

For purposes of the WHMP, the Port divided the airfield and surrounding lands into "management areas" based on the types of habitat and current land uses present. For the ten management areas, the WHMP includes a habitat description, wildlife species of concern, wildlife use, and management actions to minimize risk. Observations of wildlife and their behavior, with an emphasis on those species that pose the greatest risk to aviation safety, have been collected since February 2000. Information regarding habitat types and wildlife use has been incorporated into this inventory.

## Supplemental Site Visits

In the fall of 2008 and throughout 2009, staff from the bureaus of Planning and Sustainability, Environmental Services, and Development Services, and the Port of Portland conducted site visits within the study area. The purpose of the site visits was for staff to become familiar with the environs within the study area, to confirm information contained in the previous City and Port natural resource and wildlife inventories and to document plants and wildlife species observations. Notes and photographs from the site visits are contained in Appendix D. Additional field visits were conducted to assess and confirm Special Habitat Areas and at property owner request in the spring of 2010 to verify resource location and extent.

## Technical Review

On November 23, 2009 in response to questions about the application of the Special Habitat Area (SHA) criteria within the study, Bureau of Planning and Sustainability convening a group of technical experts to discuss the proposed SHAs. The group included representatives from US Fish and Wildlife Service, Metro, Port of Portland, Bureau of Environmental Services, Oregon State University, Portland State University and Audubon. Participants were sent a packet of materials that included: Natural Resources Inventory methodology; SHA criteria language and commentary; study area map; worksheet with specific questions relating to application of the SHA criteria; and wildlife data from Bureau of Environmental Services and Port of Portland. The questions posed to the participants were:

- Do individual grassland-associated species or assemblages of grassland-associated species utilize the identified or other grassy or sparsely vegetated areas within the study area? If so, what is the nature and significance of their use(s) in terms their respective life cycle?
- Are the identified areas, or other locations (e.g. golf courses) or features, within the study area routinely utilized by migratory birds as stopover habitat? Note: This question is meant to address habitats that have a reoccurrence of high concentrations or diversity of migratory birds such as buttes, ridge-tops, wetlands, mudflats, riparian areas or focal sites like chimneys.
- Is one or more *At Risk Species* (defined in the SHA eligibility criteria) using any of the grassy or sparsely vegetated areas identified as potential Special Habitat Areas, or other such areas, in the study area in a way that is vital to the completion of one or more phases of the identified species' life cycle?
- Currently, the four golf courses within the study area are not identified as draft SHAs. Based on the answers to first three questions, should any of the golf courses be designated SHA and if yes, please provide an explanation.
- For areas other than the golf courses, given the answers to the three questions and the SHA eligibility criteria, are the proposed SHAs appropriate or do you recommend any revisions (e.g., boundary changes), removals or additions of areas?
- Is there any other information regarding species use in the Study Area that you would like to include?
- Do you have suggestions about the wording of the SHA criteria to make the intent clearer or more precise?
- Is there some other question or comment that you believe we should be asking or which you believe hasn't been addressed?

The intent of the meeting was to visit some of the sites, have a discussion about each question and document areas of agreement and disagreement. The morning was spent touring the Portland International Airport properties and viewing some sites off-airport properties (e.g. Colwood Golf Course). In the afternoon, the group discussed each question. The general outcomes of the technical review were:

- The technical review validated the proposed SHA designations in the NRI, suggested some additions and minor revisions and bolstered confidence in the inventory as a scientifically-sound document to use as a basis for the ESEE analysis and policy discussion.
- The large upland grassland areas around the airport (e.g. 33<sup>rd</sup> Field, Portland International Center) are important habitat for a host of wildlife species, some of which have experienced significant population declines in the region and some of which are not observed anywhere else in the Metro region. The SHA designations are appropriate.
- Southwest Quadrant is unique in the region because it is a rare habitat, sandy substrate with sparse vegetation, and is used by grassland-associated species, at risk species and migratory birds. The SHA designation is appropriate.
- The vegetated areas located between the runways are used by migratory species and at risk species; however, due to the fragmentation and intensity of the runway uses around the vegetation patches they should not be designated as SHAs.
- Migratory bats, some of which are *at risk* species, use the golf courses in high concentrations. The riparian areas located in the golf courses also provide important stopover habitat for migratory bird species. The golf courses qualify and should be designated as SHA.
- The main channel of the Columbia Slough provides important migratory stopover habitat and is a connectivity corridor for multiple wildlife species. The Columbia Slough and its riparian area qualify and should be designated as SHA.

Appendix E includes a Technical Memo summarizing the process and outcomes of the meeting and packet materials.

## **CHAPTER 4. MIDDLE COLUMBIA CORRIDOR/AIRPORT NATURAL RESOURCES INVENTORY**

The Chapter 4 provides information, data and maps regarding the presence, extent and condition of natural resources along the Columbia River and Columbia Slough within study area. This chapter is organized into the following sections:

Section 4.a: The Columbia River Basin and Lower Columbia River – Provides a general description of the Columbia River Basin and a context for the inventory. Also included is a summary of Columbia River natural resources within Portland.

Section 4.b: The Columbia Slough Watershed – Contains summary information, including water quality, hydrology, fish and wildlife, regarding the Columbia Slough in Portland

Section 4.c: The Middle Columbia Corridor/Airport Natural Resources Inventory Study Area – Includes information, data and maps about natural resources at and surrounding the Portland International Airport. This section includes detailed information for the following inventory sites:

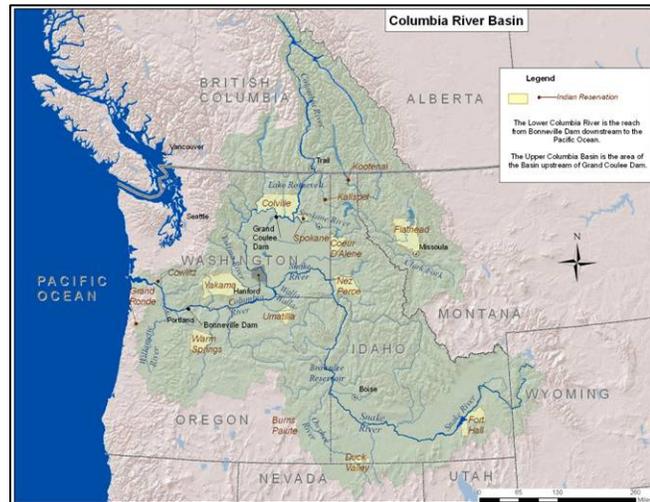
- CS1: Peninsula Canal and Buffalo Slough
- CS2: Portland International Airport
- CS3: Central Columbia River
- CS4: Middle Slough and Whitaker Slough
- CS5: Airport Way
- CS6: Little Four Corners

## Section 4a: The Columbia River Basin and Lower Columbia River

This section provides summary information that zooms in from the Columbia River Basin to the Lower Columbia River and the specific reach along which the City of Portland is situated. This section provides a regional geographic and functional context for the more detailed inventory information in subsequent report sections.

### Columbia River Basin

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 Basin includes much of Oregon, Washington, and Idaho as well as smaller portions of Nevada, Utah, Wyoming, Montana and the Canadian province of British Columbia. The Columbia River flows for more than 1,200 miles, beginning in the Rocky Mountains of British Columbia and passing through the channeled scablands of eastern Washington. The Snake, Yakima, John Day and Deschutes Rivers drain the southern and eastern reaches of the basin, further augmenting the Columbia River. The Columbia then cuts through a narrow gorge in the Cascade Mountains as it meets the Willamette Valley and passes along the northern boundary of the Portland metropolitan area. At the confluence with the Willamette River, the Columbia turns north and travels another 100 miles before discharging an average annual volume of 180 million acre feet into the Pacific Ocean near Astoria.



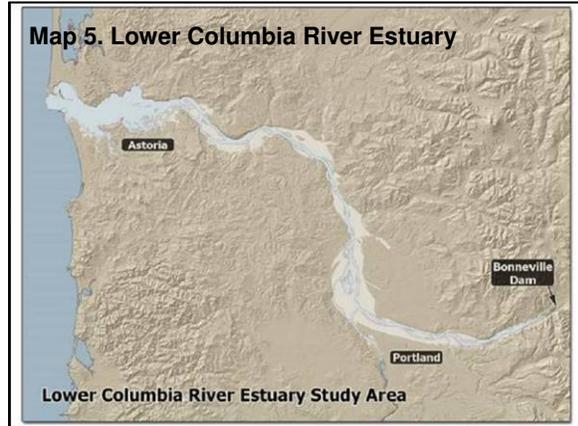
Map 4. Columbia River Basin

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 Bar at the Pacific Ocean. These sub-basins vary greatly in terms of elevation, hydrology and landscape, spanning from arid interior regions to sub-tropical coastal areas. Major tributaries include the Kootenai, Pend Oreille, Snake and the Willamette rivers. This extensive river system helps to disperse aquatic and avian species between distant areas and the Pacific Ocean. It 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.

Along its route, the Columbia River is managed intensively for agricultural and industrial uses, activities that have been central in Pacific Northwest history. Ocean going vessels make use of the Lower Columbia River, while regional barge transportation makes use of a system of locks to navigate up to Lewiston, Idaho on the Snake River. Fourteen dams provide flood management, irrigation, and power generation along the river's length. The dams also alter the flow regime of the river, modifying water temperature, reducing ecological functions provided by flow variation and seasonal flooding, and acting as a barrier to fish migration and spawning activity. The creation of dams, locks and shipping channels resulted in the inundation of many natural falls that were of significant cultural importance to Native American tribes in the Pacific Northwest. These changes in the mainstem river, combined with bank hardening and stream channelization, industrial and agricultural activity, introduction of exotic species, and urbanization throughout the basin have led to dramatic changes in historic aquatic habitats and biota.

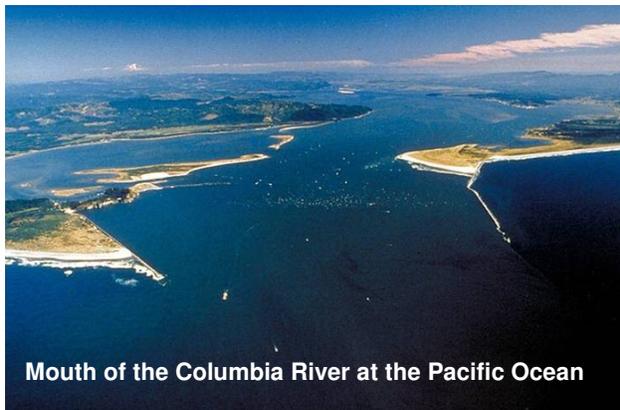
## Lower Columbia River

Bonneville Dam located within the Gorge separates the Upper and Middle Columbia River from the Lower Columbia River and associated estuary. West of the Gorge, the Lower Columbia River widens into an urbanized floodplain amid the remnants of an extensive wetland system. At the confluence with the Willamette River in Portland, the Columbia River turns north and skirts the Coast Range. For the remainder of the River's length, farm and forest lands are the predominant land uses, punctuated by smaller cities, such as Longview, and areas of riverfront industry.



The Lower Columbia River Basin contains the 146 miles of river from the Bonneville Dam to the Pacific Ocean. The Willamette River confluence is located at mile 100 at the cities of Portland and Vancouver. In all, nineteen jurisdictions and nine counties border the Lower Columbia River, 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 & Clark Bridge on highway 433 at Longview, Washington and the Astoria bridge at the mouth of the River.

The geology of the Lower Columbia River Basin is defined by historic basalt flows, the Missoula floods and tectonic uplift of the Coast Range. Thick volcanic deposits from massive lava flows 12 to 17 million years ago underlie most of central Oregon and Washington. The floods from the 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. 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.



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 mouth to control the fur trade and

Fort Vancouver was located at the confluence of the Willamette and Columbia 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.

Flood control and power generation in the Middle and Upper Columbia River basins have substantially reduced the seasonal variability of flows into the estuary. Normalizing the flow has altered the interchange between saltwater and fresh water in the estuary, shifting sediment budgets and food webs, changing habit and food availability and influencing migratory patterns. There has also been substantial

filling of wetlands along the Lower Columbia River to facilitate agriculture and development. Portions of the shipping channel between Portland and the Pacific Ocean have been dredged since 1878 to accommodate increasingly large cargo ships in order to maintain the region's link to national and international economies. Dredging continues to maintain up to a 43 foot depth along the 600 foot wide shipping corridor. The spoils from this dredging have reshaped adjacent lands and have potentially brought contaminants contained in river sediments up to the surface.

The Lower Columbia River has also experienced significant bank alterations and hardening. The Columbia River channel in vicinity of Portland historically was a dynamic system, with the bank and shallow-water, depositional areas changing seasonally. To reduce flooding and allow for development a system of levees was built; a portion of which extends along the length of Portland's bank of the river as far as Smith and Bybee Lakes. Along both banks, the ports of Portland and Vancouver have developed and maintained docks, pilings and seawalls for shipping. All of these bank alterations have significantly minimized channel dynamics, reduced the extent of shallow-water areas and reduced wildlife connections between upland, riparian and in-water habitat areas.

The Lower Columbia River contains multiple pollutants: dioxins/fuans, lead, mercury (including methylmercury), PCBs, PAHs and pesticides (including DDT and its breakdown products). These pollutants impair the water, sediment, fish and wildlife. Reproductive abnormalities in river mammals and birds have been documented in the Lower Columbia River. Arsenic levels have exceeded EPA ambient water-quality criteria for the protection of human health. Contamination of sediments is concentrated near urban and industrial areas. Other contaminants of concern, whose distribution is unknown, include radionuclides, industrial chemicals and "emerging contaminants" such as pharmaceuticals.

Recognizing historic alterations, pollution, and other impacts, the Lower Columbia River Basin continues to provide important wildlife habitat and is home to a large number of aquatic and avian species. The river is part of the Pacific Flyway for migratory birds. Over 200 species of birds can be found in the Portland Metro area and the majority of these species travel along the Columbia River. Approximately 25% of North American bird species are currently experience significant long term population declines (US Fish and Wildlife State of the Birds Report, 2009).



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

The Columbia River provides migration corridor and access to spawning streams for anadromous salmon, steelhead and Pacific Lamprey. Thirteen species of anadromous fish that use the Lower Columbia are listed under the Endangered Species Act. Sturgeon and smelt are currently or proposed as species of concern along with a number of protected marine mammals. A number of birds and amphibians are candidate species or state species of concern including the streaked horned lark, red legged frog, and painted turtles. Non-native fish, plant and animal species have further altered food web dynamics, shifting habitats, and introducing diseases and parasites.

Harbor seals, northern and California sea lions have been known to forage in the Columbia River upstream to the Bonneville Dam. The Lower Columbia River basin provides habitat for mammals (e.g. ungulates, carnivores) such as Columbia white-tailed deer. Smaller mammals such as American beaver, red fox, coyote, opossum and raccoons, have adapted well to urban environments. Wetland and riparian habitat adjacent to the river commonly is used by a variety of amphibians including Larch Mountain salamander, Cope's giant salamander, red-legged frogs, Oregon spotted frog, western pond turtles, painted turtles. Other wildlife that use wetland and riparian habitats include western gray squirrels, river otter, fisher, bushy-tailed woodrat, and several bat species (i.e. Townsend's big-eared bats, long-legged myotis, fingered myotis, silver-haired bat, California myotis, yuma myotis, little brown myotis, Big brown bat).

## Columbia River Watershed near Portland

Historically, the Columbia River in the Portland area was comprised of an extensive interconnected system of active channels, open slack waters, emergent wetlands, and riparian forests. Vegetation in bottomland and wetland forests consisted of black cottonwood, Oregon ash and willow with associated understory assemblages.

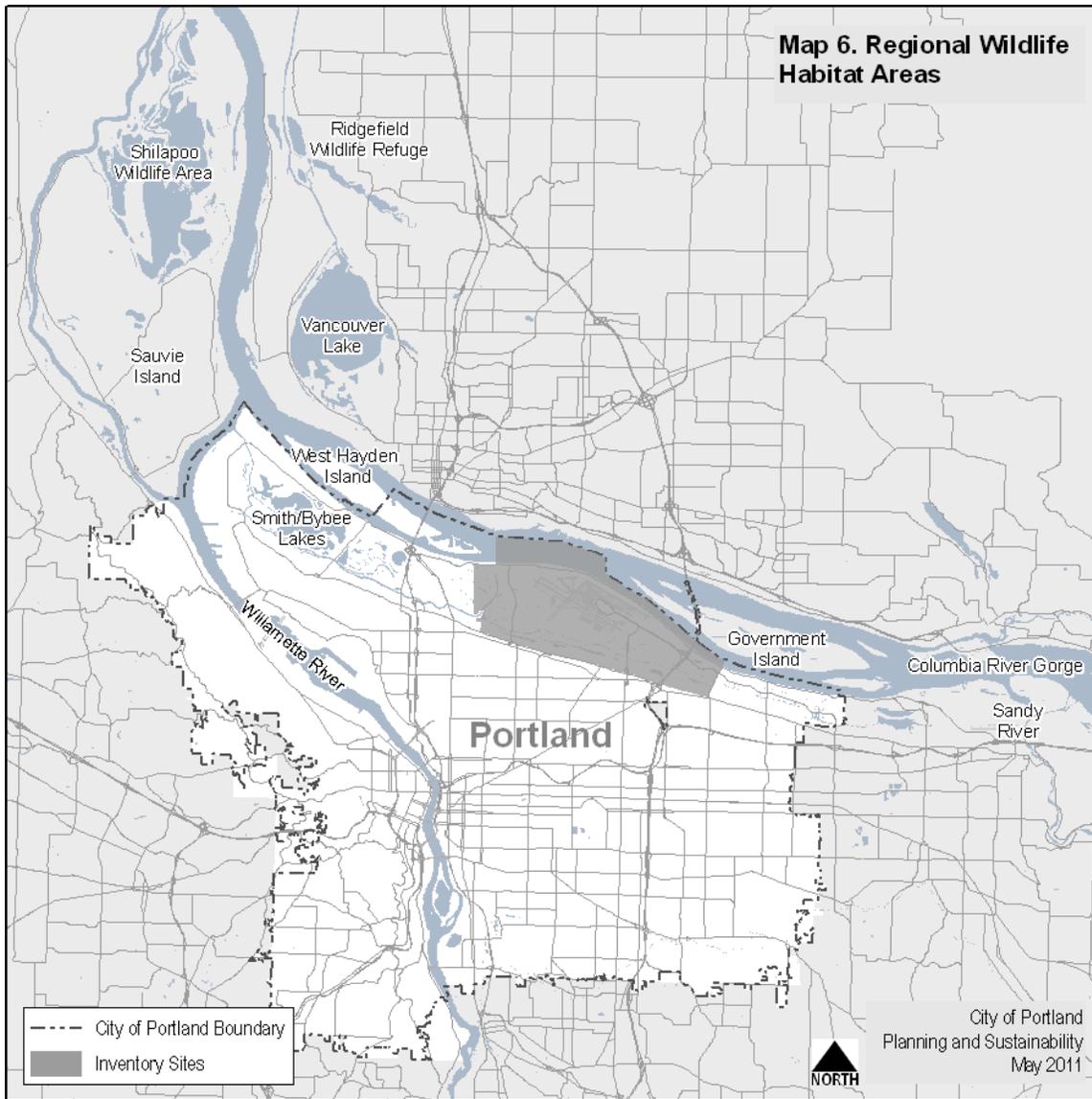
The Columbia River from the Gorge near the Sandy River to Sauvie Island is straddled by Portland to the south and Vancouver to the north. Riverfront industrial facilities, recreational marinas and housing developments are found along the river banks. The history of industrial activity and shipping has reshaped the Portland and Vancouver banks of the river, particularly since World War II. 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. Beginning in 2005, US Army Corps of Engineers (COE) has conducted dredging from river mile 95 to 105 near Hayden Island in Portland. In 2006, COE dredged from river mile 88 to 95 at the mouth of Multnomah Channel.

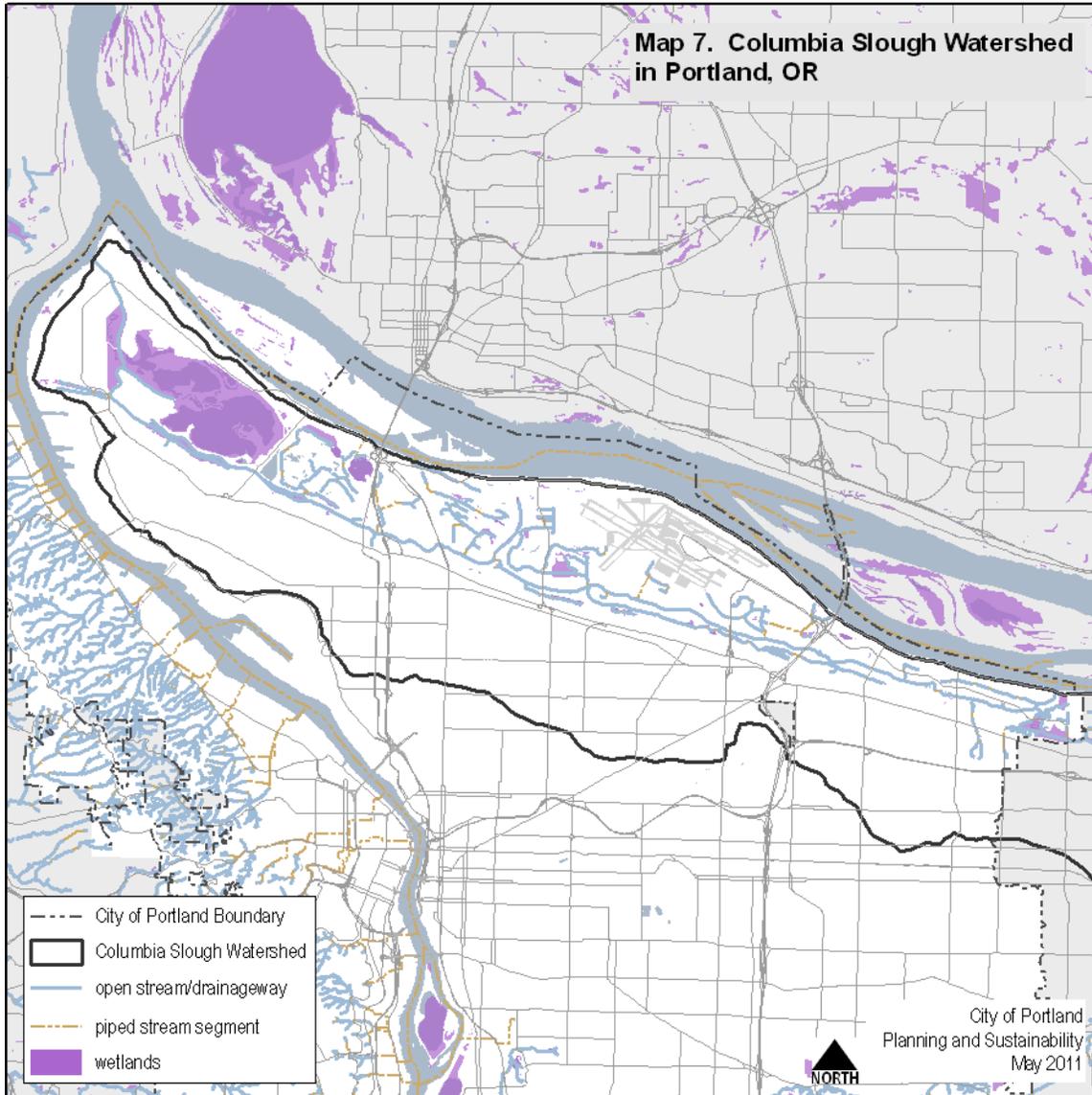
Substantial portions of the river banks have been hardened with riprap, seawalls and docks. Pilings, piers and other human-made structures extend out into the river. A dike system, managed by the Multnomah County Drainage District (MCDD), extends along the length of Portland's bank of the Columbia River as far as Smith & Bybee Lakes. MCDD manages the floodplain for the protection of lives and property, and is increasingly becoming involved in partnerships to restore and protect natural resources. More detail regarding the levee system and MCDD management of the Columbia Slough is included section 4b: Columbia Slough Watershed Overview and in the inventory site natural resource descriptions.

Taking into consideration physical alterations and development, the Columbia River and nearby resources continue to provide important watershed functions. The regional ecosystem includes important habitat areas including Ridgefield and Shilapoo Wildlife Areas, Sauvie Island, Vancouver Lake, Smith and Bybee Wetlands, West Hayden Island, Government Island, Sandy River, the Columbia River Gorge, and Forest Park (Map 6). These areas create a significant regional habitat connectivity corridor and complex. The river, mudflats and islands, provide habitat for numerous aquatic and terrestrial species. The river main channel, near-shore shallow water areas and sandy substrates provide habitat for anadromous salmonids that are listed as threatened species under the Endangered Species Act. Other species that use the Columbia River within Portland include those listed as 'at-risk' by one or more agencies or wildlife organizations including the streaked horned lark, red legged frog and painted turtles.

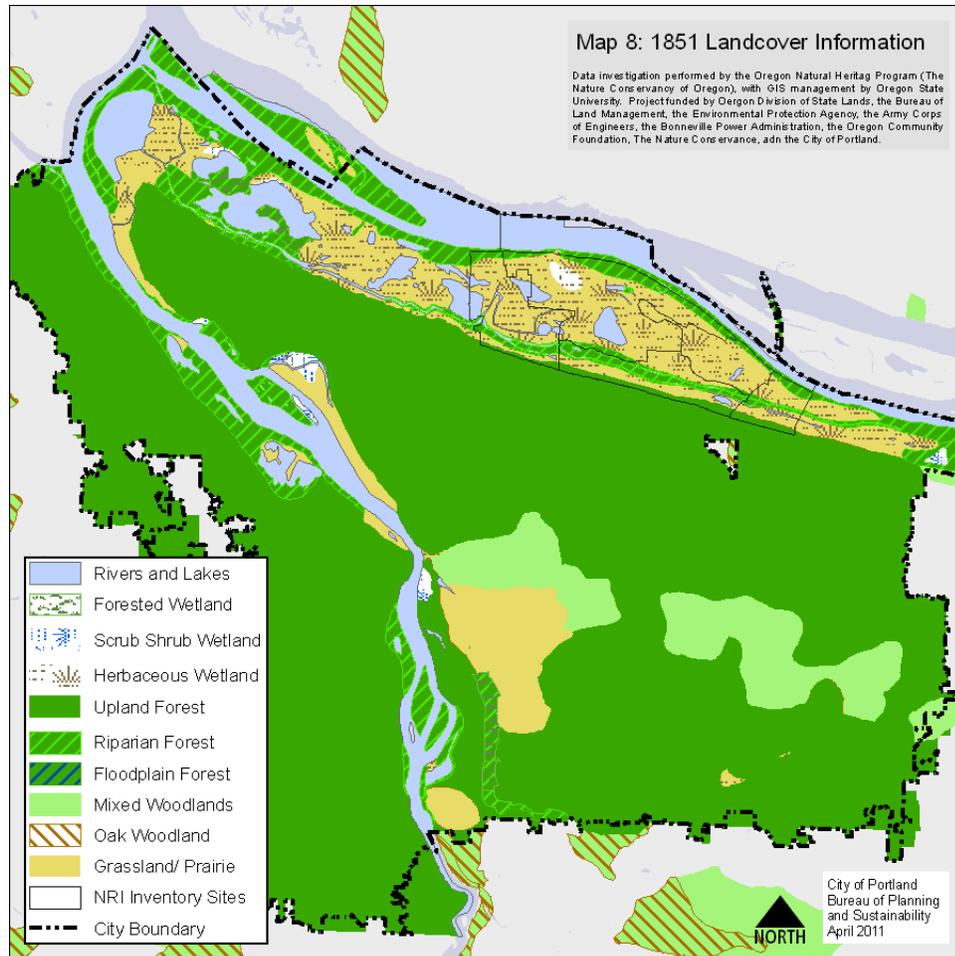


## Section 4b: Columbia Slough Watershed Overview

Regionally situated in the Lower Columbia River Basin, the Columbia Slough meanders through a 32,700-acre watershed, which is part of a regional ecosystem that includes the Willamette River and Tualatin Mountains (Forest Park), Sauvie Island, the Columbia River, Ridgefield and Shilapoo Wildlife Areas, Vancouver Lake, and the Sandy River (Map 7).



The Columbia Slough represents a portion of the historic floodplain of the Columbia River extending 20 miles between the Sandy River and Willamette River. The watershed contained a system of side channels, lakes, and wetlands. High water, known as freshets, seasonally inundated the floodplain, cutting new channels and depositing sediment. The vegetation within the watershed was predominately bottomland hardwood forests, wetland prairies and oak savannah (Map 8). Populations of waterfowl, elk, deer, river otter and other mammal utilized the watershed. All except elk continue to be regularly found in the area.



**Map 8. 1851 Landcover Information**

The Portland-Vancouver region 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 region saw the highest Native American population densities in the Columbia River Basin reaching close to 17,840 in 1800. The Portland area served as a natural gathering place for tribes from across the entire northwestern region of the United States. The Columbia South Shore area, where the airport is currently located, was particularly attractive because the Columbia River provided a rich source of salmon. Portions of the area contained abundant roots and edible plants, such as Wapato, which were also traded among groups. Of special importance to Native Americans was the Columbia Slough, a critical water way used for trading, fishing and travel. The Columbia Slough provided much smoother water for travel than the rough waters of the Columbia River. Oral histories and archeological records show that there were some permanent residences in the Columbia South Shore area, such as the Neerchokikoo village, as documented by the Corps of Discovery.



Beginning in 1805 with the Corps of Discovery and increasingly with the Donation Land Claim Act of 1850, settlers from the east came to the watershed. To support early agricultural industries, wetlands were filled, slough channels modified and native vegetation removed. Another early industry in the watershed was transportation, especially the shipment of goods. In 1907, the Seattle Portland & Spokane Railroad excavation occurred next to Smith and Bybee Wetlands. Shortly afterward, the Swift Interests stockyard and meatpacking plant began to operate on the south side of the Columbia River's Oregon Slough. Other stockyard and meatpacking businesses followed.



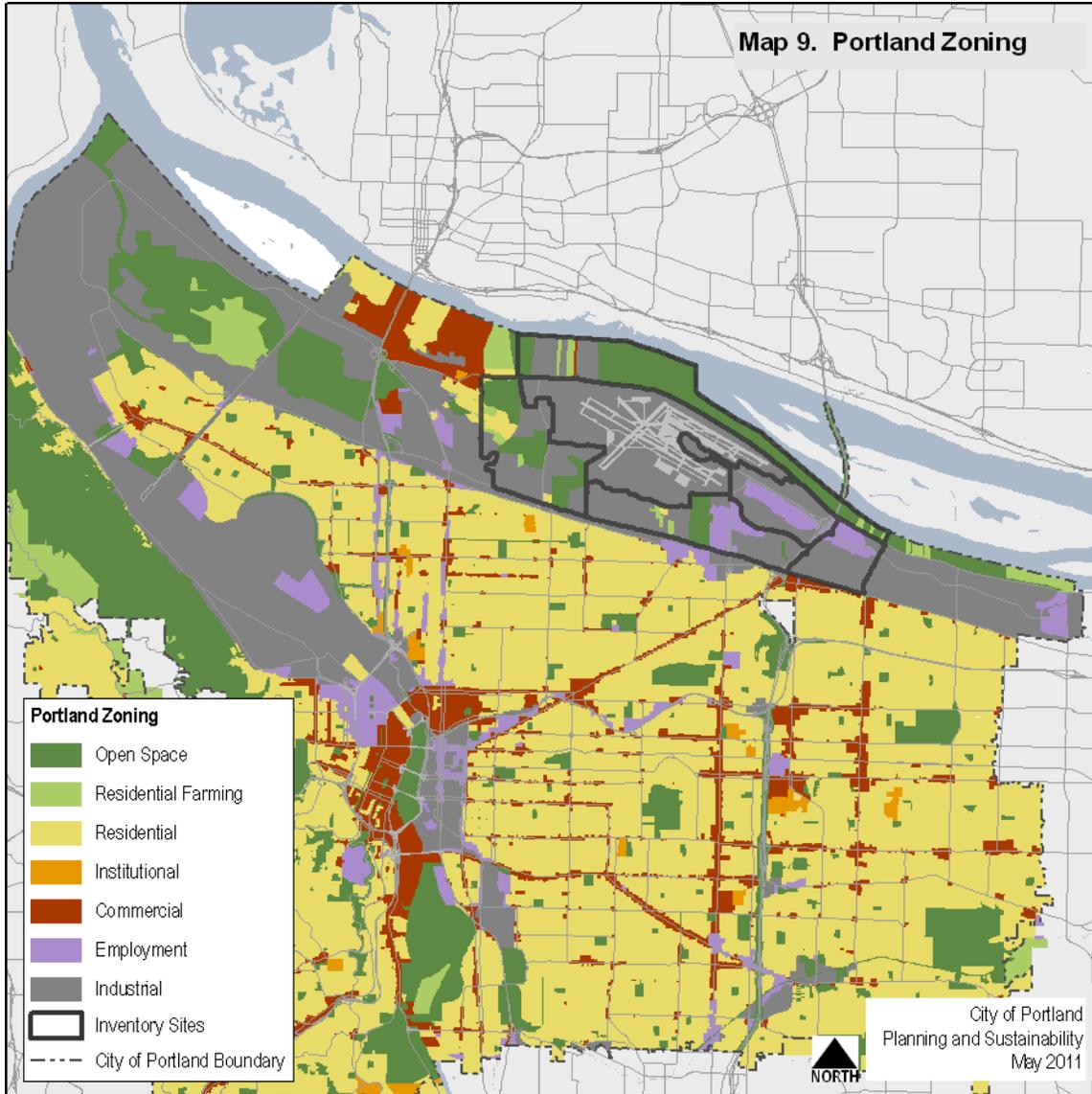
Lower Columbia Slough Levee

Beginning in 1918, levees were built to keep Columbia River flows out of the watershed and provide flood protection. The levees have been maintained and reinforced over the years to allow additional development including the Portland International Airport. Wetlands and side channels were drained and filled to allow for development. The main channel Columbia Slough was channelized, and dozens of streams/drainageways were filled or diverted to underground pipes. This resulted in a significant loss of habitat, reduction of flood storage capacity, and reduced ability to filter sediments and pollutants from surface water. Between 2005 and 2007, within the entire Metro-region, floodplain loss due to development topped 262 acres. The Columbia Slough

watershed has the highest overall proportion of undeveloped floodplain (16%) in the Metro region and has experienced the most floodplain development between 2005 and 2007 (17.5%) (Metro, State of the Watersheds Report, 2009).

Today, the Columbia Slough is a 19-mile main channel that begins at Fairview Lake and meanders westward to Kelley Point Park where it flows into the Willamette River (Map 7). The watershed also contains approximately 21 miles of secondary waterways and other remaining surface water features, such as Fairview Creek, Fairview Lake, Wilkes Creek and Smith and Bybee Wetlands. The total area of the Columbia Slough watershed is 35,140 acres. The portion of the watershed within the City of Portland is approximately 27,200 acres.

The Columbia Slough Watershed in Portland includes virtually every type of land use: residential neighborhoods, agriculture, Portland International Airport, large open spaces, 54 schools, interstate highways, railroad corridors, and heavy and light industries. In general, the portion of the watershed north of Columbia Boulevard is industrial and commercial. The area south of Columbia Boulevard is largely residential (Map 9). Development in the west and central portions of the watershed, from the confluence of the Willamette and Columbia Rivers to Interstate 205, has been influenced by the proximity to major air, water, rail, and truck transportation routes. The result of this development is that about 54 percent of the watershed is now comprised of impervious surfaces, such as roads, parking lots, and rooftops.

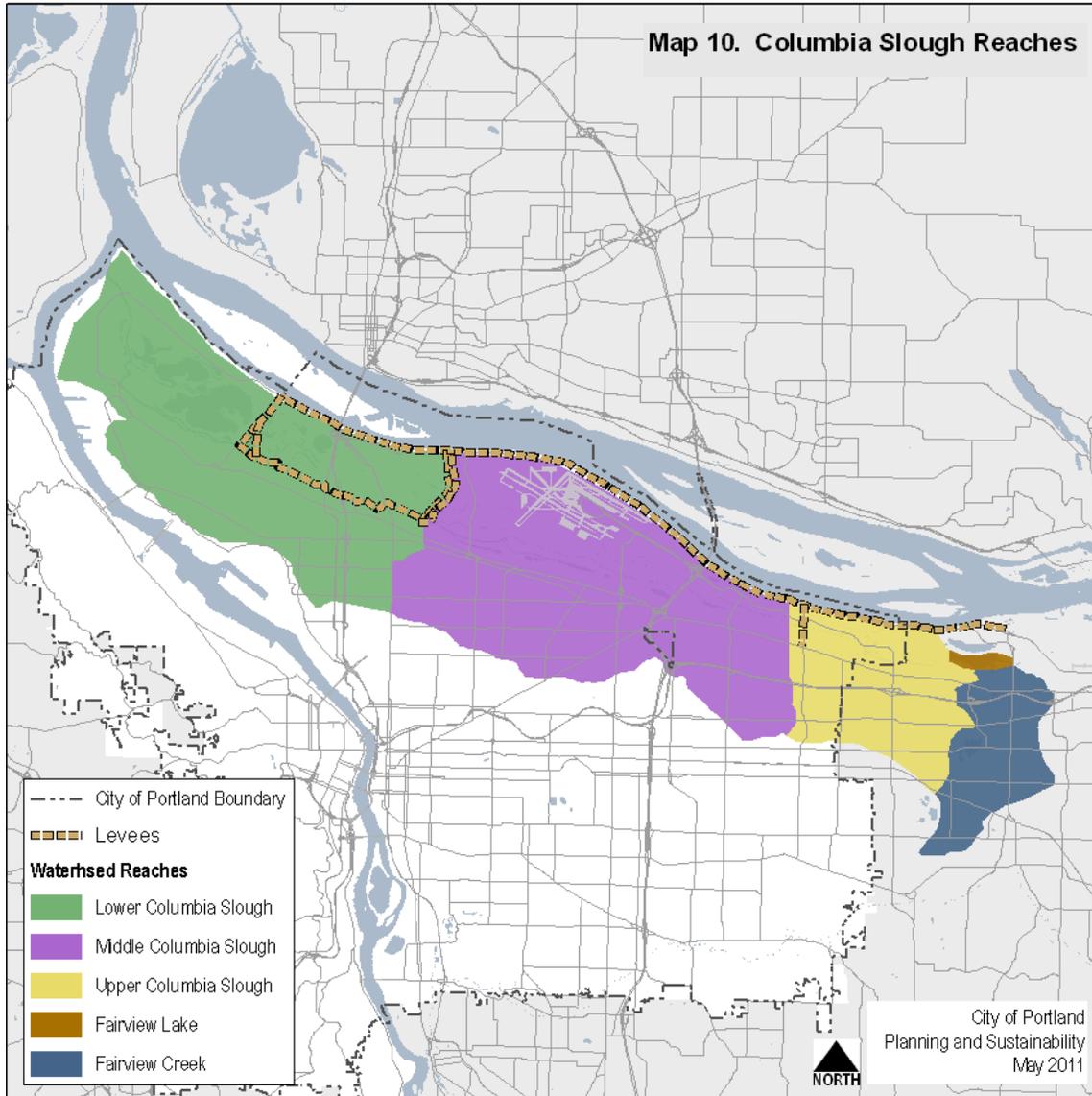


The Columbia Corridor, which includes the area from Columbia Boulevard/Sandy Boulevard to the Columbia River and from the Willamette River to the Sandy River, is home to 2,000 businesses and 60,000 jobs. The Airport Industrial District is located in the Columbia Corridor. This district is part of the City's and the regional industrial employment base and an important corridor for freight generation and movement by rail and truck. The Airport Industrial District makes up over 40% of the City's industrial land, is home to nearly one-third of the Metro area's transportation jobs and in 2009 contained roughly 1,390 acres of vacant or lesser improved land. Types of industries located in the district include transportation, warehouse, manufacturing and wholesale trade.

Even with the extensive development that has occurred in the study areas over the last 150 years, remaining natural resource features and habitat areas support a rich diversity of wildlife found nowhere else within the City of Portland.

## Hydrology

The topography of the Columbia Slough Watershed is generally flat near the Columbia River, with the elevation rising in the upland area south of the Slough (from Columbia Boulevard to the Alameda Ridge and similar upland features east of Rocky Butte). The gradient, or slope, of the Slough waterway channel is also nearly flat. As a result, the Slough can flow in both directions, depending on tide in the Lower Slough, operation of the pumps and gravity flow gates in the cross levee. The watershed is divided into five reaches, based on hydraulic characteristics (Map 10).



- **Fairview Creek** originates in a wetland complex at the base of Grant Butte, to the south near SE 181st and Powell Blvd. Fairview Creek and its tributaries flow into Fairview Lake. Flow from Osborn Creek also enters Fairview Lake.
- **Fairview Lake** is bordered by 223rd Avenue on the east, Interlachen Lane on the north, and Fairview Lake Way on the west. The lake flows into the Upper Slough through a culvert/weir system on the west side.

- The **Upper Slough reach** starts at Fairview Lake on the east and extends west to the mid-dike levee at NE 142nd Avenue. This portion of the slough receives water flow from Fairview Lake, stormwater and groundwater.
- The **Middle Slough reach** extends from the mid-dike levee near NE 142nd Avenue to the Pen2 levee near NE 18th Avenue. Two southern arms of the slough are also located in this reach – Whitaker and Buffalo Slough. The Middle Slough receives water from the Upper Slough, stormwater and groundwater. The southern arms receive significant groundwater flows that help maintain cool in-water temperatures.
- The **Lower Slough reach** starts at the Pen2 levee and extends approximately 8.5 miles to its mouth at the Willamette River. This is the only portion that is outside of the managed floodplain and is influenced by tides in the Columbia and Willamette Rivers. The Lower Slough receives flows from the Middle Slough via a pumping station, stormwater, and back-mixing from the Willamette River caused by tidal influences.

The majority of the rain that falls in the watershed either drains directly to the Columbia Slough via stormwater pipes or flows into infiltration sumps. The City of Portland Bureau of Environmental Services maintains the public stormwater collection system within the city. Impervious surfaces, including roads, parking lots and buildings, comprise approximately 54% of the total watershed. Impervious surfaces prevent rainwater from infiltrating into the ground, resulting in increased stormwater runoff and increased volume of water in the slough during storm events. Reduced infiltration also reduces the amount of groundwater, which is an important cool-water input to the Columbia Slough helping to reduce in-water temperatures.

Development in the watershed has also resulted in the diversion of many creeks, streams and drainageways from natural channels to underground pipes. Only a few surface streams still exist: Fairview, Osborn, No Name, and Wilkes Creek, and the Alice Springs complex. All of these streams and springs are in the eastern portion of the watershed.

There are approximately 21 miles of secondary drainageways in the Columbia Slough watershed. Historically, small drainageways reformed annually when Columbia River floodwater receded. After the levees were constructed, remnant secondary drainageways were likely altered and additional drainageways created to drain agricultural lands. Today, many of the remaining secondary drainageways, which are sometimes referred to as 'ditches', convey surface water and groundwater from developed and undeveloped lands to the Columbia Slough. The Multnomah County Drainage District (MCDD) operates the pumps that move water from numerous secondary drainageways into the main arm of the slough.

In 2002, the City of Portland, MCDD, and the US Army Corps of Engineers initiated a 3-year project (1135 Project) to improve water flow and quality and create additional habitat in the Middle Slough. The project consisted of dredging a meandering channel through the Slough between NE 18<sup>th</sup> Avenue and NE 158<sup>th</sup> Avenue and casting the dredge materials along the channel edges to create emergent wetlands.

Flow and water level in the Lower Slough also depend on tidal influences, macrophyte growth in the summer and pumping operations. The MCDD operates the pumps that move water from the Middle Slough to the Lower Slough and that move water from the numerous secondary drainageways into the main arm of the slough. Another factor contributing to flow and water level in the Slough are undersized, elevated or blocked culverts that impound flow upstream during the summer months.

The Middle Columbia Corridor/Airport Natural Resources Inventory area is within the Middle Slough reach of the watershed. The Middle Slough includes a substantial southern arm complex of sloughs and lakes. These include Buffalo Slough, Whitaker Slough, Johnson Lake, Mays Lake, Whitaker Ponds, and Prison Pond all of which are active groundwater discharge areas, with visible springs. The Middle Slough receives water from the Upper Slough, stormwater outfalls, natural springs, overland flow from the south,

and groundwater. Historically, dozens of free-flowing streams and drainageways drained the Alameda Ridge and provided water to the Middle Slough. Nearly all of these have been piped or filled.

## Water Quality

Good water quality is important for the health of humans, fish and wildlife communities. People use Portland's waterways including the Columbia Slough for canoeing, fishing and other recreational activities. The Columbia Slough has suffered from severe water quality problems and contaminated sediments, resulting in large part from historic agricultural and industrial wastes as well as development patterns that have reduces vegetation and increased impervious surfaces.

The Oregon Department of Environmental Quality (DEQ) placed the Columbia Slough on the state's 303(d) list in 1994/1996 (DEQ 1999). The 303(d) list identifies water bodies that are "water quality limited" because they do not meet water quality standards for certain parameters. The Columbia Slough is water quality limited for the following parameters:

- Temperature
- Dissolved oxygen
- Eutrophication – nutrients, pH, chlorophyll-a (algae)
- Total suspended solids
- Bacteria
- Toxics in the Sediment (DDT/DDE, dieldrin, dioxins, PCBs and lead)

The hydrology of the Slough is a major factor in determining what happens to the pollutants that enter the waterway. Tidal influence, pumping regime and the low-gradient topography of the slough result in pollutants entering the Upper or Middle Slough eventually end up in the Lower Slough where they can stay for days to weeks, depending on the tides. Sediments transported into the Lower Slough can stay for decades.

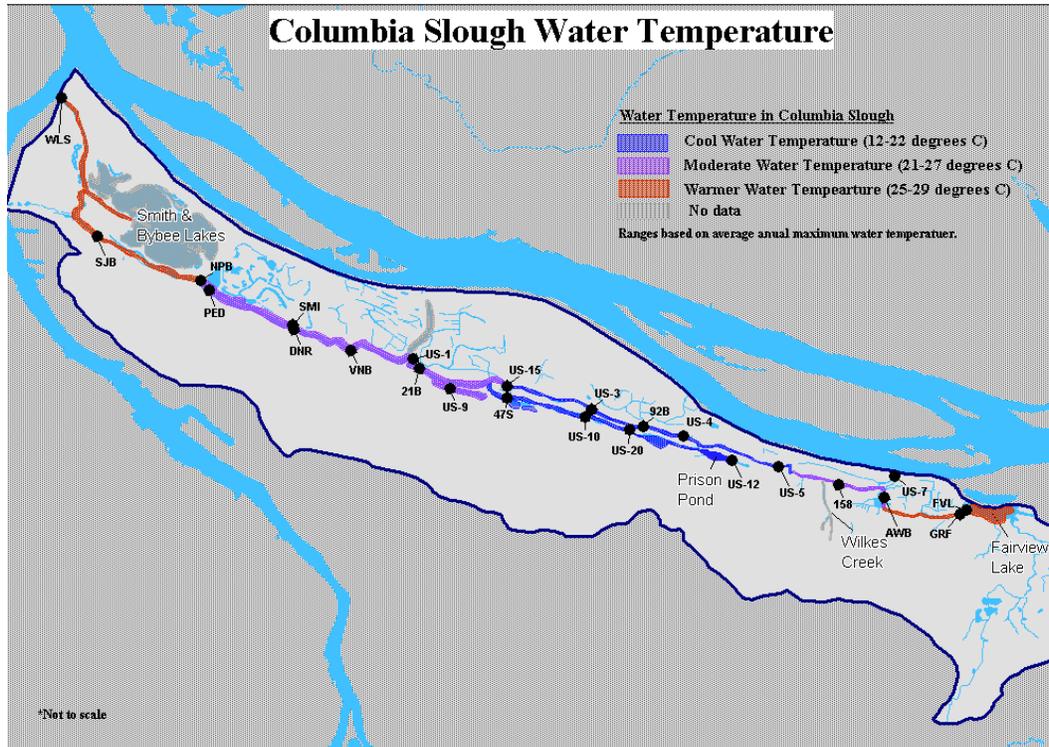
No formal water quality monitoring of the secondary drainageways has been completed. However, because water from the secondary drainageways is pumped into the Columbia Slough, the water quality of the secondary drainageways may have an impact on the water quality in the Columbia Slough.

### Temperature

Every species (microbes, fish, aquatic plants, etc.) is restricted to a certain temperature range. Most warm-water fish, such as bass, have an upper limit near 86°F (30°C) (Allan 1995). Warm-water fish usually can tolerate cold temperatures during part of the year because most warm-water streams/drainageways are cool in the winter months. However, warm-water fish are absent from streams and drainageways where the water temperature is cold year-round. Cold-water fish can survive for a short time in water above 68°F (20°C), but cannot survive at all in water above 86°F (30°C) (Allan 1995). Cool water is a basic requirement for native salmon, trout, some amphibians, and other cold-water aquatic species.

Past studies reveal that the Columbia Slough has had warm water temperatures since at least 1971, although the Slough has probably been a warm body of water since the installation of levees and because of the Slough's physical features as a low-gradient waterway (City of Portland Bureau of Environmental Services, 1995).

The Columbia Slough consistently meets temperature water quality standard in winter; it is 68°F (20°C) or cooler. In the spring, summer and fall the Slough does not meet the standard. The Middle Slough and Whitaker Slough have cooler water temperatures compared with the Upper Slough and Lower Slough, most likely because cool groundwater inflows (Map 11; note that individual locations on the map are water quality monitoring sites).



**Map 11. Water Temperature in the Columbia Slough**

A number of factors contribute to elevated water temperatures in the Columbia Slough. The banks of the Slough lack thick tree canopy, which would provide shading that could keep water temperatures cool. The physical features of the Slough are another factor. The Slough is a low-gradient and shallow system that has long residence times, which is the amount of time it takes for water to move downstream. Long residence times combined with shallow water and low shading densities can cause the water temperature to increase. Another contributing factor is culverts that are too small or sited too high and thus cause impoundments that increase water residence time. Extensive development has changed the hydrologic cycle, reducing subsurface groundwater recharge and potentially reducing cool groundwater inflow during the summer months.

#### Dissolved Oxygen

Dissolved oxygen (DO) is a very important water quality parameter for the Columbia Slough. Low DO is one of the limiting factors for fish and benthic organisms (invertebrates that live in the Slough bottom and provide food for fish). Fish use oxygen when it is transported across the gills by diffusion; this process relies on the difference in concentration of DO in the water versus in the fish.

DO in the Columbia Slough is generally high in the summer because macrophytes and algae add oxygen into the water through photosynthesis. In the fall and winter DO is generally lower, and the Slough occasionally does not meet water quality standards.

One source of low levels of DO during the fall is the reduction of DO inputs from photosynthesis when algae and macrophytes die-off and decomposition of the biomass that creates a food source for insects and bacteria, which also consume DO.

Until recently, low levels of DO in the Middle and Lower Slough in the winter was exacerbated by inflows of anti- and de-icing agents used at the airport and, to a lesser extent, the Oregon Air National Guard during severe weather events. Past deicing events resulted in DO dropping very low, in some cases to zero, in the Lower Slough for several days. Since 1997, the Port has implemented best management

practices to reduce the discharge of anti- and deicing agents to the Columbia Slough. In 2003, the airport deicing collection system became operational and significantly reduced anti- and de-icing agents in stormwater runoff, reducing biochemical oxygen demand load discharge to the Columbia Slough. The Port is continuing to update its deicing program.

Other deicing activities that could be associated with the winter low levels of DO in the Middle and Lower Columbia Slough include City, County, and State road deicing activities, and local private businesses and residence deicing activities. Currently, there is little or no data tracking or quantifying the biochemical oxygen demand contribution of these other deicing activities.

During the summer, occasional low levels of DO, generally in the early morning hours, are due to respiration by the excessive amounts of algae and macrophytes present in the Slough.

#### Eutrophication (Nutrients, Chlorophyll a, and pH)

Eutrophication is a natural process by which nutrients and organic substances enter an aquatic ecosystem and increase the biological productivity, which leads to increased amounts of algae and macrophytes. Excess algae and macrophyte growth creates conditions that interfere with the health and diversity of indigenous fish, plant, and animal populations. Excess algae and macrophyte growth also influences MCDD's ability to pump water from the Middle Slough and can make recreational use of the waterway difficult. Management agencies are continually working on strategies to optimize macrophyte growth for habitat and balance that with maintaining water quality, flow and conveyance.

High nutrients stimulate excessive algal growth (measured by chlorophyll *a*), which causes daily pH variations. pH is the measure of the acidity and alkalinity of water. Both low and high pH values are harmful to organisms. Low pH can result in increased solubility of many metals that are toxic to aquatic species. High pH can increase the toxicity of ammonia to fish and other aquatic biota. In general, if the pH of a system is near neutral, small variations in pH have little effect on the biota. However, extreme variations in pH have a great effect. In the Slough, pH fluctuations occur because during the day algae use carbon dioxide for photosynthesis, which increases pH. At night, algae continue to respire releasing excess carbon dioxide and thus lowering pH. pH in the Middle Slough generally stays within the upper and lower limits set by DEQ.

Human activities can greatly accelerate eutrophication by increasing the rate at which nutrients and organic substances enter the water. Sources of nutrients include agricultural runoff, urban runoff (stormwater), leaking septic systems, sewage discharge, eroded stream banks, and the annual recycling of nutrients. Eutrophication is also influenced by warm water, access to solar radiation (the amount of sun that reaches the water column) and slow water flows.

#### Total Suspended Solids (TSS)

Suspended solids (fine soil particles that are suspended in the water column) pose a water quality problem for multiple reasons:

- Organics such as PCB, dieldrin, DDT, DDE, and dioxin and metals that are toxic to aquatic life bind to organic matter in soil particles.
- Nutrients can bind to suspended solids, increasing eutrophication.
- Suspended solids cause turbidity and siltation that cause breathing problems in fish and limit macroinvertebrates' ability to find food.
- Suspended solids can decrease sunlight available to aquatic life.

There are two pathways in which TSS enters the Columbia Slough water body: sediment inputs to the waterway and re-suspension. The main source of new TSS in the slough is sediments transported in stormwater from streets, parking lots, driveways, agriculture runoff, and construction activities. These sediment inputs may contain pollutants described above. The second pathway, re-suspension, also referred to a bioperturbation, is when settled sediments and associated pollutants are reintroduced into the water column. This occurs in the Columbia Slough primarily as a result of carp activities.

### Bacteria

Bacteria in the Slough poses a human health threat because contact with and ingestion of human pathogens, which can occur during recreational activities such as boating and fishing, can cause skin and respiratory ailments and gastroenteritis. Fecal coliform bacteria are monitored to detect the presence of human pathogens.

In the Middle Slough, the water quality standards set by DEQ for fecal coliform are nearly always met. The occasions when the standards are not met are very few and follow no discernable pattern. Fecal coliform has many possible sources, some of which are naturally occurring in the ecosystem. Possible sources in the Middle Slough include:

- Urban stormwater runoff, which contains bacteria, primarily from pet feces
- Wildlife feces from birds and wildlife
- Old or poorly maintained cesspools and septic systems along Whitaker Slough, which may leak
- Illicit sewage discharge is also a possible source

### Sediment Quality

Sediments are soil particles, sand, clay, or other substances, that settle to the bottom of a water body. They act like sponges that soak up a variety of chemicals. Of particular interest are heavy metals and toxic organic chemicals, which are often bound to sediment particles and are not readily broken down by microbes. These chemicals do not pose a great threat to the environment if they are inert or remain insoluble. Some of them, particularly toxic organic compounds, have a tendency to leave the sediment particles, dissolve in water, and eventually become accumulated by biological organisms. Over time, some of these chemicals move up the food chain from plants to insects to fish. In the process, the amount of toxics progressively increases in concentration (called biomagnification) in the tissues of these organisms. Through the biomagnification process, low concentrations of contaminants in the sediments eventually increase to more elevated levels in organisms higher in the food chain, to an extent that may be detrimental to the organisms' well-being and to the animals or people who eat them. If dissolved organic pollutants are in the water, biomagnification can also occur directly through the water column, without sediment as an intermediary.

Other chemicals, such as heavy metals (commonly chromium, copper, lead, and zinc) may have a more direct effect on the environment through their toxicity to bottom-dwelling organisms, called benthics. Benthic macroinvertebrates (organisms lacking a backbone, such as fly nymphs, dragonfly nymphs, beetles, and true bugs) are the base of the food chain and therefore support higher organisms such as fish.

Sediments come from many sources:

- Natural weathering of rocks
- Erosion of upland soils, loose materials near stream/drainageway banks, and non-vegetated or unstabilized river banks
- Particles from impervious surfaces, such as streets, parking lots, roofs, and buildings that are transported in stormwater runoff
- Vegetative debris and breakdown products
- Construction sites without adequate erosion control

The Columbia Slough has fine, silty sediments with fairly high organic matter content. Because the Slough is located in an urban and industrial watershed, the sediments contain elevated levels of contaminants compared to sediments in pristine watershed unaffected by human activity. Studies conducted by Bureau of Environmental Services, DEQ and Metro indicated elevated levels of heavy metals, PCBs and pesticides (such as DDTs and dieldrin) in the Columbia Slough.

## Vegetation, Habitat and Wildlife

Vegetation in the Columbia slough watershed is a combination of native and non-native, invasive species. Native vegetation found throughout the Columbia Slough watershed, such as willow, black cottonwood, Oregon ash, Douglas hawthorn, Oregon white oak, sedges, and rushes, provide many important ecologic functions including supporting native wildlife. Populations of wapato and Columbia sedge are less common, found only in a few places (Lev et al. 1994).

As urbanization has occurred, non-native plant species have proliferated, adapting to the urban environment and out-competing native species. Areas that were naturally maintained by seasonal flooding have been filled, allowing non-native species to infiltrate. Some noxious weed species in the watershed include Himalayan blackberry, English ivy, reed canarygrass, purple loosestrife, and Japanese knotweed.

Along the banks of the slough, a narrow strip of remnant native riparian vegetation still exists, although it is frequently bisected by roads. Black cottonwood, Oregon ash, willow and red osier dogwood are the predominant native species. Himalayan blackberry, nightshade, Japanese knotweed and reed canarygrass are the predominant non-native, invasive species. Adjacent urban development encroaches into the riparian area, reducing its width and fragmenting habitats.



The vegetation surrounding the secondary drainageways varies greatly from bottomland hardwood forests to herbaceous vegetation.

There are remaining areas of Oregon white oak and prairies in the watershed. These vegetation assemblages continue to decline in the city.

The City of Portland's Watershed Revegetation Program partners with willing public and private property owners to plant native vegetation and remove invasive weed species throughout the watershed. To achieve water quality goals, the program focuses on properties along waterbodies. To date, the program has revegetated more than 1,000 acres along over 50 miles (272,000 linear feet) of riparian corridor throughout the Columbia Slough watershed, and has consistently exceeded the goal of 400 trees per acre. The plantings have greatly increased native vegetation diversity and total canopy coverage in the watershed, and have displaced non-native vegetation.

The Columbia Slough, secondary drainageways, wetlands, vegetation, along with other natural resource and built features, provide habitat for fish and wildlife. Many of the native species that were historically found in the Columbia Slough watershed still occur here (specific examples of wildlife are provided below). However, most of them are much less abundant. Table 7 includes Oregon Department of Fish and Wildlife (ODFW) listed species that are likely to occur in the watershed.

In addition, several introduced species have become so abundant that they dominate plant and animal communities. Although impacts have occurred, there remain valuable habitat areas and wildlife populations in the study areas, such as large wetland expanses.

Much of the Middle Columbia Corridor/Airport Natural Resources Inventory area has been classified using the Johnson & O'Neil Regional and the Port of Portland's Local classification systems. Each of the habitat classes found in the Middle Columbia Corridor/Airport Natural Resources Inventory area are discussed below. For each habitat type a summary of fish and wildlife species associated with that habitat is provided. More detail, including fish and wildlife species observed, is provided in the natural resource description for each inventory site.

**Table 7: Oregon Department of Fish and Wildlife Listed Species**

	<b>Common Name</b>	<b>ODFW Status</b>
Amphibian	Northern Red-legged Frog	Sensitive Vulnerable
Bird	Little willow flycatcher	Species of Concern
	Olive-sided flycatcher	Sensitive Vulnerable
	Willow flycatcher	Sensitive Vulnerable
	Yellow-breasted chat	Sensitive Critical
	Western purple martin	Sensitive Critical
	American peregrine falcon	Sensitive Vulnerable
	Bald Eagle	State ESA Threatened
	Osprey	Other Species of Conservation Concern
	Great Blue Heron Rookeries	Other Species of Conservation Concern
	Grasshopper sparrow	Sensitive Vulnerable
	Oregon vesper sparrow	Sensitive Critical
	Streaked horned lark	Sensitive Critical
	Western bluebird	Sensitive Vulnerable
Mammal	Fringed myotis	Sensitive Vulnerable
	California bat	Sensitive Vulnerable
	Long-legged myotis	Sensitive Vulnerable
	Hoary bat	Sensitive Vulnerable
	Silver-haired bat	Sensitive Vulnerable
Reptile	Western painted turtle	Sensitive Critical
	Western pond turtle	Sensitive Critical

### **Open Streams, Drainageways, Slough, Lakes and Rivers**

Open water habitat is abundant throughout the Columbia Slough watershed, with mainstem and secondary drainageways and several lakes and ponds. Fish and mussel species dominate the slough mainstem and some lakes and ponds, although other species are also present (e.g., macrophytes, algae). In addition, some wildlife species such as northern river otter, American beaver, nutria (non-native), muskrat, fish-dependent birds and several species of waterfowl, use open water habitats for various portions of their life cycle.

It is likely that all of the Columbia Slough's waterways historically contained off-channel and rearing habitat for coho salmon, coastal cutthroat trout, Chinook salmon, and possibly steelhead during some portion of their life cycle (Fishman 1989). Extensive lakes, wetlands, and slough channels found throughout the watershed offered a mosaic of habitat types for juvenile salmonids during their migration from their natal streams in the Willamette and Columbia basins to the ocean.

Since 2001, the City of Portland's Science, Fish and Wildlife program, Ducks Unlimited, Oregon Department of Fish and Wildlife and Floodplain Fish Investigations Northwest have been collaboratively sampling the Lower Columbia Slough for fish use. The sampling efforts have resulted in the capture of nearly 30 species of fish, freshwater shrimp, and crawfish. Salmonid distribution is limited to the Lower Slough below the MCDD No. 1 levee and pump station near NE 18<sup>th</sup> Avenue, therefore salmonids are not found within the Columbia Corridor/Airport Natural Resources Inventory study area (Bureau of Environmental Services, 1997). However, water quality of the Middle Slough, which is pumped into the Lower Slough, may impact the aquatic habitat of the Lower Slough.

As of 2004, studies of fish in the Columbia Slough, including the Upper, Middle and Lower Columbia Slough, Whitaker Slough and Buffalo Slough, have collectively identified nearly 30

species that utilize the slough mainstem during some period of their life cycle. Of these, about half are native to the watershed, and the other half has been introduced. Several of the native species are listed under the Endangered Species Act.

The Columbia Slough provides habitat for three species of native freshwater mussels. Freshwater mussels are bivalves that prefer the soft bottom substrate (silt and sand) found in the Columbia Slough. These species include Oregon floater, California floater, and winged floater. A large number of the freshwater mussels in the United States are federally listed as threatened or endangered, due to threats to mussel habitat, indirect mortality, and direct mortality. Of the three species found in the Columbia Slough, only the California floater is federally listed as a species of concern (SOC).

#### *Open Water Associated Fish and Wildlife Species<sup>5</sup>*

##### *Columbia River*

- *Fish* - Pacific lamprey, starry flounder, white sturgeon, Chinook salmon, coho salmon, steelhead trout, chum salmon, sockeye salmon
- *Birds* – common loon, horned grebe, Western grebe, Caspian tern, double-crested cormorant, lesser scaup, bald eagle, peregrine falcon, purple martin, dunlin
- *Mammals* – American beaver, Steller's sea Lion, California sea lion

##### *Middle Columbia Slough*

- *Fish* – three-spined stickleback, largescale sucker
- *Amphibians* – Northern red-legged frog, Northwest Salamander, Long-toed Salamander
- *Reptiles* – Western painted turtle
- *Freshwater Mussels* – Oregon floater, California floater, winged floater
- *Birds* – Great blue heron, green heron, wood duck, American wigeon, hooded merganser, green-winged teal, belted kingfisher, Vaux's swift, violet green swallow, tree swallow
- *Mammals* – Yuma myotis, long-legged myotis, long-eared myotis, silver-haired bat, hoary bat, muskrat, Northern river otter

### **Westside-Riparian Wetlands**

Westside-riparian wetlands are also known as riparian habitats. Riparian habitats are water-dependent ecosystems characterized by rich and diverse groups of plant and animal species. They are the transitional ecosystem between terrestrial and aquatic ecosystems. Riparian ecosystems provide a variety of watershed functions, including reducing flood peaks and regulating stream flow, stabilizing banks, and replenishing groundwater (City of Portland Bureau of Planning 2001). Riparian vegetation helps improve water quality by moderating in-water temperatures through shading and filtering sediment, nutrients, and pollutants. Riparian areas provide large wood to the stream/drainageway, while also providing a variety of food sources (fine organic litter) for aquatic species. Riparian areas also function as travel corridors for various wildlife species, provide feeding and nesting habitat for resident and neotropical migratory bird species, and provide important habitat functions for water-dependent species.

Most riparian corridors in the Columbia Slough Watershed contain buildings and paved spaces, including residential and commercial / industrial property with minimal riparian vegetation. The remaining riparian forest habitat is generally a narrow band dominated by black cottonwood, Oregon ash, willow species, and red osier dogwood, with an understory of Himalayan blackberry (non-native), common snowberry, and reed canarygrass (non-native). In general, riparian areas

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<sup>5</sup> The lists of species provided with the habitat descriptions is intended to highlight some of the wildlife species associated with each habitat type; these are not exhaustive lists. The natural resource descriptions for each inventory site provide additional information about species use.

along the Columbia Slough are narrow and fragmented, therefore important functions of riparian areas, including a contiguous wildlife travel corridor, microclimate and shade, bank stabilization and sediment control, pollution control, streamflow moderation, organic matter input, and large woody debris, are negatively impacts (see Riparian Corridors section for additional information.)

Wildlife species diversity in the watershed is richest in riparian habitats because both water-dependent and upland species use this habitat for feeding, resting, breeding, and cover. Upland species also use the riparian areas for travel, feeding, and other life functions. *Metro's Technical Report for Fish and Wildlife Habitat* (April 2005) states that over 90% of the wildlife species in the Portland region are dependent on riparian areas for some portion of their life cycle. Special status species, including western painted turtle, western pond turtle and northern red-legged frog, use wetlands during portions of their life cycle.

Stands of mature black cottonwood adjacent to waterways provide a particularly important habitat for great blue heron rookeries. One such rookery exists adjacent to the Lower Slough. In past years the rookery has had over 80 nests; however the numbers have decreased to 16 in 2009.

There are four types of wetlands in the watershed: forested wetland/riparian areas, scrub-shrub wetland, herbaceous wetland and exposed mudflats.

Forested wetlands and riparian areas often overlap in the Middle Slough. The dominant vegetation of forested wetlands is similar to riparian areas: mixed-age black cottonwood, a variety of willow species, and Oregon ash, with an understory of reed canarygrass (non-native), red osier dogwood, and common snowberry. Forested wetlands provide habitat for cavity nesters and roosting, perching, and nesting habitat for raptors, woodpeckers, and songbirds. The species found are similar to those using riparian habitats. Stands of forested wetlands are scattered throughout the watershed.

Scrub-shrub wetlands historically dominated the Columbia River floodplain, occurring on gravel bars and in stream/drainageway channels and tolerating variable water flow. This habitat type diminished with agriculture, flood control, and urbanization, and is now almost nonexistent in the watershed. The few communities remaining are dominated by willows, Douglas spirea, rose (*Rosa sp.*), common snowberry, and red osier dogwood, and are often associated with emergent wetland habitats.

Herbaceous and emergent wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The water level typically recedes in the summer, exposing mud flats and creating habitat for seasonal species such as shorebirds. Channel dredging, flood control, and draining for agriculture in the watershed have caused a sharp decline in emergent wetland habitat. The hydrologic changes to the watershed have also created a favorable environment for non-native species such as reed canarygrass and purple loosestrife.

Herbaceous wetlands are the most prevalent wetland habitat in the Columbia Slough watershed. The vegetation includes soft rush, smartweed, beggar's tick, and reed canarygrass (non-native), and sometimes includes native rice cut-grass and ovate spike-rush. Habitat value is highest where the emergent wetland is adjacent to or mixed in with other wetland or habitat types. In many areas, reed canarygrass forms a monoculture stand that reduces the habitat value of the wetland.

The City of Portland, MCDD, and the US Army Corps of Engineers initiated a 3-year project (1135 Project) in 2002 to improve water flow and quality and create additional habitat in the Middle Slough. The project created emergent wetland benches along approximately 7 miles of the Slough from NE 18<sup>th</sup> Avenue to NE 158<sup>th</sup> Avenue by dredging a meandering channel through the Slough and casting the dredged material along the channel edges. The ecological goal of the emergent wetland benches is to increase channel complexity and provide hydrologic conditions that more

closely resemble off-channel sloughs with direct connection to the Columbia River. the project will created 15 acres of in-channel emergent wetlands.

Exposed mudflats are created where the water column abuts the stream/drainageway bank, and provide a variety of habitat for numerous species. Vegetation frequently consists of aquatic macrophytes, emergent wetland species, mixed grasses, and occasionally shrub species. Shrub and groundcover include red osier dogwood, willow species, sedges, rushes, beggars tick and reed canarygrass (non-native). In many cases, riparian emergent and scrub/shrub wetlands occur adjacent to exposed mudflats and provide cover and nesting habitat for numerous songbirds. The presence of ample water and terrestrial vegetation also provides suitable nest and den habitat for a number of mammal species. In the spring and fall, these mudflats provide feeding habitat for migrating shorebirds.

#### *Forested and Scrub-Shrub Wetland Associated Fish and Wildlife Species*

- Amphibians –Northern red-legged frog
- Reptiles – Northwestern pond turtle, western painted turtle
- Birds – Great blue heron, green heron, wood duck, hooded merganser, bald eagle, band-tailed pigeon, downy woodpecker, willow flycatcher, yellow warbler, black-throated gray warbler, common yellowthroat, Wilson's warbler, bullock's oriole, bufflehead, American kestrel, merlin, Peregrine falcon, Vaux's swift, rufous hummingbird, pileated woodpecker, olive-sided flycatcher, western wood-pewee, pacific-slope flycatcher, purple martin, nushtit, brown creeper, house wren, winter wren, Swainson's thrush, orange-crowned warbler, Nashville warbler, red crossbill
- Mammals – Yuma myotis, long-legged myotis, long-eared myotis, silver-haired bat, hoary bat

#### *Herbaceous, Emergent Wetland and Exposed Mudflat Associated Fish and Wildlife Species*

- Amphibians – Northern red-legged frog
- Reptiles – Northwestern pond turtle, western painted turtle
- Birds – Great blue heron, green heron, bufflehead, common yellowthroat, wood duck, hooded merganser, bald eagle, American kestrel, merlin, Peregrine falcon, Vaux's swift, rufous hummingbird, purple martin, western meadowlark
- Mammals – Yuma myotis, long-legged myotis, long-eared myotis, silver-haired bat, hoary bat

### **Westside Conifer-Hardwood Forest**

Westside conifer-hardwood forests are also know as, and will be referred to in this document, mixed-canopy forests. Mixed-canopy forests in the Portland area generally occur in areas of low-density urbanization. The forested uplands in the Columbia Slough watershed are primarily mixed deciduous stands dominated by big leaf maple, black cottonwood, red alder, Oregon ash and willow species, with occasional Oregon white oak. These forests contain a diversity of native and non-native understory vegetation.

Most conifers found in the watershed are within City parks, and on the escarpment in the eastern portion of the watershed, south of Airport Way between NE 154<sup>th</sup> Avenue and NE 181<sup>st</sup> Avenue (the Wilkes Creek and Big Four Corners area). In addition, several revegetated areas along the Slough include western red cedar, Douglas fir, and grand fir saplings.

The snags and bare-topped trees found in forested areas provide nesting and roosting habitat for various raptors. Mature stands of trees can provide important nesting habitat for cavity dwellers such as woodpeckers and tree swallows. Diverse foliage heights (limbs and stalks of varying height) correlate to increased bird species diversity. These areas of denser vegetation result in a

greater abundance of small mammals, especially rodents (mice, voles) that are essential for healthy biological communities and important in bird food chains.

In addition to the habitat features provided by upland areas, forested upland areas also provide important functions for hydrology, water quality and air quality. Mature tree canopy intercepts up to 30 percent of the rain that falls on it and provides onsite infiltration. This helps decrease the amount of rainwater that enters the stormwater sewer system and provides some level of groundwater recharge. In addition, interception helps reduce pollutants that may reach the Slough (sediments and suspended solids). Other benefits include shade that can reduce the urban heat island effect and cool stormwater runoff, noise abatement, reduction of air temperature, carbon sequestration, and reduction of greenhouse gases.

#### *Westside Conifer-Hardwood Forest Associated Fish and Wildlife Species*

- Amphibians – Northern red-legged frog
- Reptiles – Northwestern pond turtle
- Birds – Hooded merganser, band-tailed pigeon, olive-sided flycatcher, pacific-slope flycatcher, varied thrush, black-throated gray warbler, hermit warbler, Wilson's warbler, great blue heron, wood duck, white-tailed kite, bald eagle, American kestrel, merlin, Peregrine falcon, common nighthawk, Vaux's swift, rufous hummingbird, downy woodpecker, pileated woodpecker, western wood-pewee, willow flycatcher, Hammond's flycatcher, Hutton's vireo, red-eyed vireo, purple martin, bushtit, brown creeper, house wren, winter wren, Swainson's thrush, orange-crowned warbler, Nashville warbler, common yellowthroat, yellow-breasted chat, chipping sparrow, red crossbill
- Mammals – Long-legged myotis, silver-haired bat, white-footed vole, red tree vole, yuma myotis, fringed myotis, long-eared myotis, hoary bat, pacific western big-eared bat, western gray squirrel, American beaver

#### **Mixed Herbaceous/Westside Grasslands**

Numerous areas in the watershed have been severely affected by human activities. These include the St. Johns Landfill (a grassland), dredge material disposal sites, levees, and empty lots. These non-forested open areas often contain sparse scrub brush and grass vegetation, and the soil is usually fill and/or compacted. They have taken on some of the habitat functions of natural meadow or grassland habitat, which is non-existent in the area. Levees are included in this category because they are maintained with grassy vegetation (to ensure that trees and woody vegetation do not compromise their stability for flood control).

Although these areas are often dominated by non-native grasses and invasive vegetation, they provide limited habitat for generalist species such as moles, voles, and other small mammals. Predators such as coyotes and raptors use them extensively for hunting grounds. These areas also serve as the last remaining habitats for bird species requiring meadow habitat, such as streaked horned lark and western meadowlark, whose populations have rapidly declined in the watershed in recent years. These species may occasionally be found in the last remaining agricultural fields in the upper watershed, at the St. Johns Landfill, and in the undeveloped portions of the Rivergate Industrial Area in the lower watershed.

#### *Mixed Herbaceous/Westside Grasslands Associated Fish and Wildlife Species*

- Amphibians – Northern red-legged frog
- Reptiles – Northwestern pond turtle
- Birds – Acorn woodpecker, white-breasted nuthatch, western meadowlark, great blue heron, bald eagle, American kestrel, merlin, Peregrine falcon, Vaux's swift, rufous hummingbird, purple martin, brown creeper, house wren, orange-crowned warbler, common yellowthroat

- *Mammals* – *Western grey squirrel, yuma myotis, long-legged myotis, long-eared myotis, silver-haired bat, hoary bat*

### **Urban and Mixed Environs (aka cultural / landscaped areas)**

Urban and mixed environs are generally landscaped or intensely managed (e.g. frequent mowing) areas. The vast majority of land in the Columbia Slough watershed is occupied by industrial, commercial, and residential uses. These urban areas are characterized by built structures and paved surfaces, providing minimal habitat value. Native plants, occasionally used in landscaping, and street trees provide shelter and forage for some tolerant wildlife species, as well as more sensitive migratory species. In Portland, landscape areas, although generally small and fragmented, can serve as migratory stopover habitat for species traveling along the Pacific Flyway. Street trees, in addition to providing some habitat value, help restore the natural hydrologic cycle and reduce the volume and negative effect of stormwater runoff. Residential neighborhoods often have bird feeders, bird baths, and bird houses that support some backyard wildlife during some parts of the year.

Urban areas in the watershed typically have less species diversity and a greater percentage of exotic flora and fauna than the other habitat types described above. Mammals found in this habitat type are primarily tolerant, small rodents such as the non-native house mouse. Both possum and raccoon have adapted to urbanization and can often be sighted in neighborhoods, scavenging around houses for garbage and pet food. Omnivorous birds, such as the European starling (non-native) and house sparrow (non-native), and various species of gulls and corvids (crows and jays), dominate, although some sensitive migratory birds stopover in landscape and street trees. One sensitive species, the peregrine falcon, has adapted to using Portland bridges for nesting.

This habitat type also includes open space that is maintained for specific purposes, including the airport airfield. Other examples of this habitat type include golf courses, agricultural lands, athletic fields, cemeteries, and maintained parks. The majority of the understory vegetative cover is non-native grass species. However, edges and roughs in golf courses and the use of native plants and Naturescaping (creating natural landscapes with native vegetation) can provide islands of wildlife habitat.

The urban landscape offers many opportunities for incorporating habitat. Native plants, street trees, and eco-roofs and roof gardens can provide habitat for birds and insects. Structures, such as osprey platforms and bat boxes, can be added to many developments. However, urban noise and lighting, as well as other impacts (e.g. domesticated pets) can impact wildlife use of these habitat features.

Habitat function is limited in landscaped habitat. Numerous insect-eating bird species, mice, moles, voles, and rabbits use these areas for foraging, and raptors use them for hunting grounds. Less-maintained areas provide shelter and forage for a limited number of species. Despite being isolated from other habitat areas, larger city parks can be oases for bird species.

The Portland International Airport airfield is approximately 1,000 acres and contains a large expanse of grasslands and sparsely vegetated areas, in addition to two primary parallel runways, taxiways, and associated airport roads and buildings. Per the Federal Aviation Administration (FAA) requirements, the Port of Portland has developed a Wildlife Hazard Management Plan to manage risk at the airport by reducing the probability of wildlife/aircraft collisions. The habitat provided by urban and mixed environments at the airport supports some wildlife species of concern as well as species that do not pose a risk to aviation safety.

The wildlife species of concern list consists primarily of medium to large sized birds (raptors, waterfowl, and great-blue heron) and birds with a tendency to form flocks (i.e., waterfowl, European

starling, gulls, rock pigeon) that frequent the airfield. Predatory birds such as hawks, owls and herons pose complex challenges regarding prey base (e.g., moles and voles) management. The program utilizes innovative approaches to discourage wildlife from using the airfield area, while focusing on immediate operational strategies, ongoing applied research and development, long-term management strategies, and an information and education component (Port of Portland 2003). Additionally, a City of Portland aircraft landing overlay zone, to provide safer operating conditions for aircraft, limits the heights of structures and vegetation in the area. Both the program and zoning overlay are important to consider when prioritizing future habitat restoration projects in the vicinity of the airport.

## Recreation

Recreation is one of the long-planned land uses in the watershed. The *Olmsted Parks Plan* of 1903 cited the Columbia Slough as a desirable location for recreational activities, including walking, boating, and horseracing.

The Slough waterway provides excellent canoeing and kayaking opportunities, with seven canoe and kayak launch sites. Canoeing from the headwaters to the confluence is possible; however a few portages and paddling through a couple of large culverts are required. Numerous trail segments exist within the watershed. The 40-Mile Loop Trail (which will encompass 140 miles of trails throughout Portland when completed) has many sections within the watershed. The Peninsula Crossing Trail, I-205 bike path, Lewis and Clark Greenway Heritage Trail system, and a paved bike path along much of Marine Drive provide hiking and biking opportunities.



Trail along Alderwood Drive



Paddlers near NE 42<sup>nd</sup> Avenue

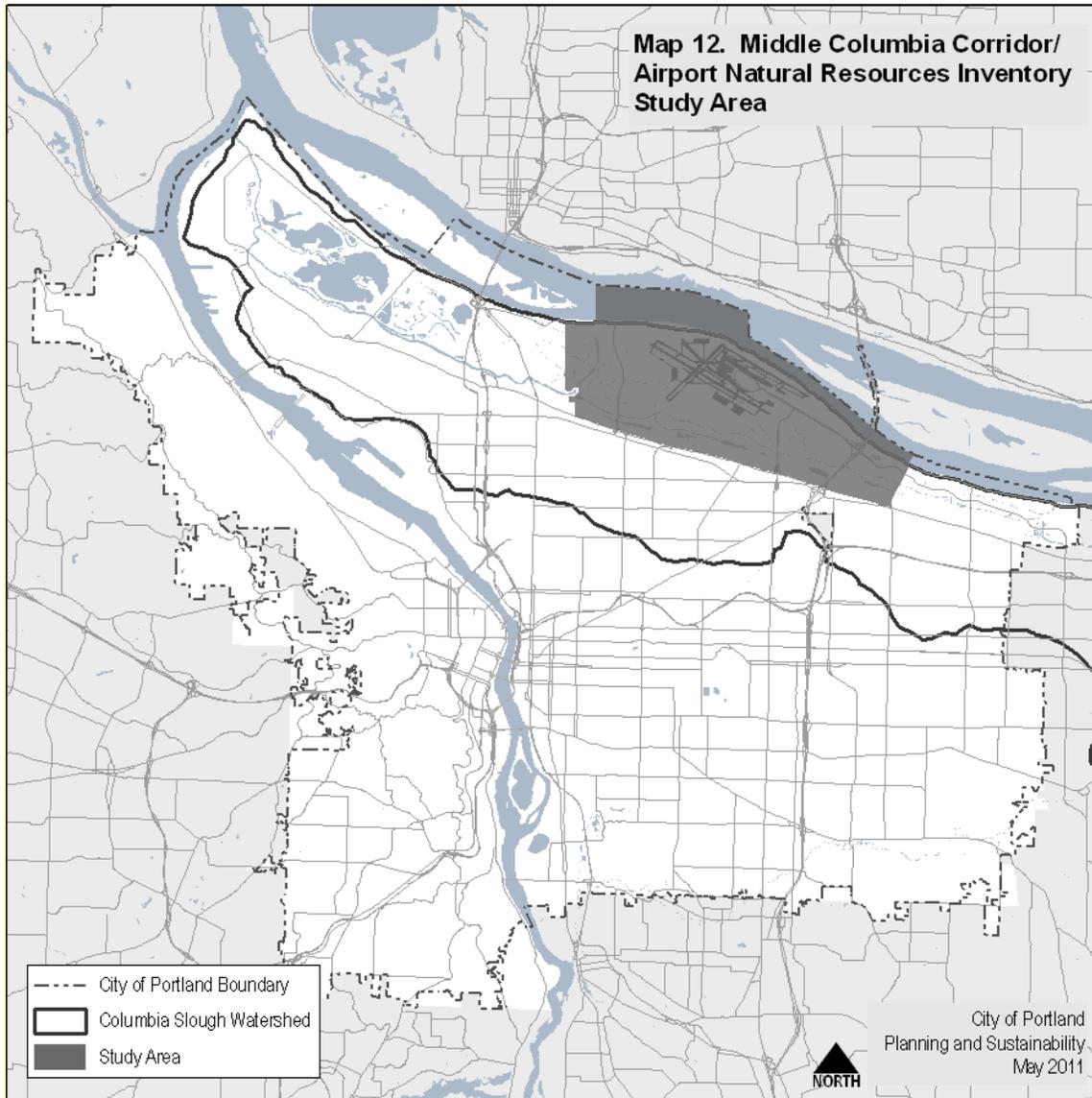
Smith and Bybee Lakes Wildlife Area, the Children's Arboretum, Kelley Point Park, six golf courses, and Whitaker Ponds Learning Center provide additional recreational opportunities. Much of the watershed provides excellent wildlife viewing opportunities.

There can be conflicts with recreation and wildlife habitat. Trails can fragment habitats and creating an edge where invasive plants (e.g. Himalayan blackberry) can spread into the interior habitat area. Some wildlife species are particularly sensitive to noise, light and domestic pets. Ground-nesting species could be impacted by off-trail hiking, biking and dog activity.

## Section 4c: Natural Resources Inventory Study Area

### Overview

The Middle Columbia Corridor/Airport Natural Resources Inventory study area is 7,390 acres in size and extends six miles from NE 122<sup>nd</sup> Avenue in the east to the Multnomah County Drainage District Levee in the west, which is located at approximately NE 17<sup>th</sup> Avenue. The study area is located primarily within the Columbia Slough Watershed, but also includes the south bank and 1,300 acres of the Columbia River (Map 12).



The study area is located near the center of the Columbia Slough watershed; in a portion that has piped surface water, dikes and levees, and a system of pumps that provide hydrologic management and flood control. The Columbia Slough waterway within the study area is composed of a main channel, called the Middle Slough, and southern channels called Whitaker Slough and Buffalo Slough. There are also

secondary drainageways<sup>6</sup> near the airport that are piped or pumped to the Middle Slough. The Middle Slough in turn drains to the Lower Slough.

The inventory study area contains approximately six miles of the Columbia River and six miles of the Columbia Slough – Middle Slough is five miles, Whitaker Slough is three miles and Buffalo Slough is one mile. The Columbia River makes up roughly 1,300 acres or 1% of the study area. There are 23 miles of secondary drainageways and 192 acres of wetlands, including Subaru Wetland. The flood area is largely contained within the levees, however there are a few locations of remaining flood area outside of the levees. The total flood area is 2,000 acres, 1,300 acres of which is open water area of the Columbia River and Columbia Slough.

## Hydrology

The Middle Slough and associated waterways are completely surrounded by levees and are within the Multnomah County Drainage District (MCDD). As a result, the water can only reach the Lower Slough if pumped or allowed to flow through the levee's gravity gates in the MCDD levee. In an average year, MCDD is able to allow Middle Slough water to flow through the floodgates into the Lower Slough by gravity for only a few weeks (generally late fall to early winter). During the other months, or when water levels in the Lower Slough are higher than those in the Middle Slough, water must be pumped against the gradient. Pump Station No. 1 has a pumping capacity of 250,000 gallons per minute (gpm).

The width of the Middle Slough mainstem waterway varies in general from 30-100 feet. A section just upstream of MCDD Pump Station No. 1 (where the Vanport Flood broke the levee and gouged out the channel) was 90 feet deep after the 1948 flood, but now is approximately 10 to 16 feet deep. The average channel depth in the Middle Slough ranges is six to eight feet (CH2M Hill 1995). Estimates of groundwater inflow in the Slough vary from 50 to 100 cubic feet per second (cfs).

In 2002, the City of Portland, MCDD, and the US Army Corps of Engineers initiated a 3-year project (1135 Project) to improve water flow and quality and create additional habitat in the Middle Slough. The project consisted of dredging a meandering channel through the Slough between NE 18<sup>th</sup> Avenue and NE 158<sup>th</sup> Avenue and casting the dredge materials along the channel edges to create emergent wetlands.

## Water Quality

As discussed in the previous section, the Columbia Slough is water quality limited for temperature, dissolved oxygen, eutrophication (nutrients, pH, chlorophyll-a), total suspended solids, bacteria and toxics in the sediment (DDT/DDE, dieldrin, dioxins, PCBs and lead).

The Middle Slough and Whitaker Slough have cooler water temperatures compared with the Upper Slough and Lower Slough, most likely because cool groundwater inflows. However, in-water temperatures do not meet water quality standards consistently in the summer. A significant contributing factor is the lack of large trees and overhanging vegetation to shade the water surface.

Water temperature is a significant factor in eutrophication and dissolved oxygen. In the spring and summer, warmer water and solar access, combined with high nutrients, results in excess algae and macrophyte growth. Algae and macrophytes use carbon dioxide in the day and produce oxygen, which can increase the dissolved oxygen concentration but can also increase pH. At night the opposite occurs and the dissolved oxygen concentration can be depleted and pH can decrease. Large fluxuations in

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<sup>6</sup> Historically, small drainageways reformed annually when Columbia River floodwater receded. After the levees were constructed, remnant secondary drainageways were likely altered and additional drainageways created to drain agricultural lands. Today, many of the remaining secondary drainageways, which are sometimes referred to as 'ditches', convey surface water and groundwater from developed and undeveloped lands to the Columbia Slough. The Multnomah County Drainage District (MCDD) operates the pumps that move water from numerous secondary drainageways into the main arm of the slough.

dissolved oxygen and pH are hard on aquatic species. Acute low dissolved oxygen can kill sensitive, less mobile, aquatic species. pH in the Middle Slough generally stays within the upper and lower limits set by DEQ.

Suspended solids concentrations in the Middle Slough are significantly less than in the Upper or Lower Slough. More than 90 percent of the water quality samples taken in the Middle Slough met water quality standards set by DEQ. There are two pathways in which TSS enters the Columbia Slough water body: sediment inputs to the waterway and re-suspension. The main source of new TSS in the slough is sediments transported in stormwater from streets, parking lots, driveways, agriculture runoff, and construction activities. These sediment inputs may contain pollutants described above. The second pathway, re-suspension, also referred to a bioperturbation, is when settled sediments and associated pollutants are reintroduced into the water column. This occurs in the Columbia Slough primarily as a result of carp activities.

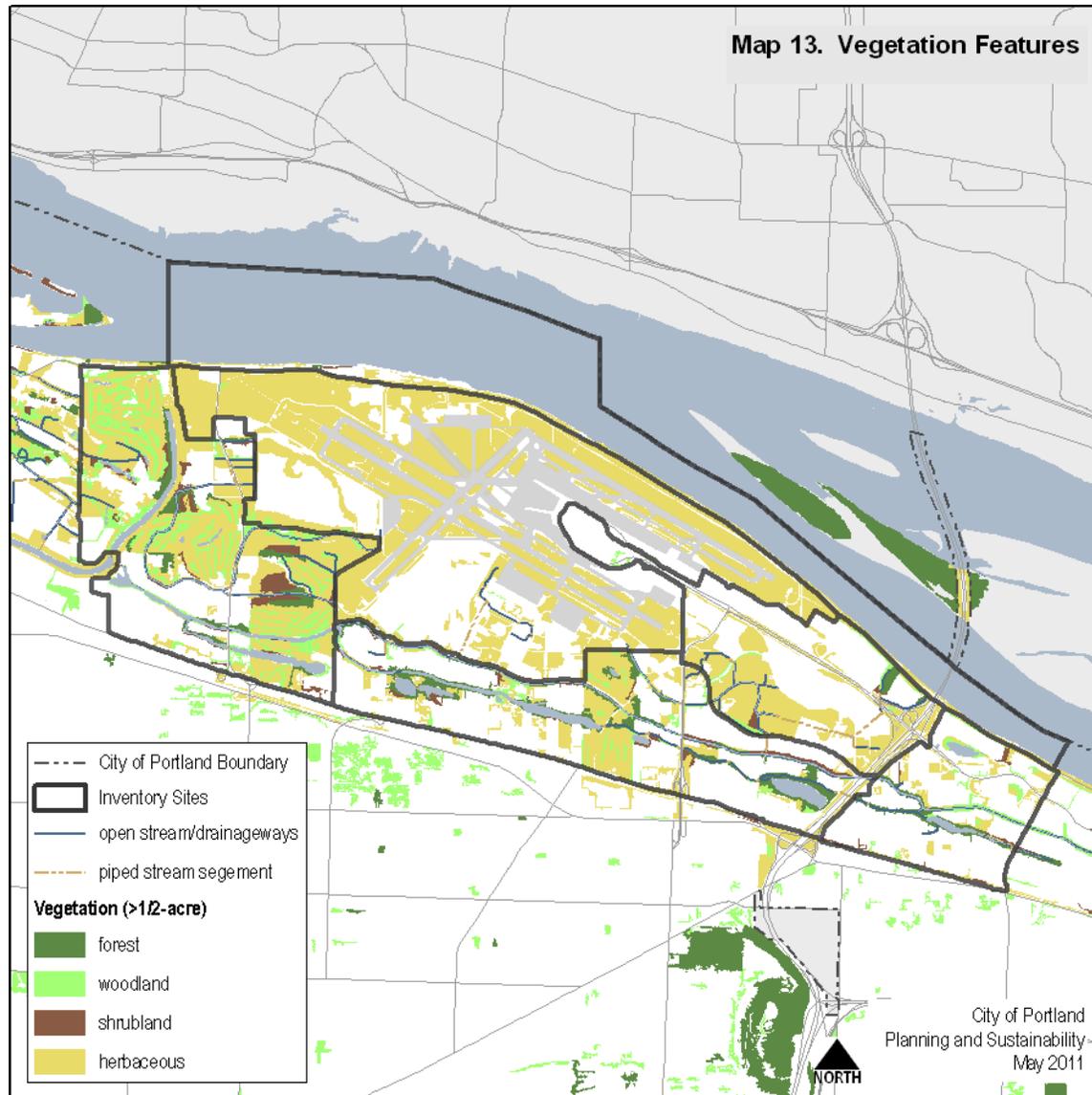
The water quality of the Middle Slough can have a significant impact on the Lower Slough. Because the Lower Slough is influence by tides, water pumped from the Middle Slough can linger in the Lower Slough for long periods of time before flowing into the Willamette River. The Lower Slough provides critical refugia habitat for anadromous salmonids seeking refuge from Willamette River and Columbia River flows. Salmonids are sensitive to warm water, low dissolved oxygen concentrations and swings in pH, as well as being impacted by other pollutants.

## **Sediment Quality**

More in-depth risk assessments in the Middle Slough conducted by DEQ and Bureau of Environmental Services indicated that the sediments do not pose significant risk to human health and the environment (City of Portland, Bureau of Environmental Services. 1997). One exception in the study area is Buffalo Slough which poses potential risk to human health and the environment. The key risk driver in Buffalo Slough appears to be human consumption of contaminated fish.

## **Vegetation, Habitat and Wildlife**

The inventory study area contains approximately 2,672 acres of vegetated patches greater than ½-acre in size, including 188 acres of forest or dense tree canopy, 300 acres of woodland, 100 acres of shrubland and 2,084 acres of herbaceous cover. These vegetated areas cover approximately 36% of the study area. There are also eight designated Special Habitat Areas, totaling 3,172 acres, within the study area. These include the Columbia River, wetlands (e.g. Subaru Wetland and Whitaker Ponds), upland grasslands, and areas of groundwater upwelling (e.g. Whitaker Slough). Impervious surfaces, such as buildings, parking lots and 45 miles of roads, cover 2,478 acres (34%) of the study area.



Even with the extensive development that has occurred in the study areas over the last 150 years, the remaining habitat areas support a diversity of wildlife. Many of the native wildlife species that were historically found in the Columbia Slough watershed still occur here. However, most of them are much less abundant. In addition, several introduced species have become so abundant that they dominate plant and animal communities. Although impacts have occurred, there remain valuable habitat areas and wildlife populations in the inventory study area. The following habitat conditions and fish and wildlife currently exist:

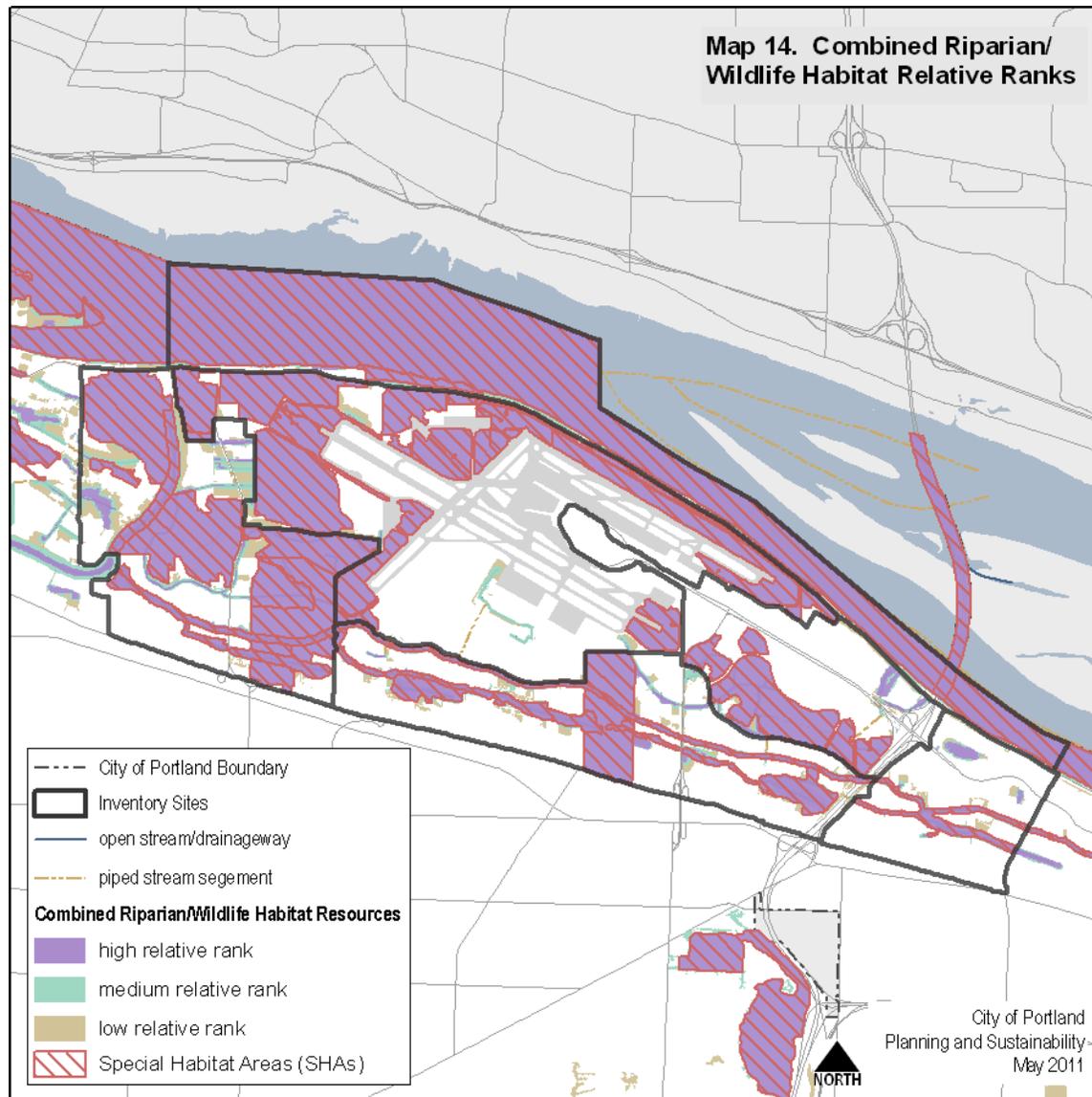
- Native vegetation such as willow, black cottonwood, Oregon ash, Douglas hawthorn, Oregon white oak, sedges, and rushes are scattered throughout the watershed. Populations of wapato and Columbia sedge are less common, found only in a few places (Lev et al. 1994).
- More than 150 species of birds roost, feed, nest and/or migrate through the inventory study area in an average year.
- More than 25 species of ducks, geese, swans, and raptors winter in the region, and neotropical migrant shorebirds and songbirds stop over in spring and fall. Many neotropical migrant songbirds and migrant waterfowl remain throughout the summer to nest in the watershed. The inventory study area hosts a number of state and federally listed species during the breeding season.

- The Middle Columbia Slough, wetlands and secondary drainageways serve as travel corridors along the Lower Columbia River, Pacific Flyway, and other migratory bird pathways. The water bodies provide a vital corridor for wildlife movement between the Columbia River Gorge, Sandy River Delta, and Blue Lake in the east, to Smith and Bybee Wetlands, Forest Park, Sauvie Island, Vancouver Lake, and Ridgefield National Wildlife Refuge to the west.
- The waterway, secondary drainageways and wetlands are home to American beaver, muskrat, northern river otter, several amphibian species, painted and western pond turtles, and 12 native fish species.
- Mammals such as coyote, black-tailed deer, and red fox live in the upland habitats.
- As urbanization has occurred, non-native species have proliferated, adapting to the urban environment and out-competing native species. Some of the noxious wildlife species in the watershed include the house sparrow, European starling, rock pigeon, nutria, common carp, bluegill, and bullfrog. Some noxious weed species in the watershed include Himalayan blackberry, English ivy, reed canarygrass, purple loosestrife, and Japanese knotweed.

<b>Table 8: Summary of Natural Resource Features in the Middle Columbia Corridor/Airport Natural Resources Inventory Study Area</b>	
	<b>Study Area (7,391 acres)</b>
<b>Stream/Drainageway (miles)</b>	
Columbia River (miles/acres)	6.2 / 1,302
Open Stream/Drainageway Channel (miles)	23
<b>Wetlands (acres)</b>	192
<b>Flood Area (acres)*</b>	2,172
Vegetated (acres)	433
Non-vegetated (acres)	265
Open Water** (acres)	1,474
<b>Vegetated Areas &gt;= 1/2 acre (acres)<sup>+</sup></b>	2,736
Forest (acres)	185
Woodland (acres)	299
Shrubland (acres)	97
Herbaceous (acres)	2,155
<b>Impervious Surfaces (acres)</b>	2,477
<p>* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.</p> <p>** Open Water includes portions of the Columbia River and Columbia Slough.</p> <p>+ 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 2008 aerial photography.</p>	

## Resource Evaluation

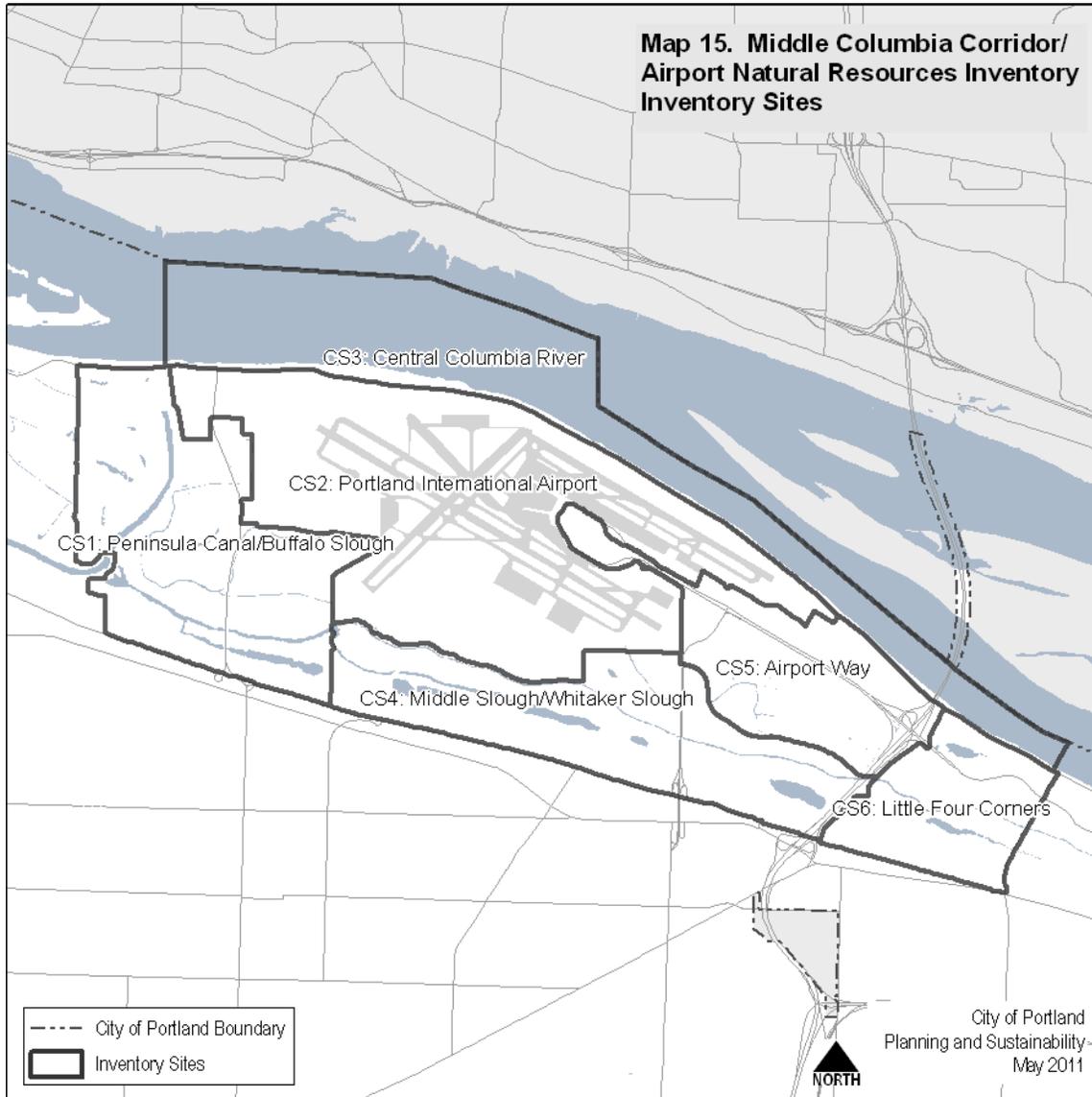
The methodology for evaluating relative resource function is outlined in the previous chapter and details are available in Appendix F – *City of Portland Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat 2008*. All of the ranked resource areas provide significant riparian and habitat value, although current condition and function levels vary considerably. The relative ranks can help inform planning programs, design of development or redevelopment projects, and mitigation and restoration activities. Map 14 depicts the combined riparian corridor and wildlife habitat relative ranks.



<b>Table 9: Summary of Ranked Resources in the Middle Columbia Corridor/Airport Natural Resources Inventory Study Area</b>				
<b>Total Inventory Site</b> = 7,391 acres				
<b>Columbia River</b> = 1,302 acres				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources**</b>				
acres	1,848	450	527	2,826
percent total inventory site area	25	6	7	38
<b>Wildlife Habitat</b>				
<b>Wildlife Habitat**</b>				
acres	0	345	10	355
percent total inventory site area	0	5	<1	5
<b>Special Habitat Areas***</b>				
acres	3,387			
percent total inventory site area	46			
<b>Combined Total<sup>†</sup></b>				
acres	3,484	237	196	3,916
percent total inventory site area	47	3	3	53
** High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Willamette 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.				

## Section 4d: Inventory Sites

There are 6 inventory sites in the Middle Columbia Corridor/Airport Natural Resources Inventory study area (Map 15). They range in size from approximately 500 acres to 2,000 acres, and include the land, Columbia Slough, Peninsula Drainage Canal, Whitaker Slough, Buffalo Slough, secondary drainages, wetlands, Columbia River banks and portions of the Columbia River. The inventory sites support a variety of uses, primarily airfield uses at the Portland International Airport and also surrounding uses include industrial, commercial, residential, parks and natural areas.



The following report sections provide information for each inventory site. Each site section starts with a summary of site characteristics (Table 10) and is followed by a description and evaluation of natural resources.

**Table 10: 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 Slough river mile; beginning at the confluence with the Willamette River, mile 0 is where the centerline of the Willamette meets the centerline of the Columbia Slough.
<b>Site Size:</b>	Size estimates include land features, streams and drainageways, wetland and portions of the Columbia 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.

Following 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 value or quality of the natural resources. The descriptions are based in part on research and site visits completed by City staff between 2008 and 2009. Other information sources used to develop these descriptions include: Port of Portland Strategic Environmental Evaluation; Port of Portland Wildlife Hazard Management Plan; the Bureau of Environmental Services Columbia Slough Characterization; 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 F - *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2009).

The natural resource evaluation process includes:

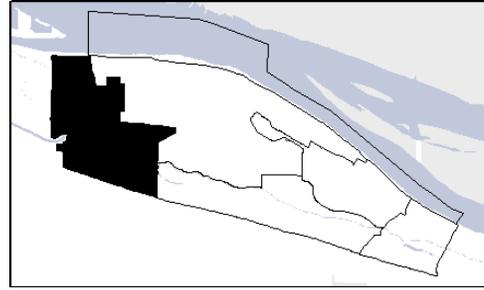
1. Mapping key resource features associated with riparian corridors and wildlife habitat
2. Applying science-based criteria using GIS models to assess functions and attributes and generate initial relative ranks for natural resource features in the site
3. Incorporating Special Habitat Areas
4. Combining 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 CS1: Buffalo Slough/ Peninsula Canal



### Summary Information

Watershed: Columbia Slough

Neighborhood: East Columbia, Sunderland, Woodlawn, Concordia, Cully

USGS quadrangle and quarter section maps: 1N1E01, 1N1E02, 1N1E11, 1N1E12, 1N1E13, 1N1E14, and 1N2E07

River Mile: 8.8-10.2 (beginning at the Multnomah County Drainage District levee that separates the Lower and Middle Columbia Slough to the confluence of Whitaker Slough and the Columbia Slough main channel)

Site Size: 1,287 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: General Industrial 2 (IG2)  
Open Space (OS)  
Single Dwelling Residential (RF, R20 and R10)  
Aircraft Landing height overlay (h)  
Airport Noise overlay (x)  
Environmental Conservation overlay (c)  
Environmental Protection overlay (p)

Existing Land Use: industrial; golf courses; residential; natural area

General Description: This site includes part of the Middle Slough including Buffalo Slough, Peninsula Canal and portions of the main arm of the Columbia Slough. Multiple secondary drainageways are found in the site including Elrod Slough, which is an east-west channel that discharges to the Columbia Slough. Subaru Wetlands (approximately 43 acres) and Blue Heron Meadows wetland (approximately 4 acres) are also located within the site boundaries.

Resource Features: open water stream/drainageway channels; herbaceous, scrub-shrub and forested wetlands; vegetated flood area; bottomland hard wood forest; 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):

- *CS11: Blue Heron Meadows Wetlands* –wetland (W); bottomland hardwood forest (B); and migratory stopover habitat (M)
- *CS12: Peninsula Drainage Canal* – migratory stopover habitat (M); wildlife connectivity corridor (C); area vital to at risk species including Western painted turtles (S)
- *CS13: Subaru Wetlands* – wetland (W); bottomland hardwood forest (B).
- *CS14: Buffalo Slough* – wildlife connectivity corridor (C); resources or structure that provides unique habitat function in natural or built environment because it is an active groundwater upwelling area (U).

- *CS15: Buffalo Street Mitigation Site* – migratory stopover habitat (M); and wildlife connectivity corridor (C)
- *CS25: Columbia Edgewater Country Club* – migratory stopover habitat (M)
- *CS26: Elrod Slough Complex* – wildlife connectivity corridor (C) and wetland (W)
- *CS27: Riverside Golf Course* - area vital to at risk bat species (S); migratory stopover habitat (M)
- *CS28: Broadmoor Golf Course* - area vital to at risk bat species (S); migratory stopover habitat (M)
- *CS30: Middle Slough* – area vital to at risk species including Western painted turtle and Northern red-legged frog (S); migratory stopover habitat (M); and wildlife connectivity corridor (C)

Special Status Species:

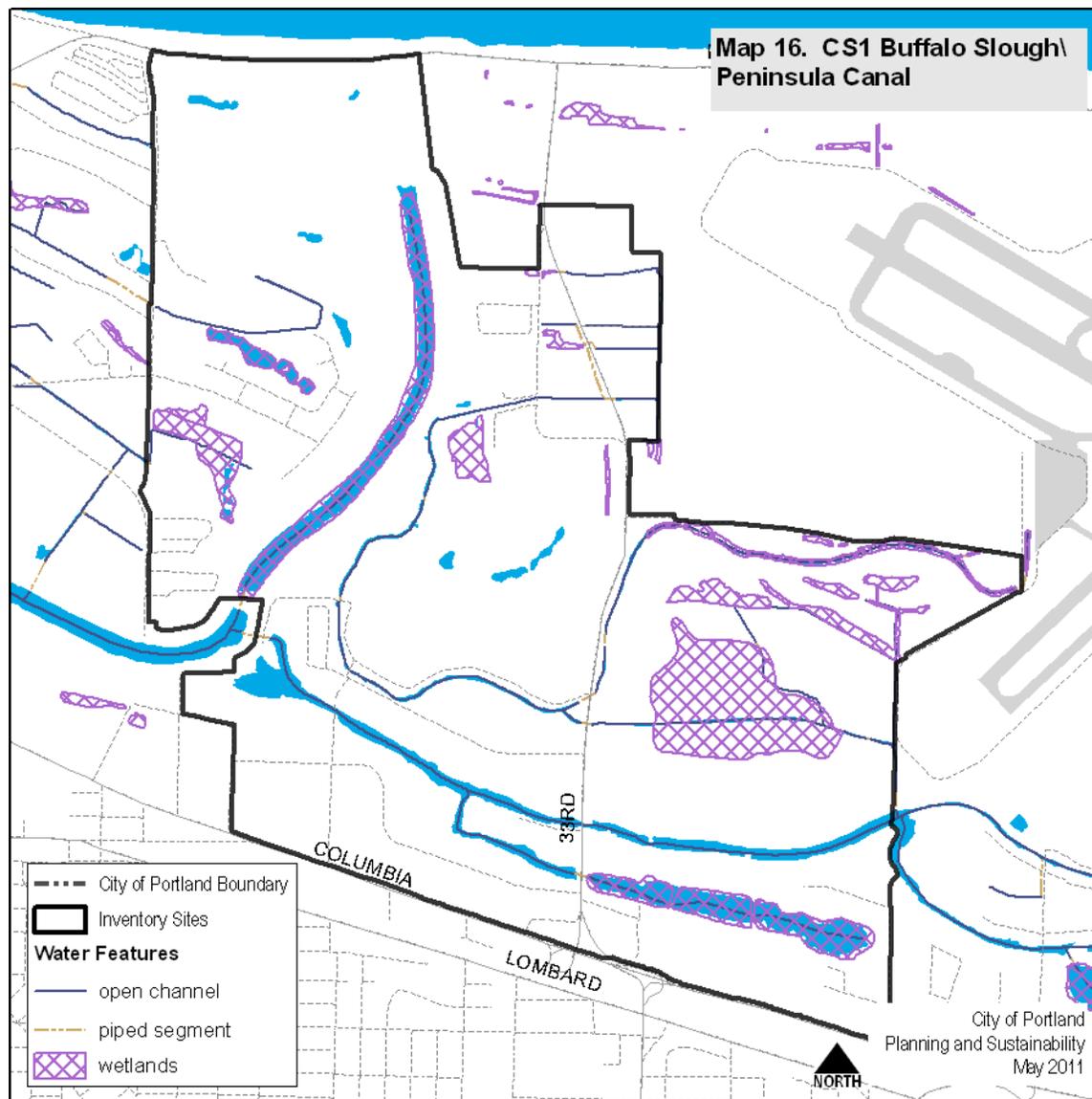
- *Birds:* American kestrel, bald eagle, band-tailed pigeon, bufflehead, bullock's oriole, bushtit, common yellowthroat, downy woodpecker, hooded merganser, great blue heron, house wren, loggerhead shrike, olive-sided flycatcher, peregrine falcon, purple martin, swainson's hawk, swainson's thrush, vaux's swift, western meadowlark, western wood peewee, white-breasted nuthatch, willow flycatcher, wood duck and yellow-rumped warbler
- *Mammals:* American beaver
- *Reptiles:* Western painted turtle, western pond turtle
- *Amphibians:* Northern red-legged frog, Western painted turtle

Natural Hazards: flood area

Contamination: Yes

## Site Description

The Buffalo Slough/Peninsula inventory site is 1,287 acres in size. The site includes industrial land uses around the Columbia Slough including the Multnomah County Drainage District Headquarters; three golf courses (Broadmoor, Riverside and Columbia Edgewater); residential land uses west of Peninsula Canal and vacant lands. The site contains approximately 271 acres of impervious area, including 10.5 miles of roads. Site CS1 Map 1 shows an aerial view of the Buffalo Slough/Peninsula inventory site.



A roughly 1.5-mile long section of the Columbia Slough main arm, extending from the main cross levee to the confluence of Whitaker Slough, Buffalo Slough and Peninsula Canal, traverses this site. The site also contains 5.7 miles of secondary drainageways, including Elrod Slough, and 9 wetlands equaling 120 acres. The 341-acre flood area includes 74 acres of open water, 231 acres of vegetated flood area and 36 acres of non-vegetated flood area (CS1 Map 2). The Multnomah County Drainage District (MCDD) maintains the levees and water levels in the Columbia Slough to provide flood protection and stormwater conveyance. The management of the Columbia Slough waterways riparian reduces flooding and affects the riparian corridor functions. The inventory models have been adjusted to reflect a lesser level of function than assigned to more active flood areas in the rest of the City.

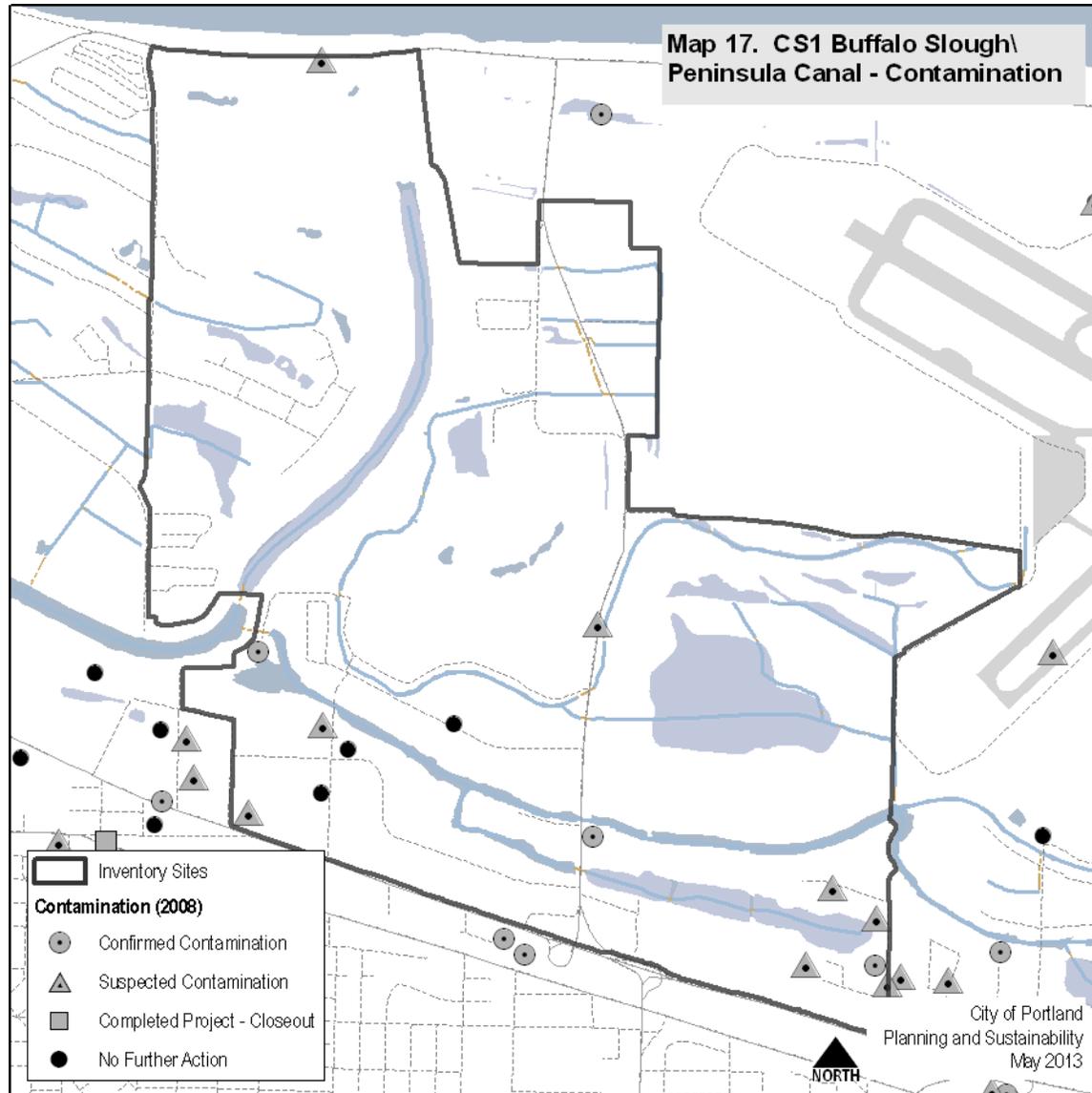
Vegetated areas at least ½ acre include approximately 53 acres of forest or dense tree canopy, 207 acres of woodland, 53 acres of shrubland and 510 acres of herbaceous cover (CS1 Map 2).

The City of Portland Bureau of Environmental Services (BES) has conducted revegetation projects throughout the site. There are currently eight active and nine completed sites, and one prospective revegetation site. Much of the revegetation has occurred in riparian areas around the Columbia Slough, Buffalo Slough, Elrod Slough, and associated with wetlands including Blue Heron Meadows and the Freightliner Wetland. BES, in partnership with the US Army Corps 1135 program, replaced two small vehicle bridges over Buffalo Slough to improve water quality and habitat. Under the same program BES is currently planning new bridge over Buffalo Slough at NE 33<sup>rd</sup> Ave.

There are also two Port of Portland mitigation sites located in this inventory site – Buffalo Street and Elrod Road mitigation sites.

<b>Table 11: Summary of Natural Resource Features in CS1: Buffalo Slough/Peninsula Canal</b>	
	<b>Study Area</b> (1,287 acres)
<b>Stream/Drainageway (miles)</b>	9
<b>Wetlands (acres)</b>	120
<b>Flood Area (acres)*</b>	341
Vegetated (acres)	231
Non-vegetated (acres)	36
Open Water** (acres)	74
<b>Vegetated Areas &gt;= ½ acre (acres)<sup>†</sup></b>	823
Forest (acres)	52
Woodland (acres)	207
Shrubland (acres)	53
Herbaceous (acres)	510
<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 Slough, Buffalo Slough and Peninsula Canal within the site. † 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 2008 aerial photography.	

The Oregon Department of Environmental Quality (DEQ) has identified confirmed and suspected contaminated areas within the site (Map 17). Soil, groundwater and surface water within the site contain contamination resulting from past and current activities. Historic industrial uses, combined sewer overflows and agricultural runoff may have contributed over the past 50 years to contamination. More current contamination is the result of used motor oil spills, abandoned drums and other industrial uses. Types of pollutants found in the site included ethylbenzene, toluene, TPH, xylenes, cyanide sludge and metals. Potential environmental and health risks include recreational exposure and fish consumption. Ingestions of sediment, water and organisms may post a threat to wildlife, aquatic and pelagic organisms. Bioaccumulation may post 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>.



## Natural Resource Description

The natural resources are described for sub areas of the inventory site (see Map 18).



### Middle Columbia Slough

The site contains approximately 3.5 miles of the Columbia Slough main channel, referred to here as the Middle Slough. The portion of the Middle Slough within the site is characterized by a low gradient channel and extensive macrophyte growth that impacts flow and water quality. The riparian area adjacent to the Middle Slough is generally one to two trees in width. These areas are generally bottomland hardwood forest comprised of black cottonwood and red alder. Other native vegetation species present include Douglas-fir, western red cedar, snowberry, red-flowering currant, red-osier dogwood, Indian plum, Oregon grape, Nootka and swamp rose, and vine maple. Invasive plant species found throughout in the riparian area include Himalayan blackberry, Japanese knotweed and reed canary grass.



Paddlers in the Middle Columbia Slough

The Middle Slough and associated waterways are completely surrounded by levees and are contained within MCDD. As a result, the water can reach the Lower Slough only if pumped or allowed to flow through the MCDD levee gravity gates that separate the Middle and Lower Columbia Slough. In an average year, MCDD allows Middle Slough water to flow through the floodgates into the Lower Slough by gravity for only a few weeks (generally late fall to early winter). During the other months, or when water levels in the Lower Slough are higher than those in the Middle Slough, water must be pumped against the gradient. Pump Station No. 1 has a pumping capacity of 250,000 gallons per minute (gpm).

The width of the Middle Slough waterway varies in general from 30-100 feet. A section just upstream of MCDD Pump Station No. 1 (where the Vanport Flood broke the levee and gouged out the channel) was 90 feet deep after the 1948 flood, but now is approximately 10 to 16 feet deep. The average channel depth in the Middle Slough ranges from 6 to 8 feet NGVD (CH2M Hill 1995). Estimates of groundwater inflow in the Slough vary from 50 to 100 cubic feet per second (cfs).

The Columbia Slough is water quality limited for multiple parameters including bacteria, temperature, dissolved oxygen and biochemical oxygen demand (BOD), eutrophication (phosphorus, chlorophyll a, pH), heavy metals and total suspended solids. In general, the Middle Slough has better water quality than the Upper and Lower Slough. Water temperatures are generally cooler in the Middle Slough, due in large part to cool groundwater inputs. Macrophyte and algae growth is extensive in the Middle Slough. This is a result of slow flows, solar access (lack of shading) and high concentration of nutrients. Macrophytes and algae produce oxygen during the day but at night they respire using oxygen and producing carbon dioxide. This can result in the dissolved oxygen concentration and pH becoming low during the morning hours and creating inhospitable conditions for some species of fish, amphibians and macroinvertebrates.



Business along Middle Columbia Slough

The Middle Slough provides habitat for numerous native fish and wildlife species including:

- Fish – three-spined stickleback, largescale sucker
- Mussels – Oregon floater, California floater, winged floater
- Amphibians – Northern red-legged frog, Northwest Salamander, Long-toed Salamander
- Reptiles – Western painted turtle
- Birds – Great blue heron, green heron, wood duck, American wigeon, hooded merganser, common merganser, green-winged teal, belted kingfisher, Vaux's swift, violet green swallow, tree swallow, Willow flycatchers
- Mammals – Yuma myotis, long-legged myotis, long-eared myotis, silver-haired bat, hoary bat, muskrat, Northern river otter, American beaver

Habitat in the Middle Slough is affected by nearby development. Industrial development, including buildings, loading areas and parking lots, encroach into the riparian area fragmenting habitat and reducing shade potential from riparian vegetation. Cornfoot Road, north of the Middle Slough between NE 47<sup>th</sup> Avenue and Alderwood Road, is in close proximity (between 25 and 100 feet) of the waterway and impacts riparian vegetation, wildlife habitat and water quality.

The Middle Slough has been designated Special Habitat Area CS30 because it meets the S criteria by providing important habitat for at risk species, including Western painted turtle and Northern red-legged frog. The riparian corridor provides migratory stopover (M) habitat for birds and bats, some of which are also listed as at risk by the City (S) including Willow flycatcher, silver-haired bat and others. Both the waterway and the riparian area are a wildlife connectivity corridor (C), providing wildlife an opportunity to move between other important habitat areas including Johnson Lake, Whitaker Slough, Whitaker Ponds and Buffalo Slough.

### Buffalo Slough

Buffalo Slough is a one-mile southern arm of the Columbia Slough in the vicinity of NE 33<sup>rd</sup> Drive. The western portion of Buffalo Slough is surrounded by industrial development and has a narrow area of riparian vegetation. The middle of Buffalo Slough is bordered by the Broadmoor Golf Course, there is industrial development to the east and south and a Port of Portland mitigation site to the north.

The Buffalo Slough, like much of the Columbia Slough, is a low gradient channel. The primary sources of flow in Buffalo Slough are groundwater from the south and stormwater outfalls; there are no tributaries to Buffalo Slough. The flow is influenced by the culvert at NE 33<sup>rd</sup> Drive, which can impound flow. The low gradient nature of the slough, the crossings and relative lack of shading can cause water to become stagnant, especially in the summer, resulting in warm water temperatures, algae and macrophyte growth, and reduced dissolved oxygen concentrations.

During a summer 1996 survey of aquatic macroinvertebrates in Buffalo Slough by Parametrix, Inc., the most dominant species found were Chironomid midges, ostracods, and oligochaete worms. Amphipoda (scuds-crustacea), Copepoda (microcrustaceans), Cladocera (microcrustaceans), and Corixidae (water boatmen) were also found. The preliminary conclusion from this analysis was that limited diversity of the benthic community is most likely due to low levels of dissolved oxygen (Wisseman, 2001).



Sediment testing was performed in Buffalo Slough to test for risks associated with contamination. The most commonly found sediment contaminants included heavy metals (lead, zinc, chromium, copper) and toxic organic chemicals (pesticides and PCBs). Many of the toxic organic chemicals have been banned for many years, so these chemicals could have been washed into the Slough years ago or have recently been introduced into sediments from “legacy” sources. Legacy sources are upland sources that may become disturbed during construction activities. Contaminant levels were found to be fairly low and uniform throughout the entire Columbia Slough. Sediment toxicity assays performed on sediments from Buffalo Slough did not show toxicity to benthic organisms (e.g. insects that live in the sediment). However, studies show a potential risk to humans who consume fish caught in Buffalo Slough due to bioaccumulation of toxic organic chemicals.

The vegetated riparian area around Buffalo Slough is very narrow, except at the Port of Portland Buffalo Street Mitigation Site.

West of NE 33<sup>rd</sup> Drive, the riparian area consists of a strip of trees one to two trees deep, predominantly comprised of black cottonwood, with an understory of Himalayan blackberry and English holly. English ivy is also locally present, but mostly as a ground cover—very little has begun to climb into the trees. Along the south bank is a shrubland vegetation type containing a wide range of woody species, many of which are young trees (less than 15 feet). Black cottonwood, pin oak, and willow (spp.) have the largest representation. Other species include: paper birch, black locust, English laurel, butterfly bush, Scots broom, and Himalayan blackberry. There is very little ground cover present.

Along the west edge of NE 33<sup>rd</sup> Drive, north of the riparian forest, is an area of grass-covered lawn largely fronted by English laurels and a few other ornamental shrubs. East of NE 33<sup>rd</sup> Drive, the tree canopy is less dense but contains similar vegetation as that to the west: black cottonwood with a Himalayan blackberry understory. At the golf course, the vegetation is primarily maintained turf grasses.

During a site visit in spring 2009 the following birds were observed using Buffalo Slough and surrounding vegetation: American robin, marsh wren, redwing blackbird, Oregon junco, song sparrow, Anna's hummingbird, mourning dove, mallard, ringneck duck, and American widgeon. Two nutria were also seen swimming across the slough.

The Buffalo Slough is designated Special Habitat Area CS14.A and B because it is an active groundwater upwelling area (U) and it provides a wildlife connectivity corridor between other important habitat areas including the Middle Slough and Buffalo Street Mitigation Site (C).

The Port of Portland Buffalo Street Mitigation Site is located between the eastern end of Buffalo Slough and Columbia Slough. In 1994 the Port planted the site with native vegetation. Trees include Oregon ash, black cottonwood, Oregon white oak and Western red cedar. Shrubs included red osier dogwood, Douglas spirea, red alder, black hawthorn, oceanspray, and willow. Ground covers included yarrow, aster, red columbine, slough sedge, rushes and fescues. Since 1994, the site has been managed to reduce invasive species and establish the plantings. Today the site has areas of woodland habitat, open grasses, meadows and wetland. Portions of the uplands provide refugia for amphibian and reptiles. Table 12 is a list of fish and wildlife species observed by Port of Portland staff between 2001 and 2008.



The Port of Portland Buffalo Street Mitigation Site has been designated a Special Habitat Area (CS14) because it meets multiple criteria. The area provides migratory stopover habitat for avian species (M) and it is a wildlife connectivity corridor between Buffalo Slough and the Middle Slough (C).

<b>Table 12: Port of Portland Fish and Wildlife Species Observations in Buffalo Slough Site 2001-2008</b>		
<b>Birds</b>		
Accipiter, unidentified	*Eurasian wigeon	*Ring-necked duck
American crow	European starling	Red-breasted sapsucker
American goldfinch	Flycatcher, unidentified	Red-tailed hawk
American kestrel	Gadwall	Red-winged blackbird
American robin	Golden-crowned sparrow	Ruby-crowned kinglet
*American wigeon	Great blue heron	Shrew
Ash-throated flycatcher	Great egret	Song sparrow
Bald eagle	Green-winged teal	Spotted towhee
Band-tailed pigeon	Gull, unidentified	Stellar jay
Barn owl	*Hooded merganser	Swainson's thrush
Barn swallow	House finch	Swallow, unidentified
*Belted kingfisher	House wren	Thrush, unidentified
Bewick's wren	Hummingbird, unidentified	Tree swallow
Brown-headed cowbird	Killdeer	Turkey vulture
*Bufflehead	Lazuli bunting	Vaux's swift
Bullock's oriole	*Mallard	Violet-green swallow
Bushtit	Marsh wren	Warbling vireo
*Cackling goose	Mourning dove	Western scrub jay
*Canada goose	Muskrat	Western wood peewee
*Canvasback	Northern flicker	Willow flycatcher
Cedar waxwing	*Northern shoveler	Wilson snipe
*Common merganser	Nuthatch	Wood duck
Common yellowthroat	Nutria	Yellow-rumped warbler
Dark-eyed junco	Osprey	
*Double-crested cormorant	Peregrine falcon	
Downy woodpecker	* Pied-billed grebe	
<b>Mammals</b>		
Beaver	Deer	River otter
Black-capped chickadee	Mole	Squirrel
Cottontail rabbit	Opposum	Vole
Coyote	Raccoon	
<b>Reptiles and Amphibians</b>		
Garter snake	Pacific treefrog	
<b>Fish</b>		
*Carp		

\*Observed in adjacent open-water habitat

Peninsula Drainage Canal

Peninsula Drainage Canal is a roughly 1.5 mile long isolated slough segment. Peninsula Drainage Canal was originally created by the Corps of Engineers in 1921 in an attempt to improve water quality in the Lower Columbia Slough by flushing it with flows from the Columbia River. However, this effort did not succeed because the tidal effect and low gradient of the Lower Slough did not allow enough additional Columbia River flow to improve water quality. Furthermore, the opening to the Columbia River silted in quickly. In 1948, instead of reinforcing the canal levee, the ends of the canal were plugged. Today the Peninsula Drainage Canal acts as a closed system, bound on all sides by levees. Until 1999/2000 the canal was used as watering for livestock resulting in soil compaction and erosion.



Peninsula Drainage Canal

The forested area along the northwest bank of the canal is a high quality black cottonwood forest with a Pacific willow and red-osier dogwood understory. Several snags are present and there is some large wood in the channel. An emergent bench exists below the wooded strip including scouring rush and young ash trees. The southwestern bank of the canal is occupied by an open cottonwood forest. Some large snags are present here as well. The understory contains red-osier dogwood, Himalayan blackberry, as well as some English ivy and reed canary grass. The east side of the canal is almost completely reed canary grass with a few swamp roses.

Peninsula Drainage Canal supports one of two known significant populations of Western painted turtles within the Columbia Slough Watershed in the City of Portland. The area also provides habitat for kingfisher and wind shelter for waterfowl off the Columbia River. Avian species known to utilize the site: American wigeon, Anna's humming bird, bald eagle, cackling goose, common merganser, Eurasian wigeon, greater white-fronted goose, green-winged teal, loggerhead shrike, northern flicker, northern pintail, northern shoveler, olive-sided flycatcher, purple martin, red-tailed hawk, ringneck duck, raverner's goose, swainson's hawk, tree swallow, western meadowlark, willow flycatcher and white-breasted nuthatch. Extensive signs of beaver have been observed. Western painted turtle, western pond turtle and northern red-legged frog have been documented by ODFW using the canal, as well as bull frog and carp.

Peninsula Drainage Canal is designated as a Special Habitat Area (CS13) because it provides habitat for migratory avian species (M); important habitat for Western Painted turtle, which is an at risk species (S); and is a wildlife connectivity corridor between the Columbia Slough and Columbia River (C).

Sediment testing performed in the Peninsula Drainage Canal found risk marginally above acceptable levels for human health. In December 2002, DEQ issued a conditional "no further action" letter for the canal however, long-term monitoring of this site is necessary.

#### Blue Heron Meadows

Until 1999, this area was primarily used for agriculture including row-crop fields and pastures. High winter/spring groundwater formed standing open water areas used by large numbers of migrating and wintering waterfowl and shorebirds for resting, feeding, staging and courtship.

In 1999/2000 much of the agricultural uses ended and residential development began around the wetlands. Blue Heron Meadows wetland was established as an open space tract. Stormwater from the residential development is treated in bioswales and then discharged to the wetland.



The eastern side of the wetland is woodland consisting black cottonwood/red alder and shrubland containing red-osier dogwood, Douglas spiraea, willow, cattails, and common rush. Areas identified as shrubland contain a mixture of species including Douglas spiraea, red-osier dogwood, and willow. Several species of wetland emergents are found around the pond edges.

Along the north and west of the wetland complex is heavily vegetated woodland with black cottonwood, red alder, and Oregon ash. Primary understory components were red-osier dogwood and reed canary grass with Himalayan blackberry along the south side of the drainage channel continuing all the way to NE 13<sup>th</sup> Ave. and spreading into the open shrubland to the west. Several species of wetland emergents are found around the pond edges.



The large field that encompasses the northern half of the survey site is still used for agricultural purposes. Portions of this field are seasonally covered with shallow standing water. The herbaceous area in the southwest is a grassy pasture and the area within the pond complex is a combination of reed canary grass with a native grass mix that was seeded when the water quality ponds were created.

In April 2009, tree frogs and red-winged blackbirds were heard around the ponds, and mallards and Canada geese were observed on site. Deer tracks were also observed and residents confirmed that a group of five deer regularly use the site along with garter snakes, nutria, and coyotes.

Blue Heron Meadows wetland is designated as a Special Habitat Area (CS11) because it is a remnant wetland with associated bottomland hardwood forest vegetation (W, B); and it provides migratory stopover habitat for avian species (M).

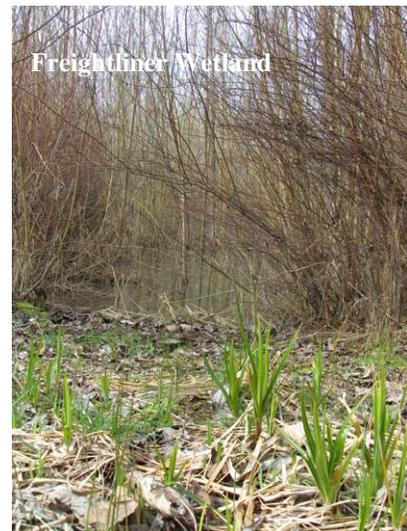
#### Freightliner Wetlands

To the south of Blue Heron Meadows wetland is a wetland, a secondary drainageway and associated vegetated areas informally referred to as Freightliner Wetlands (also called Merritt Wetlands) and Gertz Ditch. The wetland has been altered over the years to accommodate development and portions of the existing wetland are mitigation for impacts. The Bureau of Environmental Services conducted revegetation on multiple properties associated with the wetland. The revegetation projects are now closed and property owners maintain the site.

The vegetation south and east of the wetland is composed mostly of black cottonwood, red alder, and ash. On higher ground, particularly toward the southern portion of the survey site, western red cedar, grand fir, and Douglas-fir are present. Understory shrubs include; Douglas spiraea, red-osier dogwood, willow species. Himalayan blackberry is also present, however mostly in areas with a high edge-to-area ratio (e.g. wind rows, property line plantings). Where present, ground cover is generally a mixture of rushes, bulrushes, moss, and creeping buttercup. English ivy is also present localized patches.

A small interior area of shrubland to the east is comprised mostly of willow, Douglas spiraea, and young alder and cottonwood trees. The understory in this area contains small-fruited bulrush, common rush, moss and/or water, leaf litter or bare ground.

Along Gertz Ditch is a narrow strip of trees. To the north of Gertz Ditch and to the southwest of the wetland the vegetation is generally either mown turf grass, grassy pasture, or fields of reed canary grass.



Wildlife observed during spring 2009 site visits include: black-capped chickadee, yellow-rumped warbler, mallard, Canada geese, and a tree frog.

### Corrections Forested Wetland (CRCI)

Located to the west of the Department of Corrections on NE 33<sup>rd</sup>, is a forest wetland, a stretch of Elrod Slough and riparian vegetation. The wetland, known as the CRCI Wetland, and riparian area is an active Bureau of Environmental Services revegetation site.

The forested area is composed primarily of black cottonwood, red alder, and Oregon ash, including several large, well established trees. Snowberry and Douglas spiraea are the main understory shrub species along with a small amount of the following weedy species: Himalayan blackberry, English ivy, spurge laurel, and English holly. The eastern edge of the area is primarily red alder with some grand fir.



The interior of this site supports a dense, native shrubland, a somewhat rare occurrence in the slough. Species present include: Nootka rose, swamp rose, red-osier dogwood, Douglas spiraea, tall Oregon grape, and blue and red elderberry. Notably, there are some especially large red-osier dogwood stands on site. Reed canary grass, teasel, and poison hemlock are the most common weed species.

Dry herbaceous areas of the site contain mixed grasses including reed canary grass. Wetter herbaceous areas contain primarily slough sedge, Dewey's sedge, common rush, small-fruited bulrush, and cattail.

During 2009 site visits, wildlife observed included: tree frogs, goldfinch, song sparrow, black-capped chickadee, northern flicker, American crow, brown creeper, red-tail hawk, mallard, wood duck, and cormorant. Deer tracks and coyote scat were also seen.

### Elrod Slough

Elrod Slough drains areas north of Broadmoor Golf Course and west and south of Riverside Golf Course. It connects with Subaru Wetlands, Port of Portland mitigation sites, the forested wetland on property owned by the Oregon Department of Corrections and drainageways to the north. The dominant tree species along Elrod Slough are black cottonwood and mixed conifer-hardwood trees. Elrod Slough, as well as Riverside Golf Course, are within the flood area and can provide flood storage during large storm events. Elrod Slough is actively maintained for flow conveyance by the Multnomah County Drainage District. Maintenance includes riparian vegetation removal within 25 feet of the waterway and removal of in-water large structure woody debris. Elrod Slough flows to MCDD pump station #2 where it is pumped into the Slough.



Elrod Slough and associated riparian vegetation provide resting, roosting, nesting, foraging and shelter opportunities for birds and mammals. Red-tailed hawk, barn owl, great horned owl, great blue heron, European starling, mallard, Canada goose, gulls, and American crow are known to use Elrod Slough and surrounding vegetation.

A portion of Elrod Slough and surrounding riparian area is located on Portland International Airport property. This area is located between Subaru Wetland to the south and SW Quad to the north.<sup>1</sup> There are small wetlands and riparian vegetation, that in combination with Elrod Slough provide habitat for a

<sup>1</sup> Inventory Site CS2: Portland International Airport provides a natural resource description for SW Quad.

number of wildlife species. The Port also has an upland mitigation site located here - Elrod Slough Mitigation Site. The site includes big-leaf maple, Oregon ash, black cottonwood, Douglas fir, western red cedar, native rose, Pacific ninebark, snowberry, willow and red osier dogwood.

<b>Birds</b>		
Accipiter, unidentified	Gold-crowned sparrow	Red-shouldered hawk
American crow	Golden eagle	Red-tailed hawk
American goldfinch	Great-blue heron	Red-winged blackbird
American kestrel	Great egret	Ring-necked duck
American pipit	Great horned owl	Ring-necked pheasant
American robin	Green-winged teal	Rock dove
American widgeon	Greater white fronted goose	Rough-legged hawk
Bald eagle	Golden-crowned kinglet	Ruby-crowned kinglet
Band-tailed pigeon	Golden-crowned sparrow	Savannah sparrow
Barn owl	Gull sp.	Say's phoebe
Barn swallow	Hooded merganser	Sharp-shinned hawk
Belted kingfisher	Horned lark (incl. Streaked)	Short-eared owl
Bewick's wren	House finch	Song sparrow
Black phoebe	House sparrow	Spotted towhee
Black-capped chickadee	House wren	Stellar's jay
Black-headed grosbeak	Killdeer	Swainson's hawk
Brewer's blackbird	Lapland longspur	Townsend vole
Brown Creeper	Lazuli bunting	Tree swallow
Brown-headed cowbird	Least sandpiper	Turkey vulture
Bullock's oriole	Lincoln's sparrow	Vaux's swift
Bushtit	Loggerhead shrike	Violet-green swallow
Cackling goose	Long-billed curlew	Warbler, unidentified
Canada goose	Mallard	Western kingbird
Cedar waxwing	Merlin	Western meadowlark
Cliff swallow	Mountain bluebird	Western sandpiper
Common snipe	Mourning dove	Western scrub jay
Common yellowthroat	Northern flicker	Western tanager
Cooper's hawk	Northern harrier	Western wood pewee
Dark-eyed junco	Northern pintail	White-breasted nuthatch
Downy woodpecker	Osprey	White-crowned sparrow
European starling	Peregrine falcon	Wood duck
Falcon, unidentified	Pied-billed grebe	Yellow-headed blackbird
Fox Sparrow	pigeon	Yellow warbler
Gadwall	Purple martin	Yellow-rumped warbler
Gambusia	red-breasted nuthatch	
<b>Mammals</b>		
Beaver	Deer mouse	Nutria
Black-tail deer	Feral cat	Raccoon
Cottontail rabbit	Gray-tailed vole	Squirrel
Coyote	Mole	
<b>Reptiles and Amphibians</b>		
Bullfrog	Long toe salamander	Western painted turtle
Garter snake	Pacific treefrog	
<b>Fish</b>		
*Carp		

\*Observed in adjacent open-water habitat

The airport actively manages this area to reduce wildlife strike risks. Management includes bird hazing with noise, physically removing nests, performing egg intervention, reducing surface ponding, and managing vegetation. The Port does not perform these activities within the Elrod Slough drainageway.

Portions of Elrod Slough, the Port Mitigation Site and surrounding wetlands and riparian vegetation are designated Special Habitat Area CS26 because this area provides a wildlife connectivity corridor (C) to other habitats including Subaru Wetland and SW Quad and there are multiple wetlands (W).

Secondary Drainageways and Fazio Fields

Located along NE 33<sup>rd</sup> Drive, north of Subaru Wetlands, are five secondary drainageways, all hydrologically connected, and open fields, called Fazio Fields, which were formerly agricultural lands. The secondary drainageways currently provide surface water and groundwater conveyance from undeveloped and developed lands.

On the east side of NE 33<sup>rd</sup> is a composting facility. There are two secondary drainageways, one to the north and one to the south, of the composting facility that flow to the east then south along the eastern boundary of the area known as Fazio Fields. These drainageways then flow west across NE 33<sup>rd</sup>, connect with Elrod Slough, which flows to MCDD pump station #2 where it is pumped into the Slough. A small strip of large trees, primarily cottonwoods and willows, surround the northernmost drainageway. The understory is comprised of Himalayan blackberry and red-osier dogwood with little to no herbaceous cover. The shrubland on the south bank is largely Himalayan blackberry with a thin strip of grass along the water's edge. Woodland vegetation south of the large parking lot and the northwest corner of the area is mostly cottonwood with some willow, dogwood, and Himalayan blackberry. There are several large standing cottonwood snags that have nest cavities and insect hunting holes. During a spring 2009 site visit, many birds were heard but only the red-winged blackbird and house finch were identified.

To the west of NE 33<sup>rd</sup>, the open fields have been developed; in 2007, Concordia College constructed an Olympic throwing facility. However, two open channels that convey stormwater still exist.

To the east of NE 33<sup>rd</sup> Drive, the drainages and the surrounding vegetation are owned and managed by the Port of Portland. Within Fazio Fields the two secondary drainageways were likely created to drain the fields when the property was farmed; these drainageways also connect up with the northern drainageways to flow under NE 33<sup>rd</sup> and into Elrod Slough. Fazio Fields are covered in grass with a large expanse of common rush, a wetland associated plant, and several large patches of Himalayan blackberry. Table 14 is a list of wildlife species identified by Port of Portland staff between 2002 and 2009.

<b>Birds</b>		
American crow	Common merganser	Mourning dove
American goldfinch	Common snipe	Northern pintail
American kestrel	Cooper's hawk	Peregrine falcon
American robin	European starling	Red-tailed hawk
American widgeon	Gadwall	Red-winged blackbird
Bald eagle	Great-blue heron	Ring-necked duck
Belted kingfisher	Great egret	Song sparrow
Black-capped chickadee	Great horned owl	Turkey vulture
Bushtit	Hooded merganser	Western kingbird
Canada goose	Mallard	Western meadowlark
<b>Mammals</b>		
Black-tail deer	Coyote	Nutria

### Subaru Wetland

Subaru Wetland is a 50-acre juncus/willow wetland and is surrounded by the Broadmoor Golf Course. The wetland dominated by Himalayan blackberry. Red osier dogwood, willow and rushes are also present.

The southern edge of the wetland is delineated by a well-established Cottonwood-Ash Forest, containing an understory of Himalayan blackberry and red-osier dogwood. The northern edge of the wetland has another belt of black cottonwood forest with a red alder understory and a grassy belt that extends to the Elrod Slough bank. A smaller patch of planted woodland exists in the northwest corner of the site and is composed of Douglas-fir, red alder and mixed native shrubs with a grassy understory. Several standing cottonwood snags are scattered throughout.



A more open and younger assemblage of the cottonwood-ash forest with a Himalayan blackberry and red-osier dogwood understory are present along the wetland's eastern edge and along Broadmoor Canal, which flows through the wetland.

Much of the interior is a wooded wetland comprised primarily of willow species and reed canary grass with some slough sedge, nettle, and teasel interspersed. Some Oregon ash is also present, but not in great abundance. A few fairly large patches of yellow flag dominate openings in the northeastern section. A good amount of downed woody debris is also present along with much standing water.

The non-wooded portion of this wetland has a very high water table and is largely covered with reed canary grass with patches of native emergent vegetation including soft rush, tule, and cattail. The northern most portion of the herbaceous region is an active horse pasture, dotted with a few weeping willows and flanked by a blackberry thicket to the east.

The wetland and vegetation provides food, roost, perch and nesting sites for song birds, waterfowl, woodpeckers, raptors and shorebirds. During site visits the following birds were observed: common yellowthroat, song sparrow, robin, mourning dove, Vaux's swift, scrub jay, mallard, bufflehead, varied thrush, savannah sparrows, Virginia rail, and common snipe (1989, 2009). Several deer and nutria and/or beaver trails run across the wet shrubland, and numerous slides have been worn into the banks of Broadmoor Canal, indicating that wildlife is accessing the waterway. Coyote scat was observed in the more open portion of the shrubland. Interspersion with other natural areas is high because Subaru Wetland is located near other small wetlands, drainageways, Peninsula Canal and the Columbia River.

Subaru Wetland collects surface water from surrounding land and drains to the Broadmoor Canal, which flow through the wetland and to Elrod Slough, which is located north and west of the wetland. Subaru Wetland filters sediments and pollutants from surface water; cycles nutrients and contribute to the food web; moderates air and water temperatures; provides a channel migration area for the secondary drainageways; and provides connectivity to other habitats in close proximity to the wetlands including the Columbia Slough main channel.



Subaru Wetland is a designated Special Habitat Area (CS13) because it is a wetland complex (W) surrounded by bottomland hardwood forest (B).

The use of fertilizers and pesticides at Broadmoor Golf Course may have negative impacts to water quality and habitat of the wetland and drainageways. Bird hazing at the golf course may also impact other wildlife using this area. Trash from the parking lots to the west has blown onto the western edge of the survey site, and a seemingly iron-rich seep is flowing onto the site from the diagonal corner of the employee parking lot of the northernmost warehouse.

A smaller wetland is located to the north of Subaru Wetland. The unnamed wetland is forested, primarily with black cottonwood, willow and Oregon ash and also contains areas of herbaceous vegetation and invasive species such as Himalayan blackberry.

### Golf Courses

There are three golf courses located in the inventory site: Columbia Edgewater, Riverside and Broadmoor. Golf courses, while highly manicured landscapes, provide some of the largest contiguously vegetated areas within the city.

The Broadmoor Golf Course and Elrod Slough along the Riverside Golf Course, along with other locations in the study area, were recently surveyed by US Fish and Wildlife Services for bat use (2009). Bat species documented using the golf course include Little Brown Myotis (*Myotis lucifugus*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), and Hoary Bat (*Lasiurus cinereus*). The bats utilize water bodies for drinking and foraging and the trees for roosting, both day and night. The first two species, Little Brown and Big Brown, can roost in varying structures from buildings to snags. Silver-haired Bat uses tree crevices and snags. Hoary Bat roosts in tree foliage. Silver-haired and Hoary are migratory and migrate through the study area in the summer. The complex of habitat features at Broadmoor Golf Course (Middle Slough, Buffalo Slough, Subaru Wetland, Broadmoor Canal and riparian tree canopy) and at Riverside Golf Course (Elrod Slough, wetlands and riparian trees) provide habitat for bats. Columbia Edgewater Country Club was surveyed for bat use by Perkins in 2003 and found the same four species plus Long-legged Myotis (*Myotis volans*). Based on the available information, it is reasonable to expect that bats use riparian trees for roosting and open water bodies for foraging and drinking on all three golf courses.

Golf courses, particularly riparian corridors with tree canopy, are utilized by a high concentration and diversity of migratory birds as they travel along the Pacific Flyway, Columbia River, and Columbia Slough Corridor. Willow Flycatchers (an *at risk* species) have been documented by city staff along the Columbia Slough on the east side of Broadmoor and it is likely that they are nesting in riparian habitats throughout the three golf courses. It is likely that the trees located throughout the golf courses are also used by a high concentration of migratory birds. All three golf courses are located between the Columbia River and Columbia Slough. The golf courses are also located on the historic Columbia River floodplain adjacent to the confluence with the Willamette River, a stopover on the Pacific Flyway. Columbia Edgewater is located with 300 feet of the river, while the others are roughly 1 mile of the river.

Columbia Edgewater (CS25), Riverside (CS27) and Broadmoor (CS28) golf courses are designated as Special Habitat Areas because they provide migratory stopover habitat (M); Riverside and Broadmoor are also designated SHA because they provide habitat for at risk bat species (S).

## 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 15). 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 the Methodology Overview section of this report and the *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2008).

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 portions of the Columbia River and Columbia Slough, vegetated and non-vegetated flood area, riparian forest with associated shrub and groundcover, as well as other types of vegetation that contribute to the riparian functions as detailed in the natural resource description. These landscape features provide the following riparian functions:

- 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 assigned to the Columbia Slough, Whitaker Slough, the wetlands, and secondary drainageways. Riparian forests and areas of dense tree canopy receive a high or medium relative ranks depending on proximity to open water. Medium and low relative ranks are generally assigned to lower structure riparian vegetation associated with the slough, drainageways and wetlands. Other resource areas are assigned a high, medium or low relative rank depending on the proximity and extent of vegetation relative to the water body (CS1 Map 4).

### Wildlife Habitat

A wildlife habitat patch is, for purposes of the inventory model, defined as forest and/or wetland areas, 2 acres in size or greater, plus 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.

Based on the wildlife habitat model criteria, a medium relative ranking is assigned to forested areas along the Columbia Slough and Whitaker Slough and to wetlands and associated forest vegetation, reflecting patch size, interior area and proximity to water and other patches.

Special Habitat Areas (SHA) descriptions

SHAs 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 (CS1 Map 5).

There are ten SHAs located in site CS1:

- *CS11: Blue Heron Meadows Wetlands* –wetland (W); bottomland hardwood forest (B); and migratory stopover habitat (M)
- *CS12: Peninsula Drainage Canal* – migratory stopover habitat (M); wildlife connectivity corridor (C); area vital to at risk species including Western painted turtles (S)
- *CS13: Subaru Wetlands* – wetland (W); bottomland hardwood forest (B).
- *CS14: Buffalo Slough* – wildlife connectivity corridor (C); resources or structure that provides unique habitat function in natural or built environment because it is an active groundwater upwelling area (U).
- *CS15: Buffalo Street Mitigation Site* – migratory stopover habitat (M); and wildlife connectivity corridor (C)
- *CS25: Columbia Edgewater Country Club* – migratory stopover habitat (M)
- *CS26: Elrod Slough Complex* – wildlife connectivity corridor (C) and wetland (W)
- *CS27: Riverside Golf Course* - area vital to at risk bat species (S); migratory stopover habitat (M)
- *CS28: Broadmoor Golf Course* - area vital to at risk bat species (S); migratory stopover habitat (M)
- *CS30: Middle Slough* – area vital to at risk species including Western painted turtle and Northern red-legged frog (S); migratory stopover habitat (M); and wildlife connectivity corridor (C)

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 (CS1 Map 6).

**Table 15: Summary of Ranked Resources in CS1: Buffalo Slough/Peninsula Canal**

<b>Total Inventory Site = 1,287 acres</b>				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>				
acres	233	178	237	647
percent total inventory site area	18	14	18	50
<b>159W5.9 Wildlife Habitat</b>				
<b>Wildlife Habitat*</b>				
acres	0	155	5	160
percent total inventory site area	0	12	<1	13
<b>Special Habitat Areas**</b>				
acres	696			
percent total inventory site area	54			
<b>Wildlife Habitat - adjusted by Special Habitat Areas ***</b>				
acres	696	13	<1	709
percent total inventory site area	54	1	<1	55
<b>Combined Total****</b>				
acres	727	77	78	882
percent total inventory site area	57	6	6	69

\*High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Willamette 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.



# Site CS1 - Map 1: Peninsula Canal/ Buffalo Slough

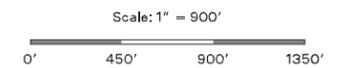
## 2007 Aerial Photography

-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.





# Site CS1 - Map 2: Peninsula Canal/ Buffalo Slough

## Water-Related Features

### Water Bodies

-  Stream/Drainage
-  Culvert or Piped

### Other Features

-  Flood Area
-  Wetlands
- Outfalls**
-  Stormwater
-  Combined stormwater /sanitary
-  Abandoned

### Bank Type

-  Beach
-  Bio-engineered
-  Vegetative
-  Non-vegetative
-  Site Boundary
-  City Boundary
-  Unclassified Fill Bank
-  Rock Bank
-  Seawall
-  Pilings
-  Urban Services

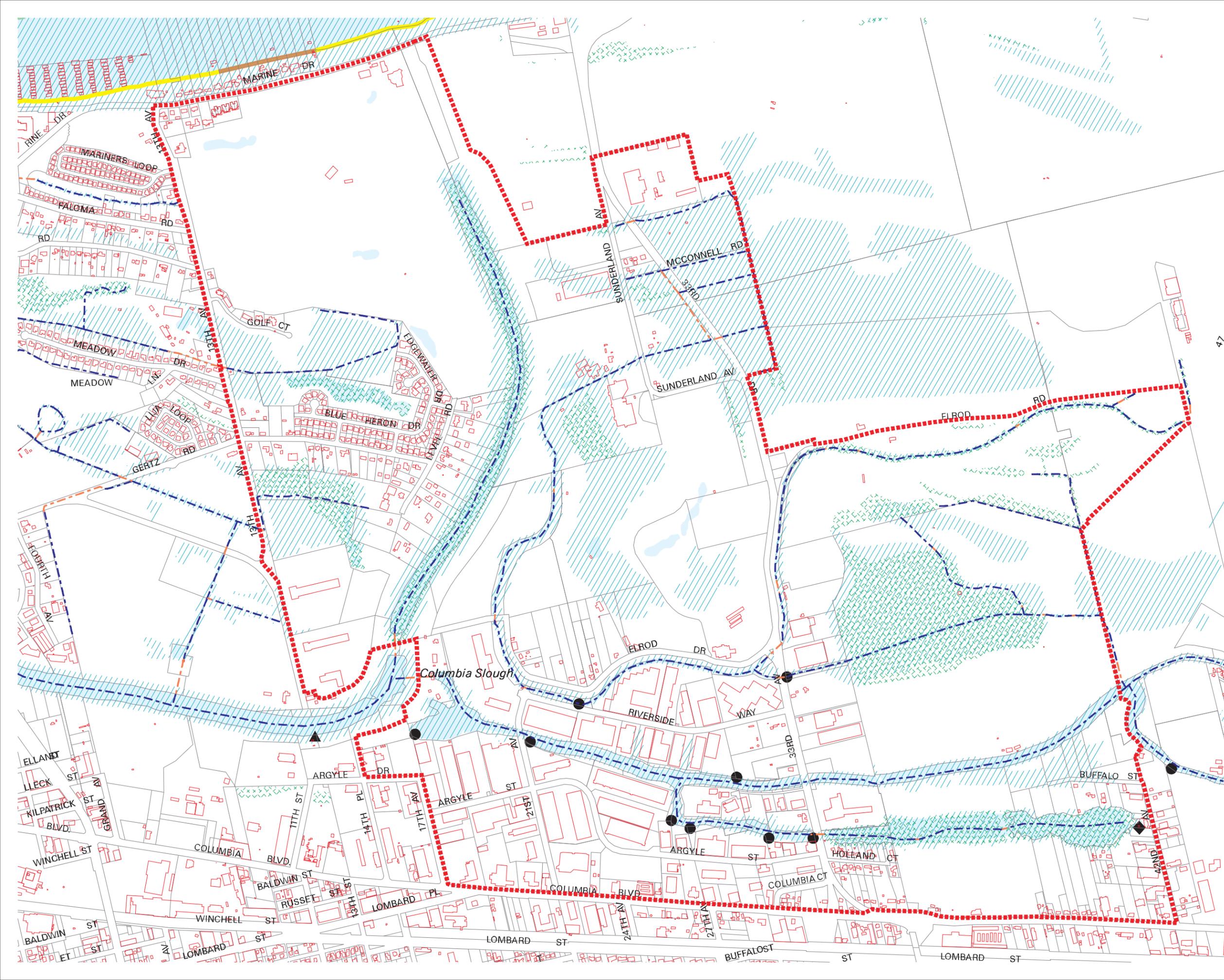
### INFORMATION SOURCES:

**Water Bodies:**  
Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date. Outfalls: Maintained by BES (June 2008) Location is approximate and data may be incomplete.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 900'

0' 450' 900' 1350'





# Site CS1 - Map 3: Peninsula Canal/ Buffalo Slough Vegetation Features

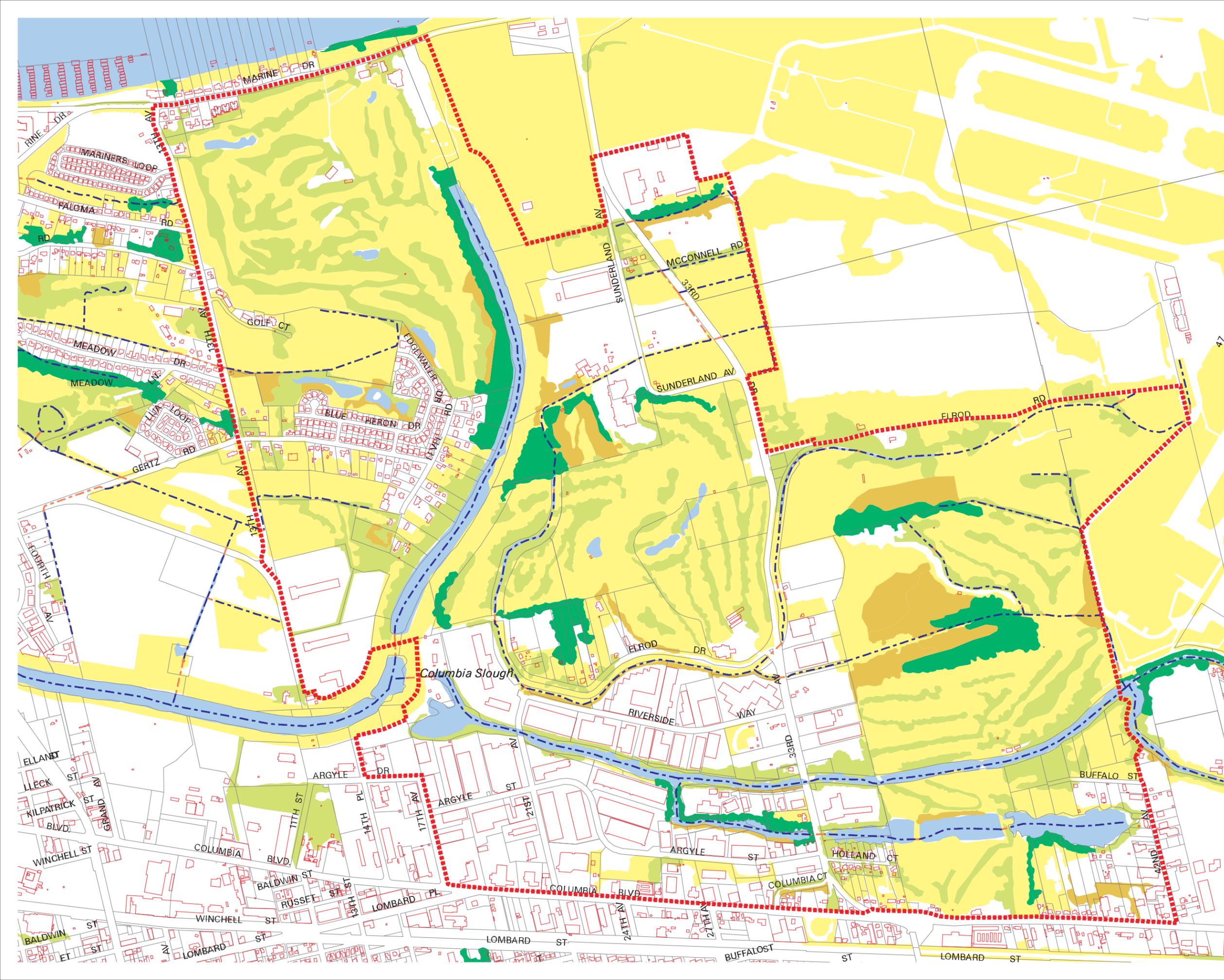
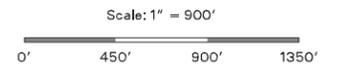
## Vegetation Types

-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

## INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.





# Site CS1 - Map 4: Peninsula Canal/ Buffalo Slough Riparian Resources Relative Rankings

- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 900'





# Site CS1 - Map 5: Peninsula Canal/ Buffalo Slough Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

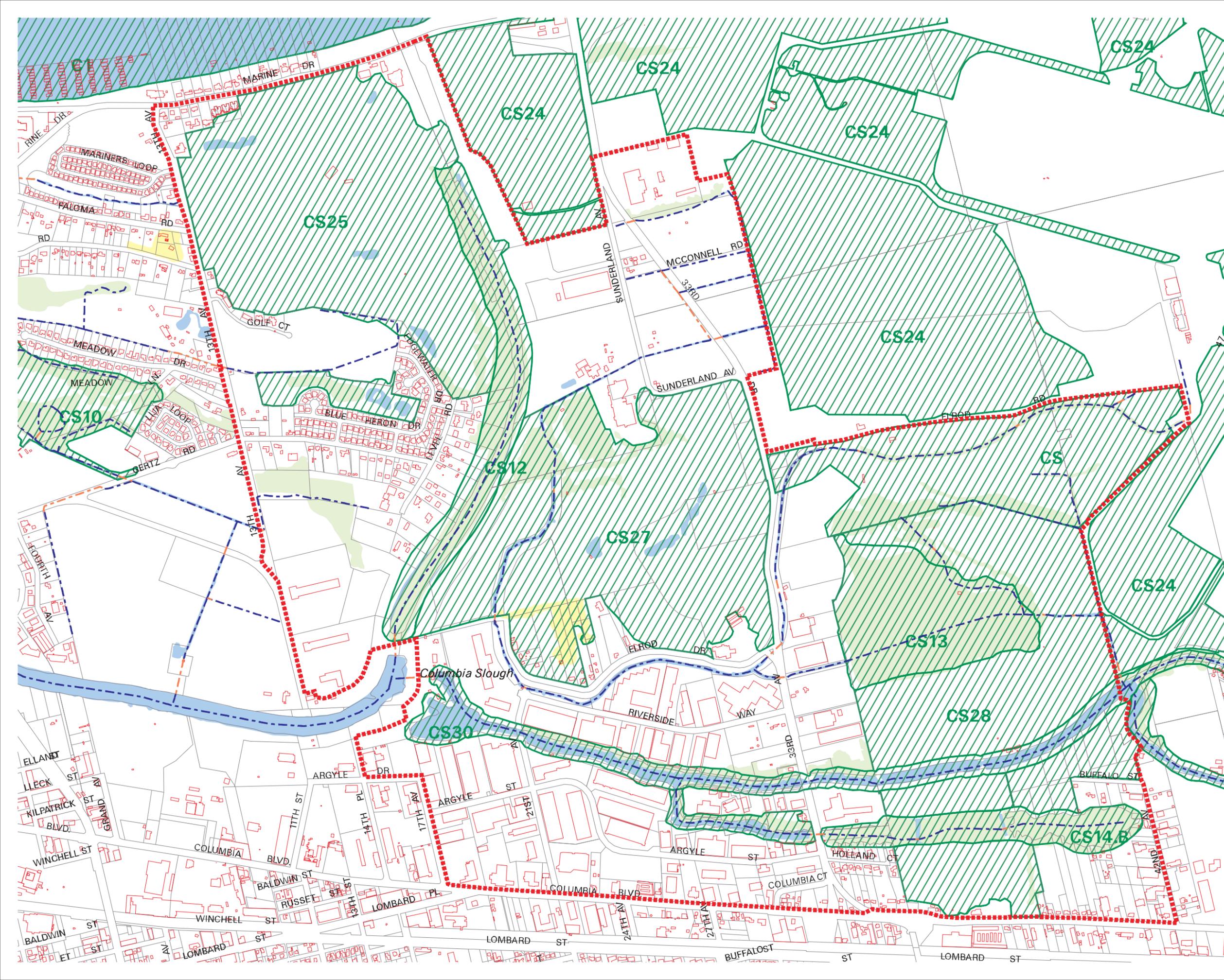
For more information, please visit our website:  
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Scale: 1" = 900'

0' 450' 900' 1350'





# Site CS1 - Map 6: Peninsula Canal/ Buffalo Slough **Combined Riparian / Wildlife Habitat Relative Rankings**

- High relative value - Special Habitat Areas \*\*
- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

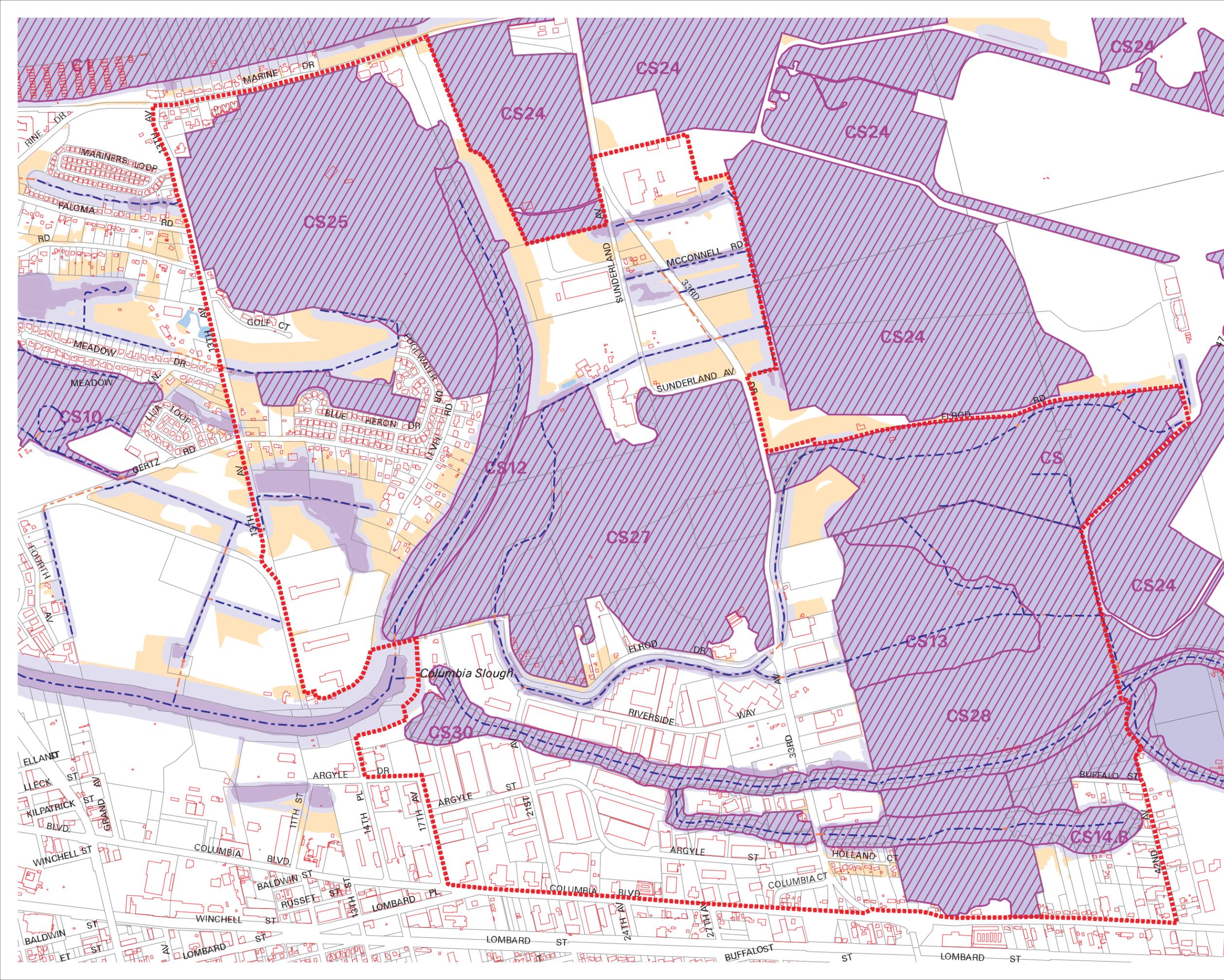
For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

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Scale: 1" = 900'

0' 450' 900' 1350'





## INVENTORY SITE CS2: Portland International Airport



### Summary Information

Watershed: Columbia Slough

Neighborhood: Sunderland

USGS quadrangle and quarter section maps: 1N1E01, 1N1E12, 1N2E05, 1N2E06, 1N2E07, 1N2E08, 1N2E09, 1N2E17 and 1N2E18

Site Size: 2,322 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: General Industrial 2 (IG2)  
Aircraft Landing height overlay (h)  
Airport Noise overlay (x)  
Environmental Conservation overlay (c)  
Scenic Overlay (s)

Existing Land Use: industrial

General Description: This site is the Portland International Airport and Air National Guard. The land is managed intensively to reduce safety risks, which includes maintaining the vegetation at an appropriate height and modifying habitat to reduce wildlife attractants. The site contains a portion of McBride Slough, remnant wetlands, two water features, one known as Keyhole Drainage and a secondary drainageway that provides stormwater conveyance for Oregon Air National Guard, and upland grassland that provides habitat for *at risk* species (e.g. Streaked Horned Lark) and migratory birds.

Resource Features: open water stream/drainageway channels; riparian scrub-shrub vegetation; herbaceous wetlands; large grasslands

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

#### Special Habitat Area(s):

- *CS24: Airport Upland Grassland* - area vital to *at risk* species (S); habitat supporting grassland-associated species (G); migratory stopover habitat (M); and wildlife connectivity corridor (C)

#### Special Status Species:

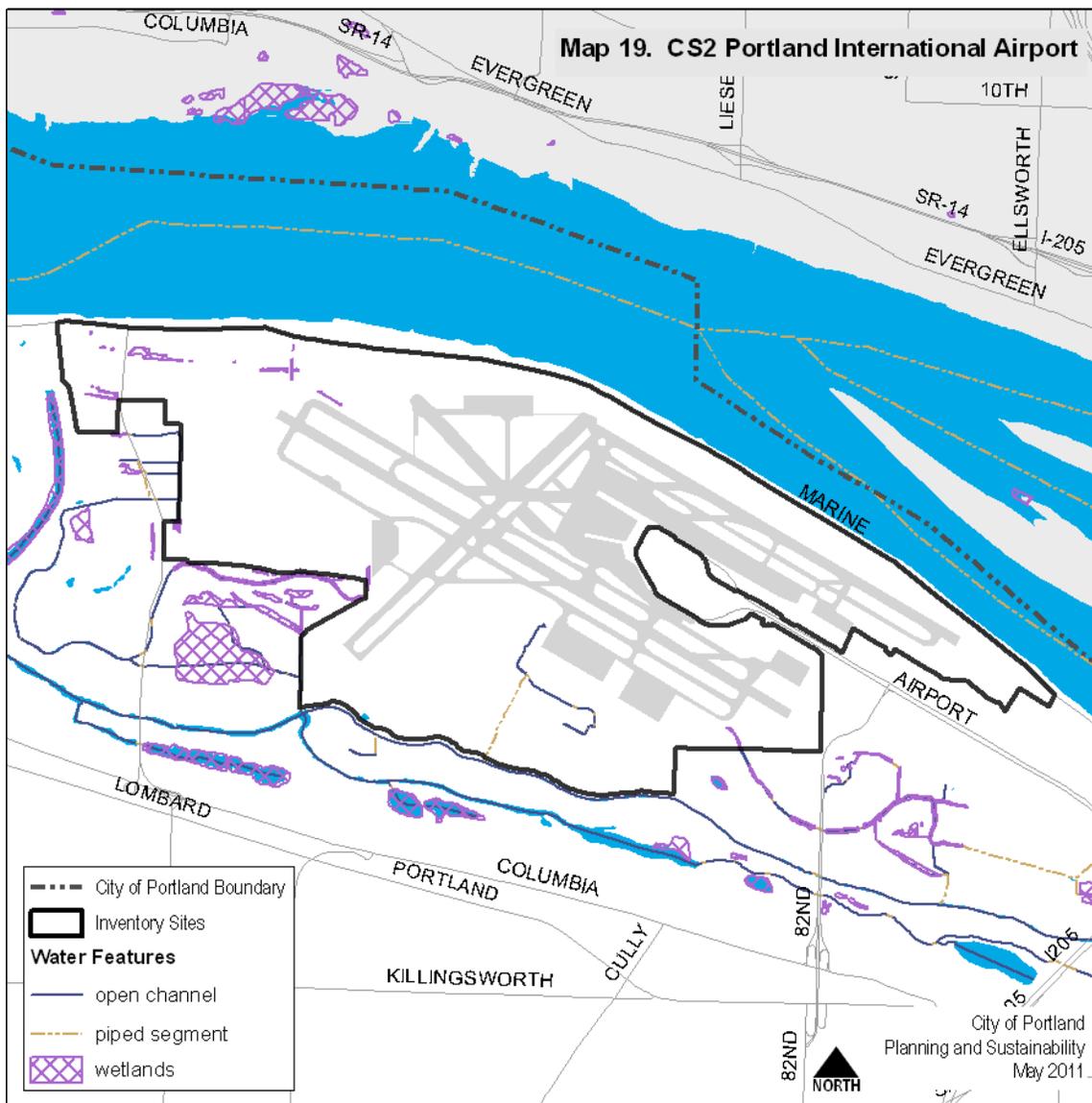
- *Birds:* American kestrel, bald eagle, common yellowthroat, dunlin, great blue heron, loggerhead shrike, long-billed curlew, merlin, Northern harrier, peregrine falcon, purple martin, short-eared owl, streaked horned lark, Swainson's hawk, Thayer's gull, Western meadowlark, great blue heron.

Natural Hazards: flood area

Contamination: Yes

## Site Description

The Portland International Airport inventory site is 2,322 acres in size and includes industrial land uses the Portland International Airport and the Oregon Air National Guard (ORANG). Approximately 1,006 acres of impervious area, including 19.2 miles of roads, are located within the site. The boundaries of this inventory site generally correspond with the airport airfield (Map 19). Site CS2 Map 1 shows an aerial view of the inventory site.

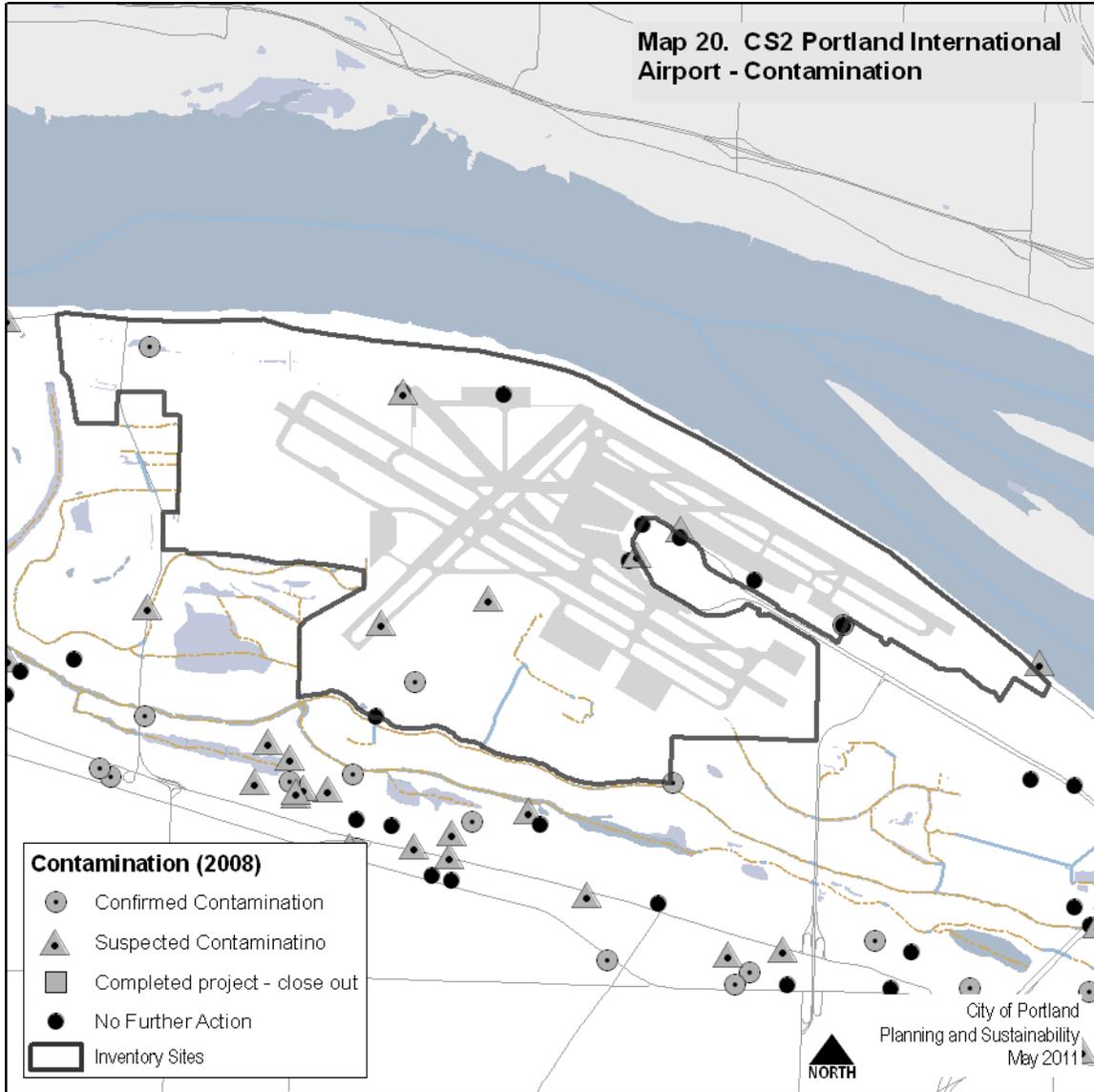


The site contains 1.2 miles of secondary drainageways and 5 acres of wetland (CS2 Map 2). The 188-acre flood area includes <1 acres of open water, 64 acres of vegetated flood area and 124 acre of non-vegetated flood area (CS2 Map 2). The Multnomah County Drainage District (MCDD) maintains the levees and water levels in the Columbia Slough to provide flood protection and stormwater conveyance. The management of the Columbia Slough waterways riparian reduces flooding and affects the riparian functions. The inventory models have been adjusted to reflect a lesser level of function than assigned to more active flood areas in the rest of the City.

Vegetated areas at least ½ acre include approximately <1 acres of forest or dense tree canopy, 8 acres of woodland and 1,074 acres of herbaceous cover (CS2 Map 3).

<b>Table 16: Summary of Natural Resource Features in CS2: Portland International Airport</b>	
	<b>Study Area (2,322 acres)</b>
<b>Stream/Drainageway (miles)</b>	1.3
<b>Wetlands (acres)</b>	5
<b>Flood Area (acres)*</b>	188
Vegetated (acres)	64
Non-vegetated (acres)	124
Open Water** (acres)	<1
<b>Vegetated Areas &gt;= ½ acre (acres)<sup>+</sup></b>	1,082
Forest (acres)	<1
Woodland (acres)	8
Shrubland (acres)	0
Herbaceous (acres)	1,074
<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 secondary drainageways within the site.	
+ 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 2006 aerial photography.	

The Oregon Department of Environmental Quality (DEQ) has identified confirmed and suspected contaminated areas within the site (Map 20). Soil, groundwater and surface water with the site contain contamination resulting from past and current activities such as a historic landfill, fuel spills on the tarmac, jet fuel use, bunker fuel spill, fire-fighting training, and underground fuel storage. Types of pollutant found in the site include total petroleum hydrocarbons, benzene, benzo(b)fluoranthene, naphthalene, polyaromatic hydrocarbons, benzo(a)pyrene, ethylebenze, toluene, TPH, xylenes, arsenic, cadmium, chromium, and lead. Potential environmental and health risks include exposure to soil and particulates, skin contact and vapor inhalation. Contaminated sediments in drainageways and ditches and contaminated surface water may pose a threat to wildlife in the site. For more information regarding contamination, visit the DEQ website at <http://www.deq.state.or.us/lq/ecsi/ecsi.htm>.



## Natural Resource Description

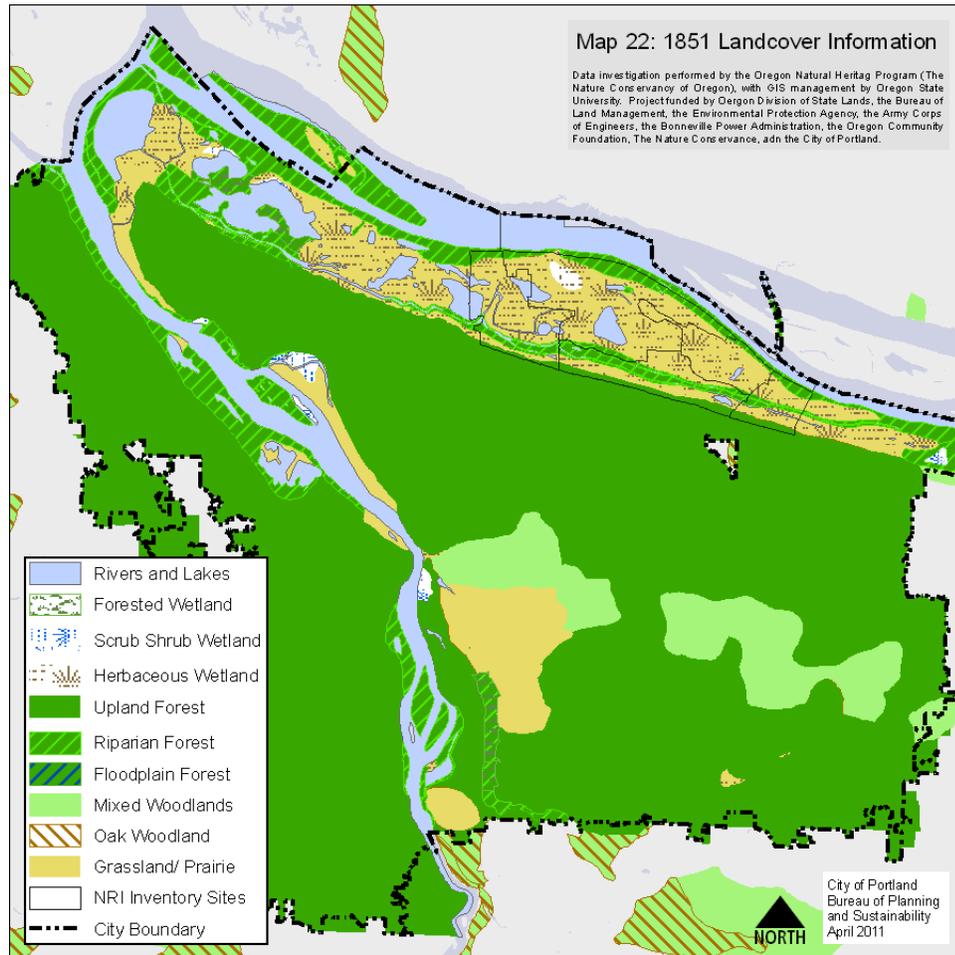
The natural resources are described for sub areas of the inventory site (see Map 21).



### Upland Grassland

Site CS2 includes approximately 2,000 acres of relatively flat, contiguous, open area; roughly 1,000 acres of which consists of low herbaceous vegetation or sparsely vegetated areas directly surrounding the Portland International Airport (PDX). Although the vegetation communities within this inventory site are not representative of a native grassland or prairie, the combination of the size of the open area, vegetation type, sandy fill and management activities causes the site to mimic some characteristics of a native grassland or prairie. Until roughly 150 years ago upland prairie and savannah habitats covered much of the Columbia Slough watershed (Map 22). Today, native grassland and prairie habitats

throughout the region have been reduced to less than one percent of their historic extent and are now defined as an imperiled habitat (Metro, 2009).



**Map 22. 1851 Landcover Information**

While inventory site CS2 does not contain native grassland or prairie vegetation, the herbaceous and sparsely vegetated areas within the site, combined with geographic location along the Columbia River and the Pacific Flyway (a critical route for migratory birds), provide upland habitat that supports a suite of grassland-associated wildlife. Over 100 species of birds, including grassland specialists, occur in this site annually. Some of these species, such as savannah sparrows and European starlings, occur in great numbers in the inventory site; while other species, such as streaked horned larks and peregrine falcon occur in smaller numbers. Rare species that occur annually on migration include long-billed curlew and loggerhead shrike.

Management of this upland grassland area is a major determining factor in the habitat type. All of the land in inventory site CS2 is currently managed by the Port of Portland to minimize hazards that increase risk to safe aircraft operations. Intensive vegetation management is one tool used by the Port to reduce habitat that attracts *high risk* species<sup>1</sup>. Wildlife, particularly some avian species, can be a significant hazard to safe aircraft operations. PDX wildlife staffs monitor and record observations of both high risk

<sup>1</sup> The Port of Portland identifies “high risk” species, which are those wildlife species that pose a high risk for collision with aircrafts. The City of Portland identifies “at risk” species, which are those fish and wildlife species experiencing significant population declines in the region (see also Special Habitat Area criteria).

and low risk wildlife species; however the focus of data collection is on high risk species. High risk species include six species of gulls, Canada and cackling geese, red-tailed hawk, osprey, barn owl, great-horned owl, mallard, European starling and American crow. The high risk group also includes several City of Portland Special Status Species: short-eared owl, northern harrier, American kestrel, peregrine falcon (also an *at risk* species), great blue heron, and Thayer's gull (Appendix D: Special Status Species in Portland). Coyotes forage in the grasslands and are also a high risk species.

PDX currently employs comprehensive strategies to actively manage all wildlife that pose a risk to safe aircraft operations. Coyote exclusion fencing has been installed around the airfield perimeter fencing which greatly reduces the occurrence of coyotes on the airfield. Other management activities include bird hazing using vehicles, horns, sirens, lasers, paintballs, and pyrotechnics; physically removing nests; performing nest intervention; and habitat modification including reducing surface area ponding and performing vegetation management. Large scale applications of rodenticide and insecticide are implemented annually on the airfield to reduce the prey base that attracts hazardous wildlife. PDX Landscaping Standards are also applied to the built environment.



The cumulative effect of all the grassy and sparsely vegetated areas, and absence of vertical structures, creates a contiguous 1,200-acre flat grassland-like habitat adjacent to the Columbia River that attracts a high diversity and concentration of migratory and grassland-associated wildlife species. However, there is some differentiation between different locations as discussed below:

- 33<sup>rd</sup> Fields
- SW Quad
- Deicing Field and Fuel Farm
- Airfield

All of the locations are part of one Special Habitat Area, CS24: Airport Upland Grasslands, because the habitats meet the criteria for migratory stopover (M), grassland-associated species use (G) and a connectivity corridor with the Columbia River (C). Some locations also meet the criterion for being vital for *at risk* species (S).

### 33<sup>rd</sup> Fields

Located west of NE 33<sup>rd</sup> Avenue is a 53-acre field comprised primarily of weedy herbaceous and shrubby vegetation, including Himalayan blackberry. There six wetlands, all less than ½-acre in size, located in the field. The field and wetlands are utilized by numerous wildlife species including: western meadow lark, great blue heron, American Kestrel, and Golden-crowned Sparrow.



The Port has employed different treatments to 33<sup>rd</sup> Field intended to reduce the site's attractiveness for migrating geese, which pose a high risk to aircraft safety. Currently, sediment fencing is installed at regular intervals to break up the landscape and deter geese from circling or landing in the field. The treatment has been successful at reducing geese use.

The treatment has been successful at reducing geese use.

### SW Quad

Between Elrod Slough and the south runway is an area known as the Southwest Quadrant (SW Quad). The SW Quad is a roughly 150-acre open field that is sparsely vegetated with grasses and weedy vegetation located over the filled area. Historically the area contained wetlands that attracted many high risk species. In 1995 and 2004, the Port filled the wetlands, mitigated for the impacts on Government Island and at Vanport Wetlands, and brought in additional fill to help drain the fields. In addition, an extensive drain field of perforated pipe was installed to help drain the fields, prevent surface ponding and the re-establishment of wetlands on the site. Currently, due to its high risk location immediately adjacent to the approach path for Runway 10R,



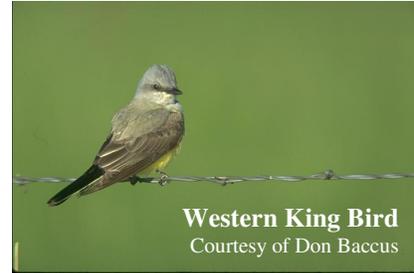
the field is mowed and disced annually, or as necessary, to prevent dense grass and herbaceous cover from becoming established. This maintenance regime is intended as a deterrent to flocks of Canada geese, a high risk species for bird strikes at the airport. The sparse grassy vegetation, sandy fill and management activities create upland habitat that supports a suite of species, including *at risk* species. Streaked horned lark utilize the site for breeding and wintering. In 2008 courtship activities of two males and a female streaked horned lark were observed in SW Quad (Port of Portland AIRMAN data, 2008). In 2009, three breeding territories of streaked horned larks were documented in the SW Quad and at least one pair successfully raised young (Oregon State University, 2009). SW Quad meets the Special Habitat Area criterion (S) area vital to an *at risk* species.

Other *at risk* species that utilize SW Quad include: peregrine falcon and Western meadow lark. Migratory species such as American pipit, Western kingbird, and lapland longspur also use the site.

*Deicing Field and Fuel Farm*

These two fields, totaling 65 acres, are located outside the Runway Protection Zone at the west end of the South Runway. Herbaceous vegetation on these undeveloped properties is mowed once or twice a year. Invasive weeds such as thistle, teasel and Himalayan blackberry are common. Targeted weed species are sprayed as needed.

These areas provide habitat for generalist species such as moles, voles, and other small mammals. Predators such as coyotes and raptors use them extensively for hunting grounds. A population of Western meadowlarks, a City of Portland *at risk* species, occurs year round in the area (Appendix D: Special Status Species in Portland). Other *at risk* species that use these locations include: Peregrine falcon, purple martin and Swainson’s hawk. Special status species that are not *at risk*, include Northern harrier, short-eared owl, and common yellowthroat. Non-special status birds that use the upland grassland habitat include savannah sparrow, lazuli bunting, barn swallow, cliff swallow, Western kingbird, and red-winged blackbird.



*Airfield*

The airfield Includes land located entirely within the airport perimeter fence and Runway Protection Zones. The airfield includes large grassy areas at the ends and outer edges of the three runways. The airfield is vegetated with non-native grasses and regularly managed to meet Federal Aviation Administration (FAA) requirements for wildlife management and vertical restrictions. The undeveloped areas inside the airport perimeter fence and Runway Protection Zone are seeded with a grass mix that is dominated by non-native fescue. Invasive weeds such as thistle, teasel and Himalayan blackberry are common. Targeted weed species are sprayed as needed. The airfield is mowed regularly to maintain the grass height between 6-10 inches as per FAA regulations.

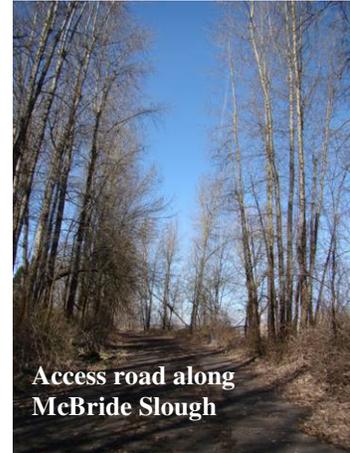


Numerous insect-eating bird species, mice, moles, and voles use these areas for foraging, and raptors use them for hunting grounds. High risk species found in the airfield include six species of gulls, Canada geese, red-tailed hawk, osprey, barn owl, great-horned owl, mallard, great blue heron, European starling and American crow. Some City of Portland special status species that do not pose a high risk to aviation safety and occur on the airfield include short-eared owl, northern harrier, American kestrel and Vaux’s swift. Some *at risk* species that do not pose a high risk to aviation safety and occur on the airfield include streaked horned lark, Western meadowlark, peregrine falcon, merlin, and purple martin. A wintering flock of approximately 25 horned larks has been documented in this area; the flock included streaked horned larks, an Endangered Species Act candidate species. There is one documented sighting of recently fledged dependent juvenile streaked horned lark on the north side of the airfield in June 2008. Western meadowlarks, another City of Portland at risk species, are present throughout the year. Winter and migrant flocks are regularly observed and range from 3 to 40 birds. They are also present in the breeding season and successful breeding by meadowlarks was confirmed on the west end of the airfield in June and July 2007 (Port of Portland, AIRMAN data).

Coyotes forage in the grasslands and also pose a risk to aircraft. Rodent populations are robust in the grassy areas. The predominant species is gray-tailed vole; other species include vagrant shrew, deer mouse, and Townsend's vole. Because these small mammals provide a prey base for coyotes and many of the high risk avian species listed above, they present an indirect risk to aircraft safety.

#### McBride Slough

Within the site is a roughly 250 linear foot segment of McBride Slough, a secondary drainageway. The portion of McBride Slough within this inventory site is inside the perimeter fence of the airport airfield. McBride Slough is remnant of historical drainageways that likely reformed each year following seasonal flooding from the Columbia River. The multiple remaining arms of the drainageway still provide stormwater conveyance to the Columbia Slough. The Multnomah County Drainage District (MCDD) actively maintains McBride Slough for flow storage and conveyance by mowing the bank, removing woody debris from the water and periodic dredging. The channels of McBride Slough are deeply incised, with steep banks.



Access road along  
McBride Slough

The riparian area around much of McBride Slough is dominated by grasses and Himalayan blackberry with some areas of willow and red-osier dogwood. The routine bank mowing reduces structural diversity of vegetation and wildlife habitat. Between mowing events the riparian vegetation provides habitat for Tree Swallow, Common Yellowthroat, Golden-crowned Sparrow and other migratory songbirds.

#### Other Secondary Drainageways

There are two water features located at the Oregon Air National Guard base. The western water feature is called Keyhole Drainage and the eastern is informally known as the ORANG Stormwater Conveyance Ditch. These drainageways perform the some of the functions of historic channels that reformed each year with seasonal Columbia River flooding.

The historic secondary drainageways have been modified over time for agricultural purposes and development. During development of airfield infrastructure the Keyhole Drainage and ORANGE Conveyance Ditch, were reconfigured to their current alignment. Both drainageways are hydrologically connected and part of a bioremediation treatment system that is operated in accordance with National Pollution Discharge Elimination System permits. The drainageways flow into water quality treatment ponds before being piped to the Columbia Slough.

Riparian vegetation associated with these drainageways primarily consists of Himalayan blackberry, grasses and some sedges and rushes. The width of the vegetated riparian area ranges from roughly 10 to 40 feet. Waterfowl and coyotes currently use the drainageways and riparian vegetation. Both waterfowl and coyotes pose a risk to aviation safety. Yellow-headed blackbirds and red-winged blackbirds also use the riparian habitats.

The Army Corps of Engineers and Department of State Lands have determined that the drainageways do not meet the criteria as jurisdictional wetlands because the drainageways are part of a stormwater system.

## 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 #). 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 the Methodology Overview section of this report and the *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2008).

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 secondary drainageways and vegetated riparian areas that contribute to the riparian functions as detailed in the natural resource description. These landscape features provide the following riparian functions:

- 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 assigned to the secondary drainageways, including McBride Slough, and wetlands. Riparian forests and areas of dense tree canopy receive a high or medium relative ranks depending on proximity to open water. Medium and low relative ranks are generally assigned to lower structure riparian vegetation around open water such as Keyhole Drainage and ORANG Stormwater Conveyance Ditch. Other areas are assigned a high, medium or low relative rank depending on the proximity and extent of vegetation relative to the water body (CS2 Map 4).

### Wildlife Habitat

A wildlife habitat patch is, for purposes of the inventory model, defined as forest and/or wetland areas, 2 acres in size or greater, plus adjacent woodland vegetation (note Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features).

The site contains forested areas and wetlands that provide wildlife habitat and connectivity between habitat patches. The forested areas provides 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 (SHA) descriptions

There is one Special Habitat Area (SHA), with two subareas in the inventory site. CS24.A and B: Upland Grassland meets four SHA criteria: area critical to sensitive species (S); upland meadow important to grassland-associated species (G); migratory stopover habitat (M); and wildlife connectivity corridor (C). The SHA ranking supersedes lower rankings generated by the GIS model. Therefore, all SHAs within the site rank high for wildlife habitat (CS2 Map 5).

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 (CS2 Map 6).

<b>Table 17: Summary of Ranked Resources in CS2: Portland International Airport</b>				
Total Inventory Site = 2,322 acres				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>				
acres	7	53	107	166
percent total inventory site area	<1	2	5	7
<b>Wildlife Habitat</b>				
<b>Wildlife Habitat*</b>				
acres	0	3	0	3
percent total inventory site area	0	<1	0	<1
<b>Special Habitat Areas*</b>				
acres	803			
percent total inventory site area	35			
<b>Wildlife Habitat - adjusted by Special Habitat Areas **</b>				
acres	803	<1	0	803
percent total inventory site area	35	<1	0	35
<b>Combined Total***</b>				
acres	804	25	33	862
percent total inventory site area	35	1	1	37
* 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.				

# Site CS2a - Map 1: Portland International Airport

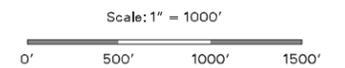
## 2007 Aerial Photography

-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.





# Site CS2a - Map 2: Portland International Airport

## Water-Related Features

### Water Bodies

Stream/Drainage

Culvert or Piped

Flood Area

Wetlands

**Other Features**

**Outfalls**

- Stormwater
- Combined stormwater /sanitary
- Abandoned

**Bank Type**

- Beach
- Bio-engineered
- Vegetative Rip Rap
- Non-vegetative Rip Rap
- Unclassified Fill Bank
- Rock Bank
- Seawall
- Pilings

Site Boundary

City Boundary

Urban Services

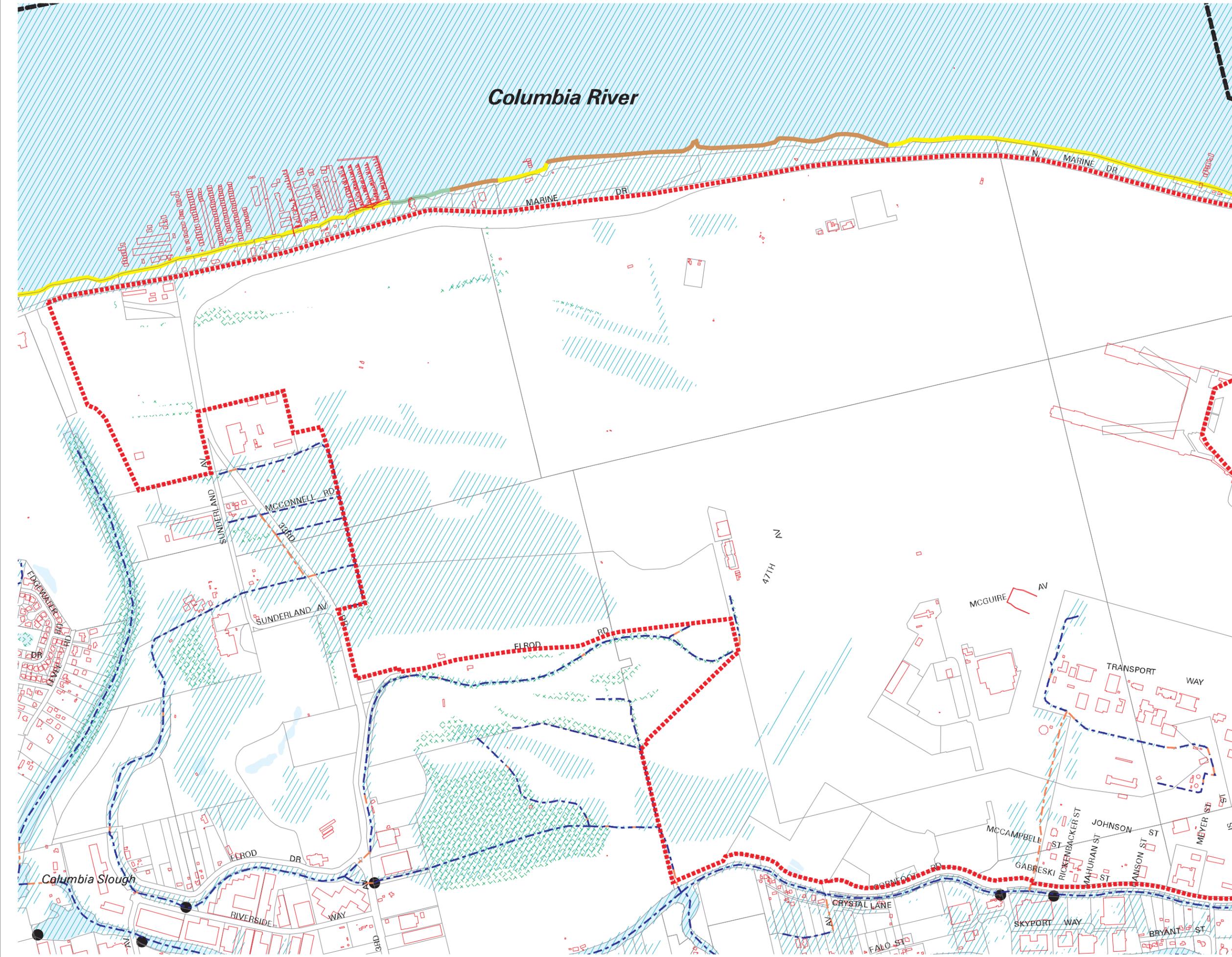
**INFORMATION SOURCES:**

**Water Bodies:**  
Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date.  
**Outfalls:** Maintained by BES (June 2008) Location is approximate and data may be incomplete.

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Scale: 1" = 1000'

0' 500' 1000' 1500'





# Site CS2a - Map 3: Portland International Airport

## Vegetation Features

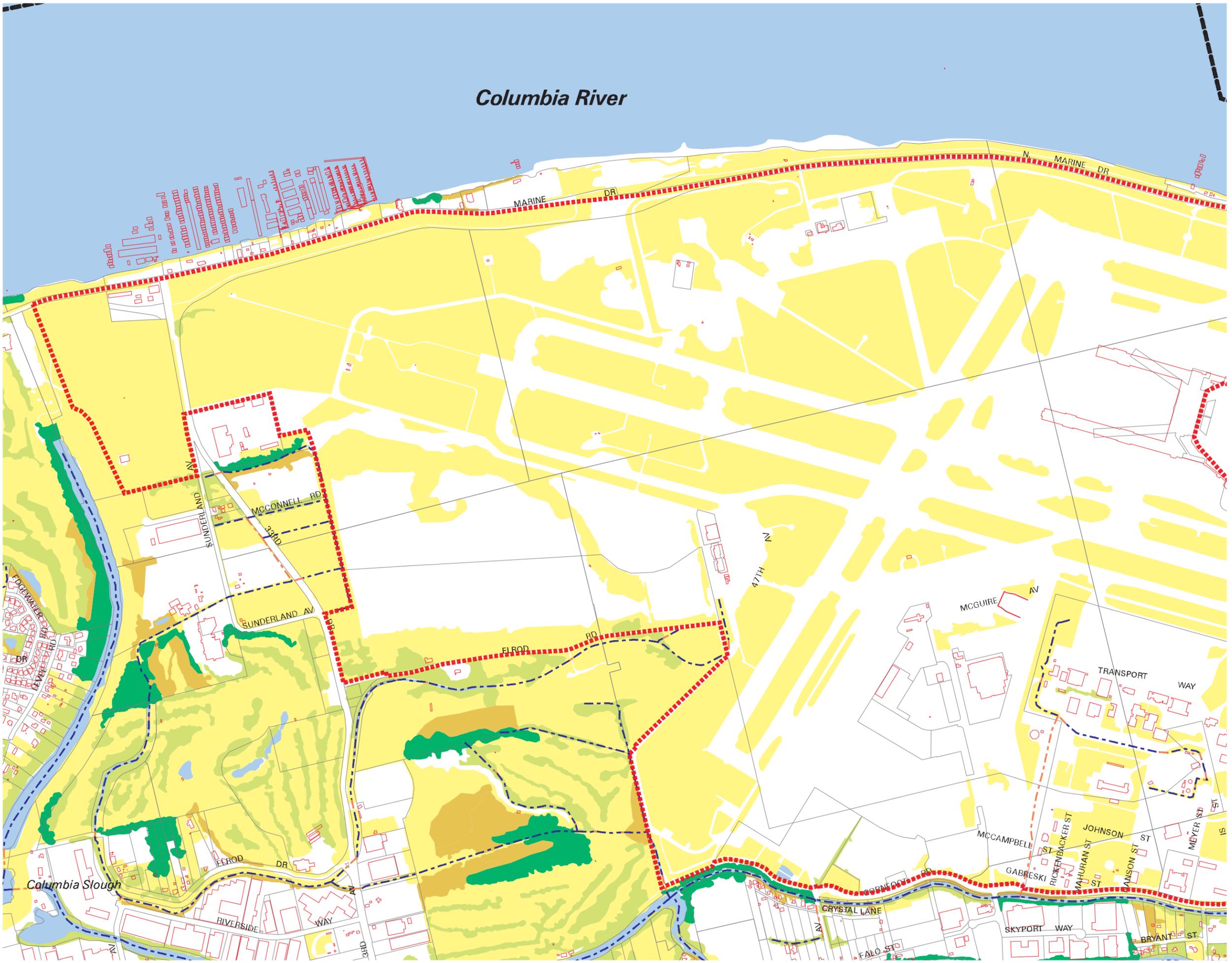
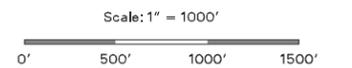
### Vegetation Types

-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

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# Site CS2a - Map 4: Portland International Airport Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

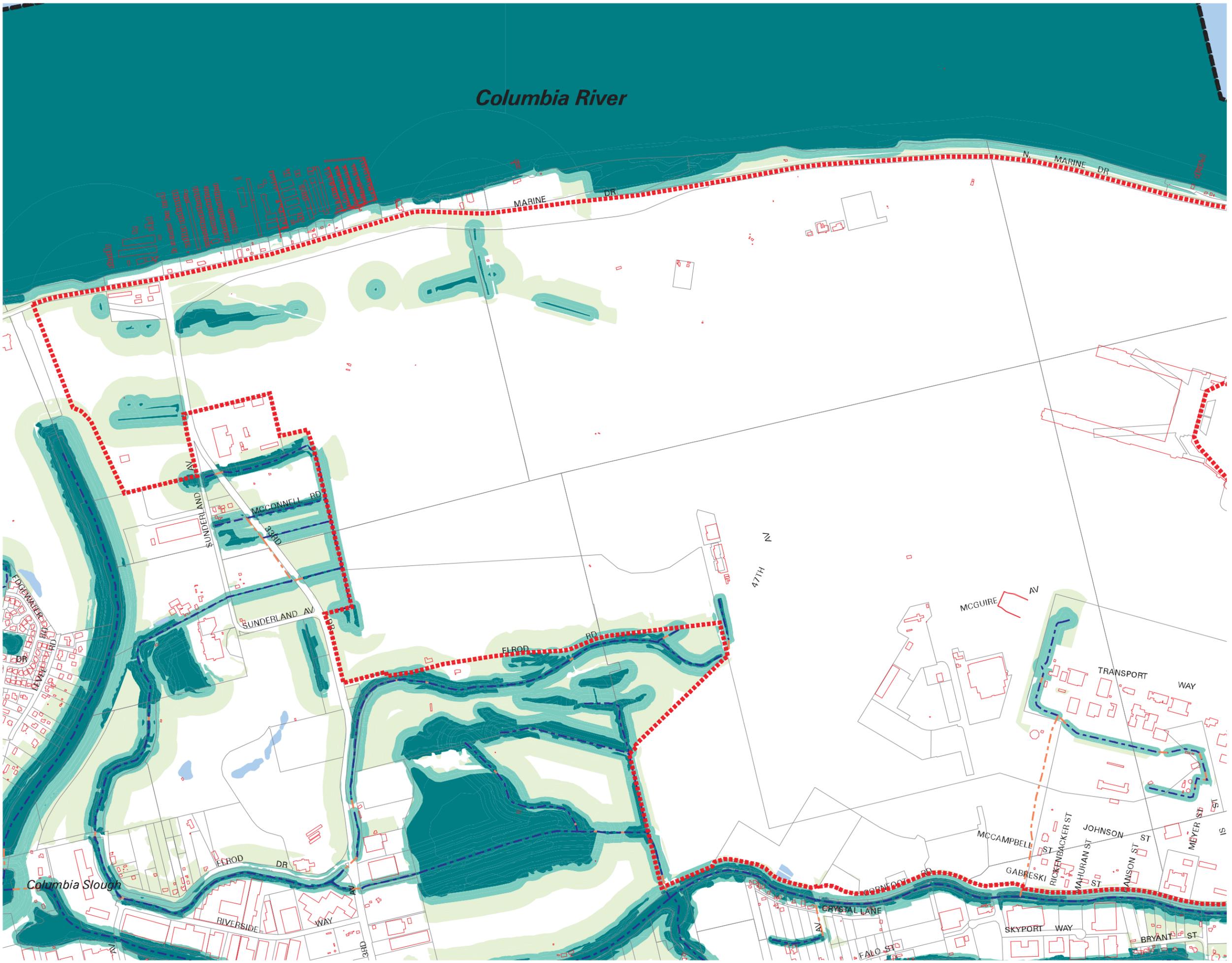
The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

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# Site CS2a - Map 5: Portland International Airport

## Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

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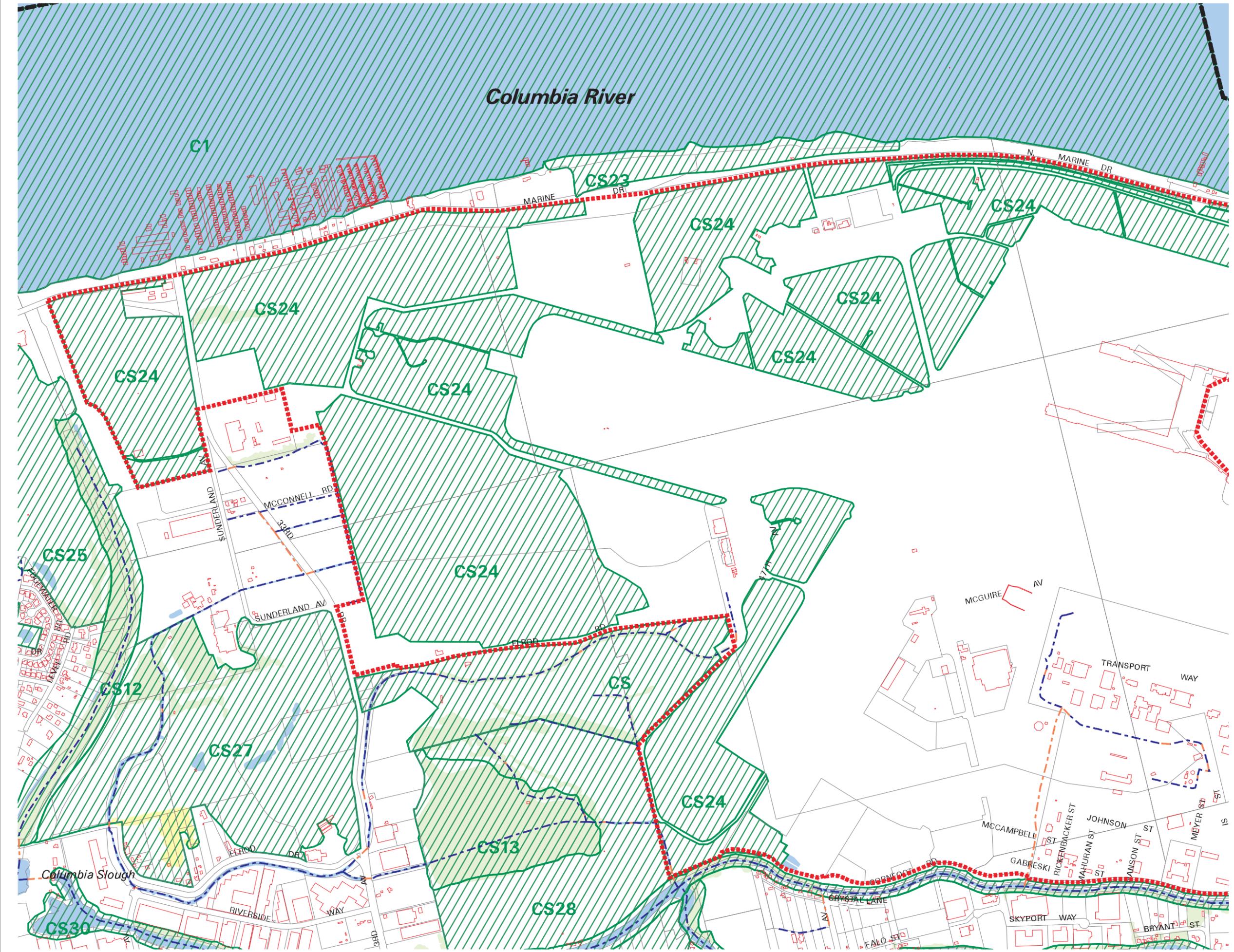
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Scale: 1" = 1000'





# Site CS2a - Map 6: Portland International Airport

## Combined Riparian / Wildlife Habitat Relative Rankings

- High relative value - Special Habitat Areas \*\*
- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

### INFORMATION SOURCES:

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\*\* SHA ranking supercedes lower relative values.

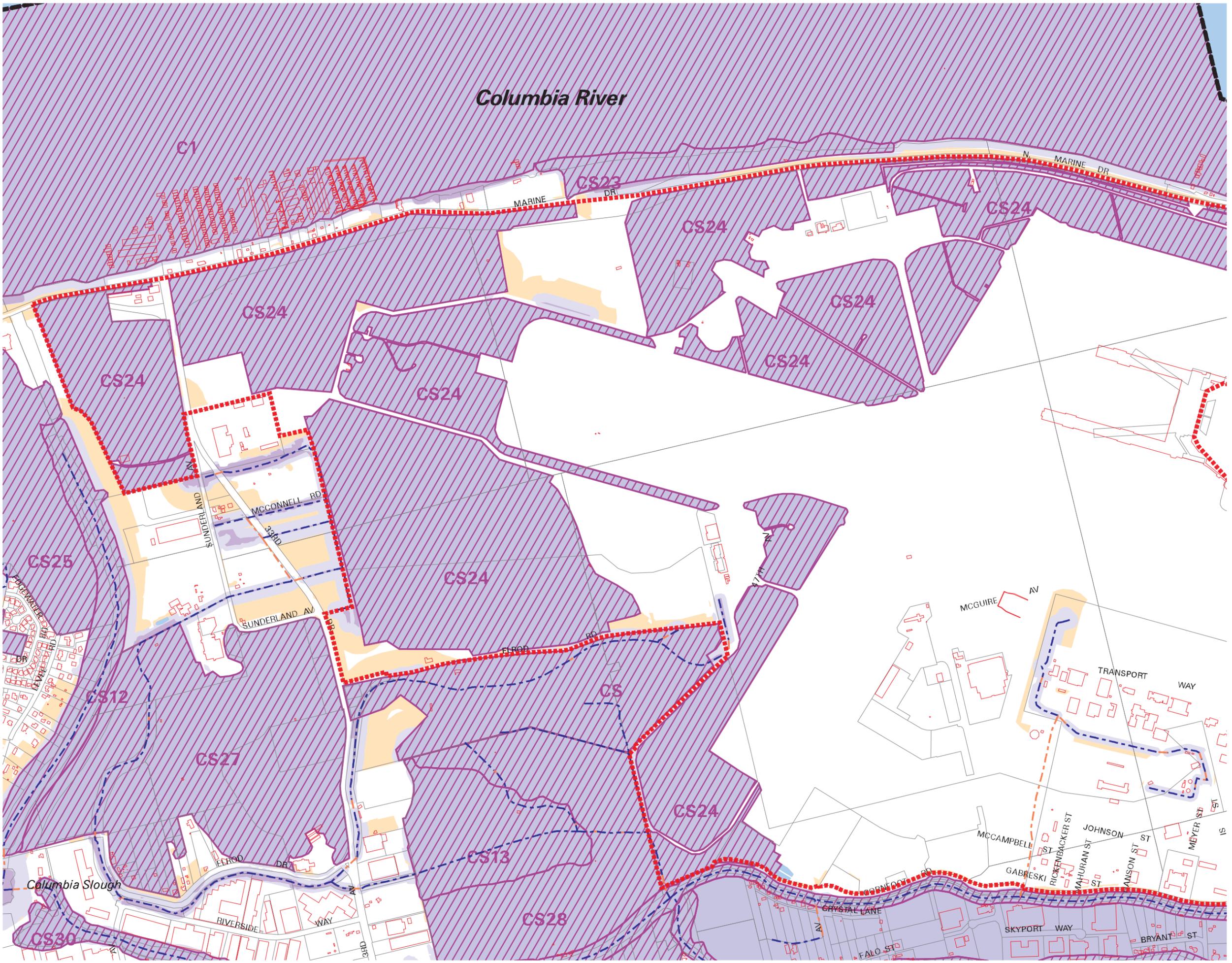
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Scale: 1" = 1000'

0' 500' 1000' 1500'





# Site CS2b - Map 1: Portland International Airport

## 2007 Aerial Photography

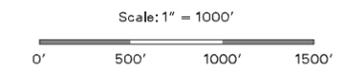
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary



### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

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# Site CS2b - Map 2: Portland International Airport

## Water-Related Features

### Water Bodies

Stream/Drainage

Culvert or Piped

Flood Area

Wetlands

### Other Features

#### Outfalls

Stormwater

Combined stormwater /sanitary

Abandoned

### Bank Type

Beach Unclassified Fill Bank

Bio-engineered Rock Bank

Vegetative Rip Rap Seawall

Non-vegetative Rip Rap Pilings

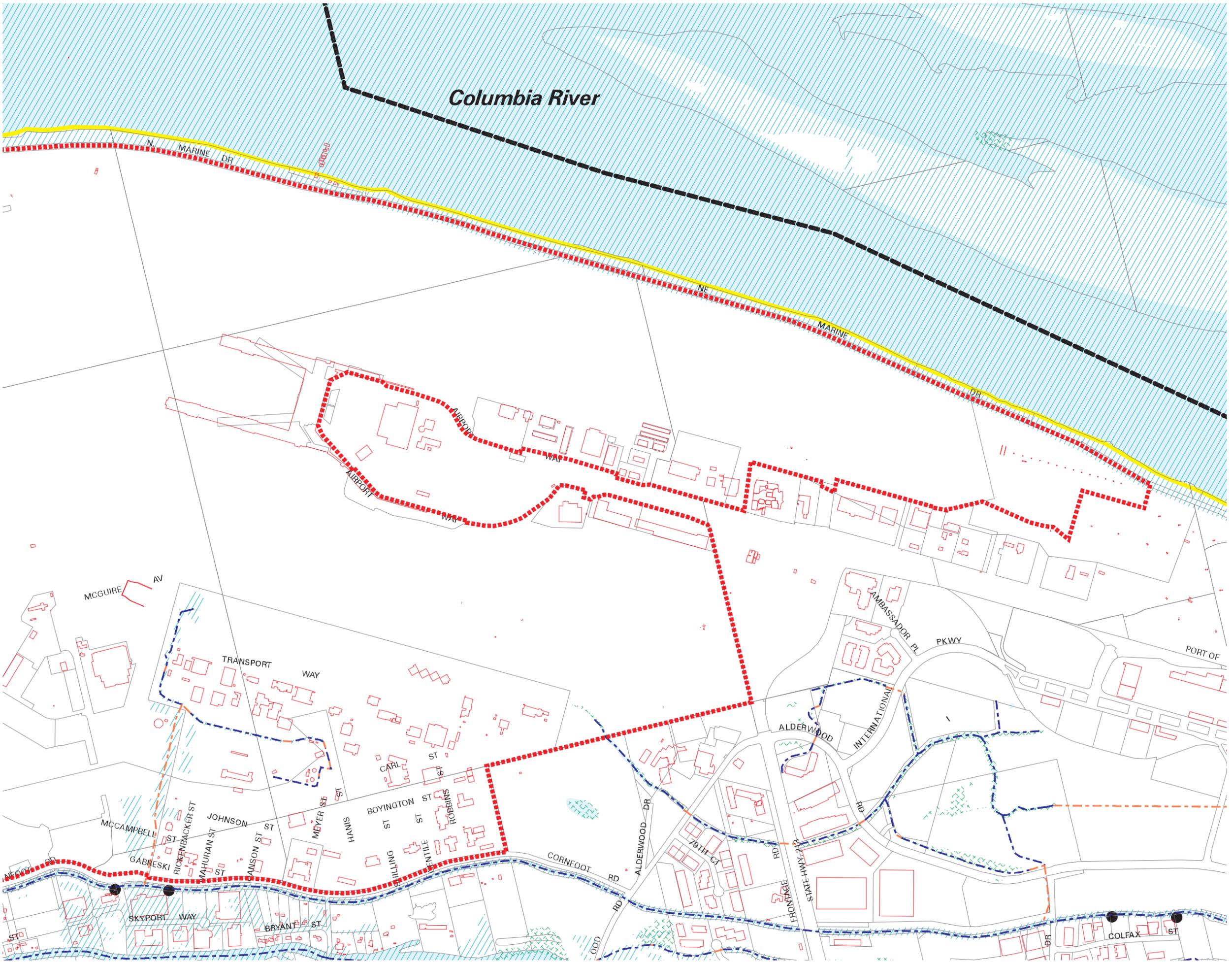
Site Boundary Urban Services

City Boundary

### INFORMATION SOURCES:

**Water Bodies:**  
Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date. Outfalls: Maintained by BES (June 2008) Location is approximate and data may be incomplete.

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# Site CS2b - Map 3: Portland International Airport

## Vegetation Features

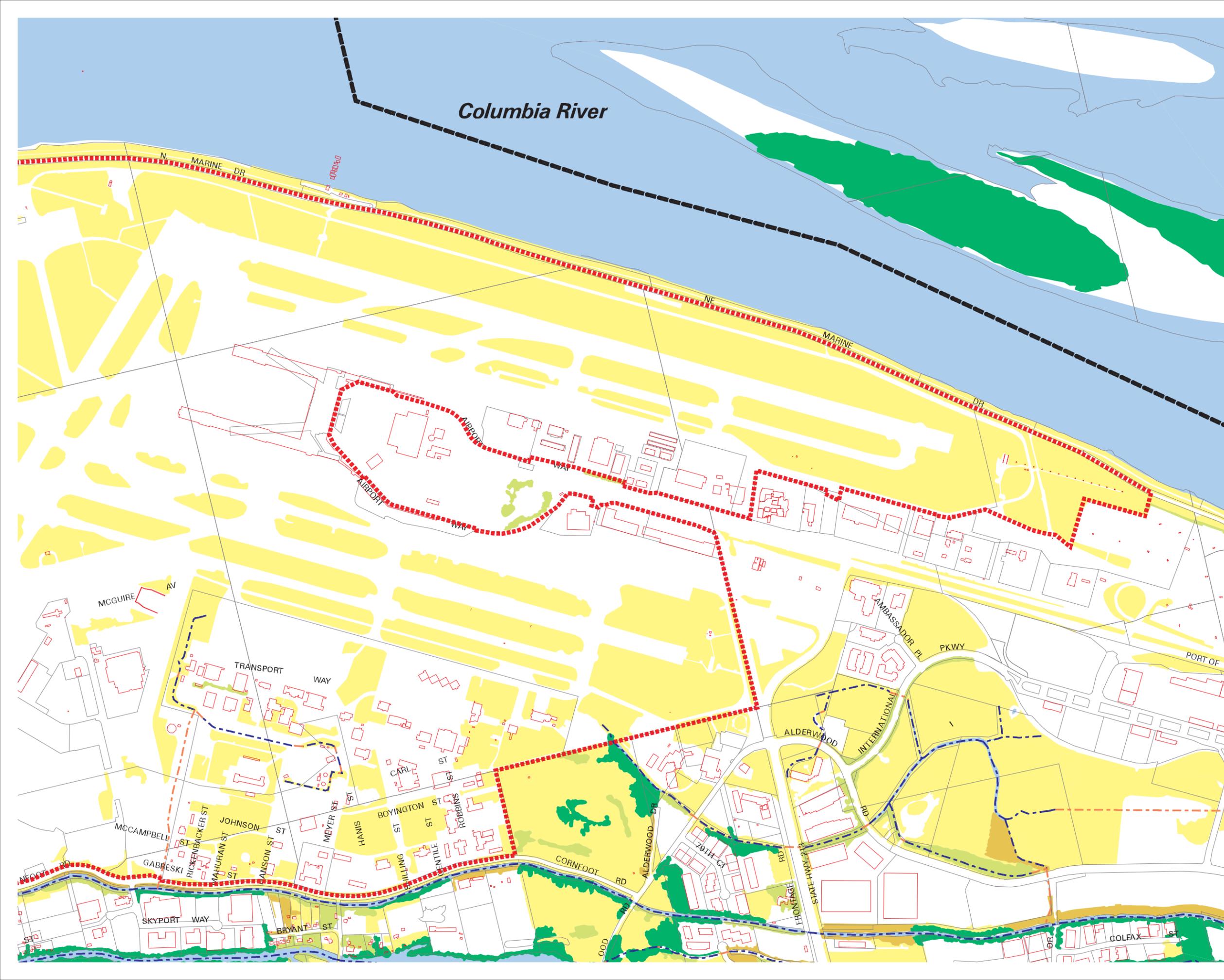
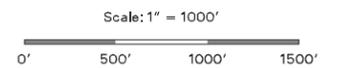
### Vegetation Types

-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

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# Site CS2b - Map 4: Portland International Airport Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

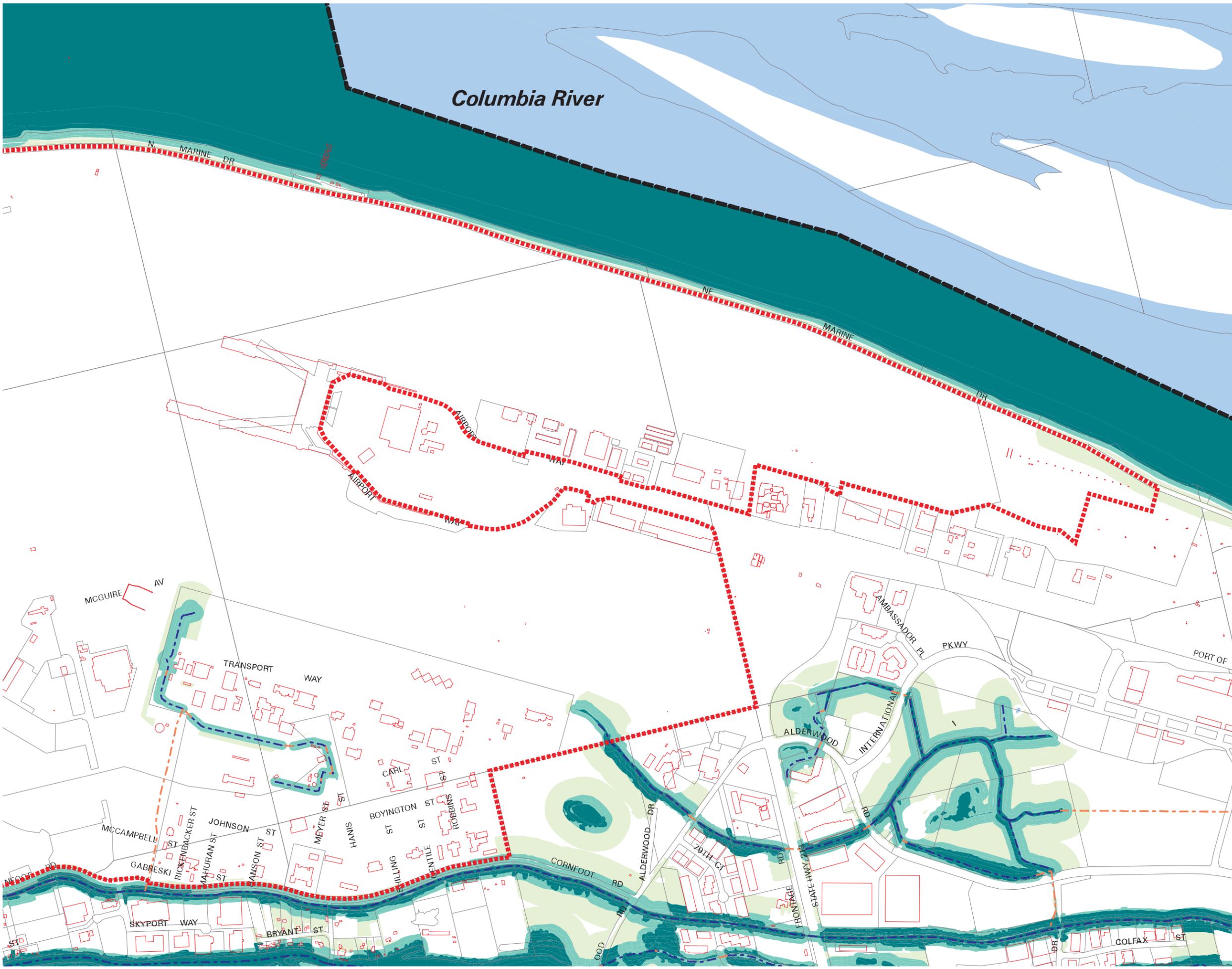
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# Site CS2b - Map 5: Portland International Airport Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

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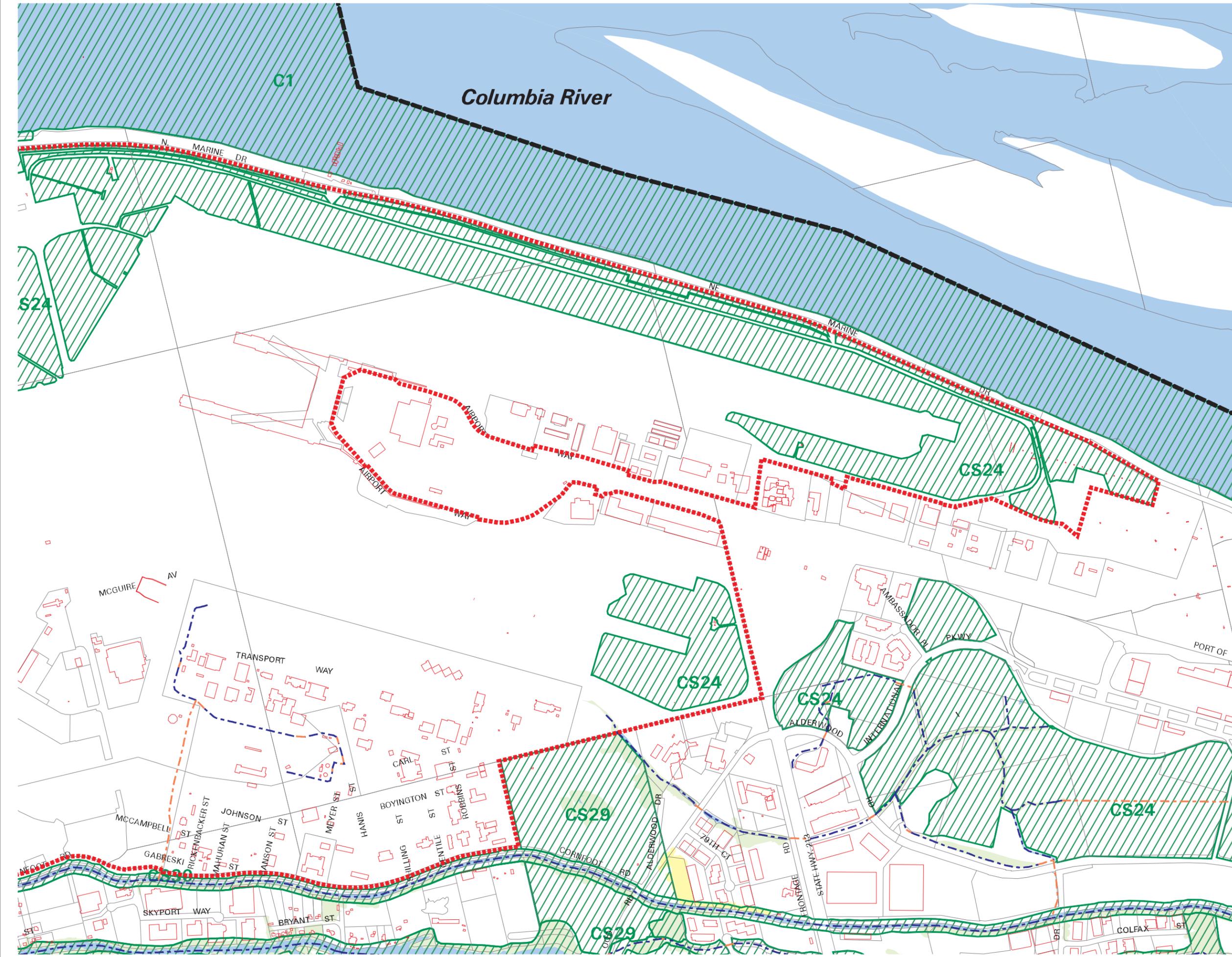
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<http://www.portlandonline.com/planning/index.cfm?c=40437>

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Scale: 1" = 1000'





# Site CS2b - Map 6: Portland International Airport

## Combined Riparian / Wildlife Habitat Relative Rankings

- High relative value - Special Habitat Areas \*\*
- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

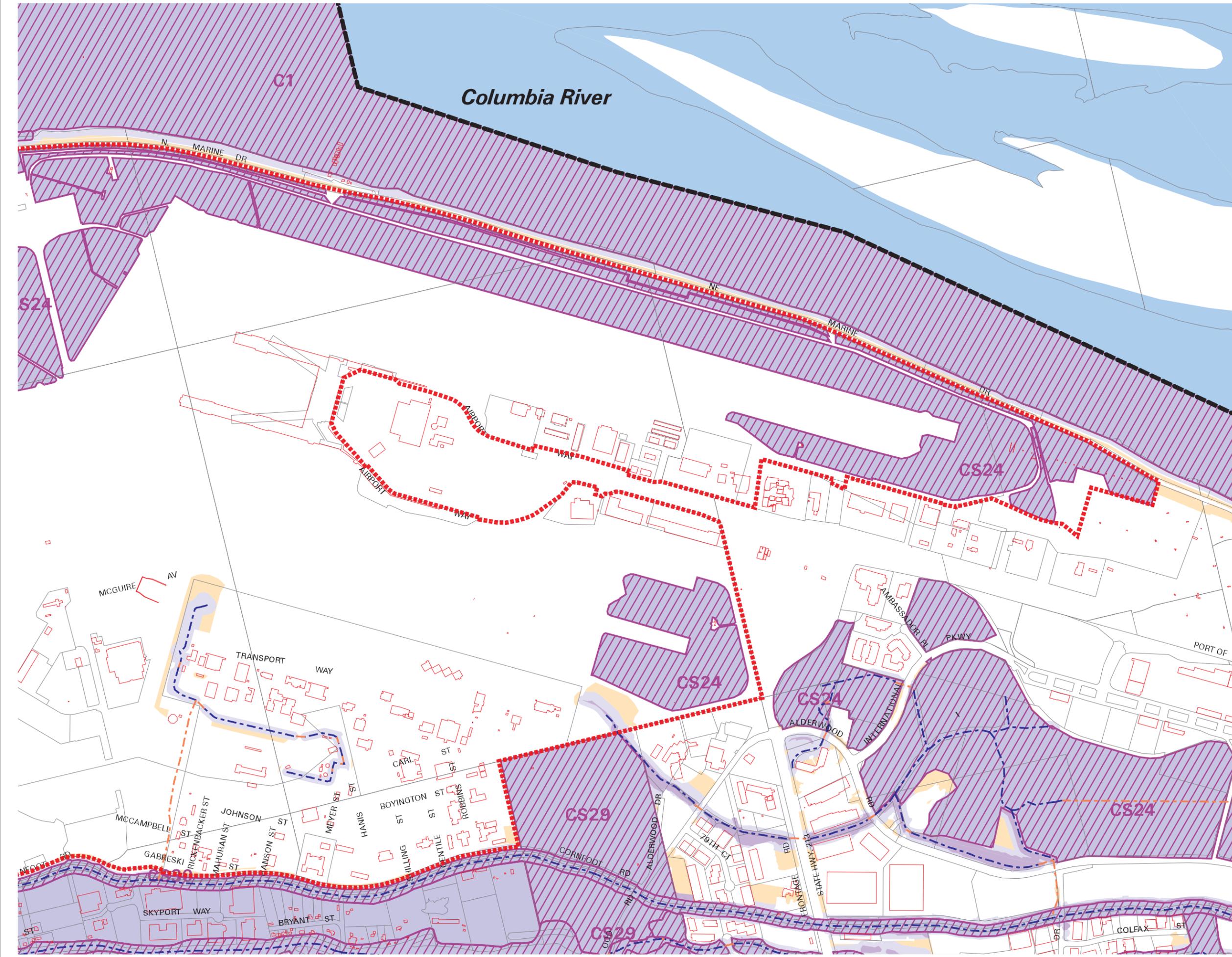
\*\* SHA ranking supercedes lower relative values.

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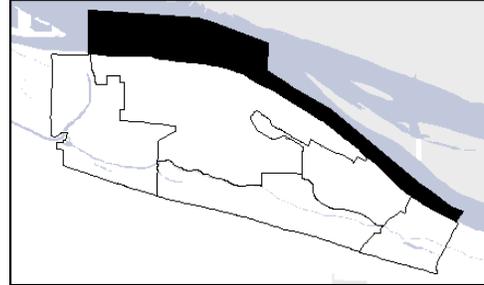
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Scale: 1" = 1000'





## INVENTORY SITE CS3: Central Columbia River



### Summary Information

Watershed: Columbia Slough and Columbia River

Neighborhood: East Columbia, Parkrose

USGS quadrangle and quarter section maps: 1N1E01, 1N1E02, 1N2E04, 1N2E05, 1N2E06, 1N2E08, 1N2E09, 1N2E10, 1N2E14, 1N2E15, 2N1E35, 2N1E36 and 2N2E31

River Mile: 108-114

Site Size: 1,430 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: General Industrial 2 (IG2)  
General Commercial (CG)  
Single Dwelling Residential (RF)  
Open Space (OS)  
Aircraft Landing height overlay (h)  
Airport Noise overlay (x)  
Environmental Conservation overlay (c)  
Scenic Overlay (s)

Existing Land Use: open space; residential; marina; levee; transportation

General Description: This site is primarily the Columbia River and its bank. A flood control levee that was built in 1919 by the USACE and MCDD separates the river from the historic floodplain. Marine Drive is located on top of the levee. The majority of the river bank is undeveloped and owned by the Port of Portland. There is a private marina and a public boat launch, Gleason Boat Ramp, located in the western section of the site. To the east of the Gleason Boat Ramp is Broughton Beach. The Columbia River is a migration channel for anadromous salmonids and is on the Pacific Flyway for migratory birds. Parts of the river are dredged to maintain a navigation channel for movement of goods.

Resource Features: river and shallow water areas; beach

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):

- *C1: Columbia River/Beaches* - area critical to sensitive species including NOAA designated Critical Habitat (S) and connectivity corridor (C)

#### Special Status Species:

- *Birds:* bald Eagle, bufflehead, Dunlin, great blue heron, merlin, Peregrine falcon, purple martin, red-necked grebe, short-eared owl, streaked horned lark, Thayer's gull, western meadowlark, western sandpiper
- *Mammals:* American beaver, northern river otter
- *Fish:* coho, chum, Chinook, steelhead, sockeye salmon, lamprey

Natural Hazards: flood area

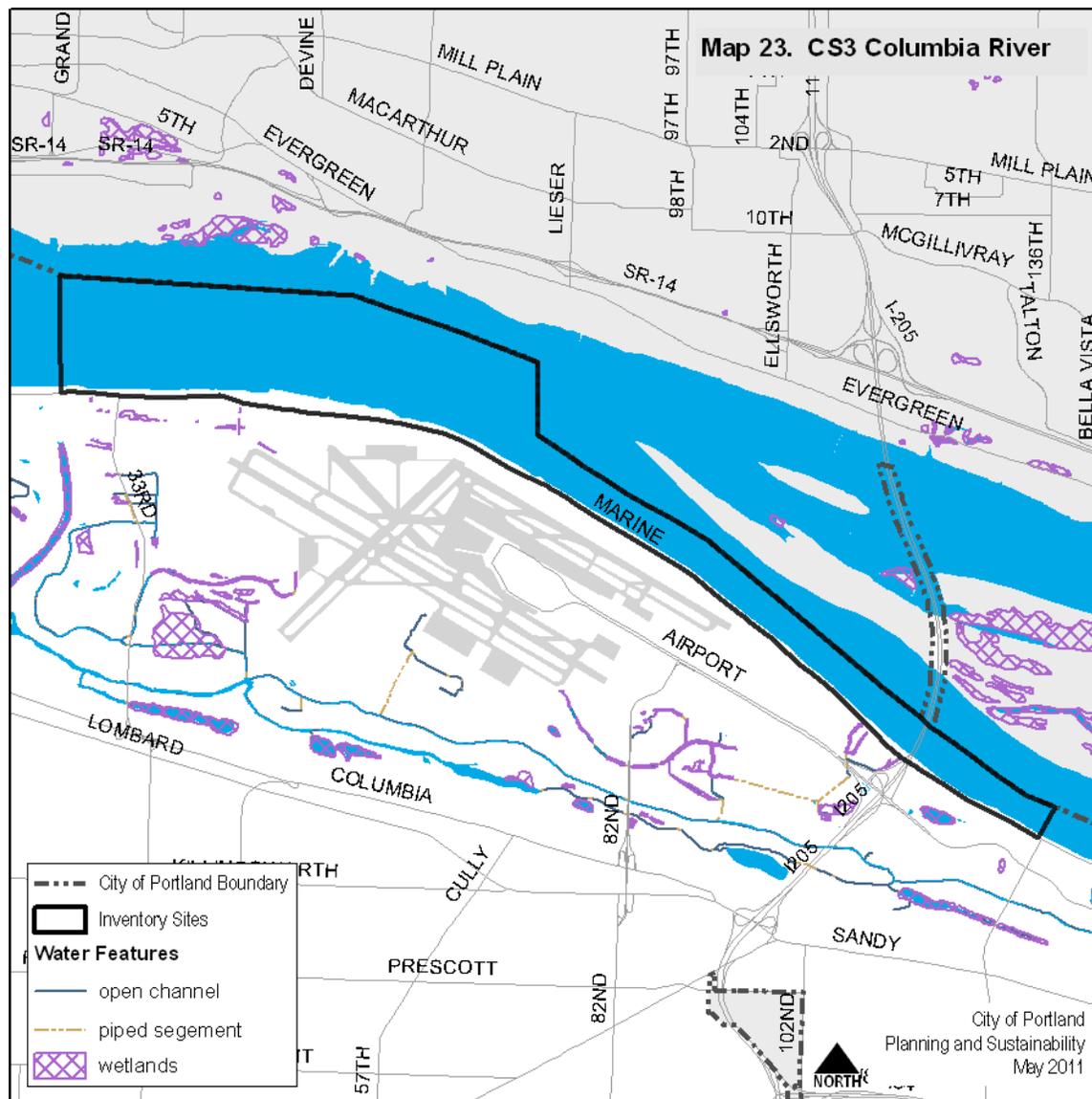
Contamination: Yes

## Site Description

The Columbia River inventory site is 1,430 acres in size, 128 acres of which is terrestrial and the remaining 1,302 acres is the Columbia River. The inventory site boundaries are formed by Marine Drive to the south, the city limits to the north, approximately NE 122<sup>nd</sup> Avenue to the east and the western boundary is an extension of the Peninsula Canal levee to the city limits (Map 23). The majority of the river bank is undeveloped, except for a private marina and public boat launch (Gleason Boat Ramp). The river bank function is constrained by the levee along Marine Drive. The site contains approximately 62 acres of impervious area, including 4.6 miles of roads, located the site. Site CS3 Map 1 shows an aerial view of the inventory site.



Columbia River



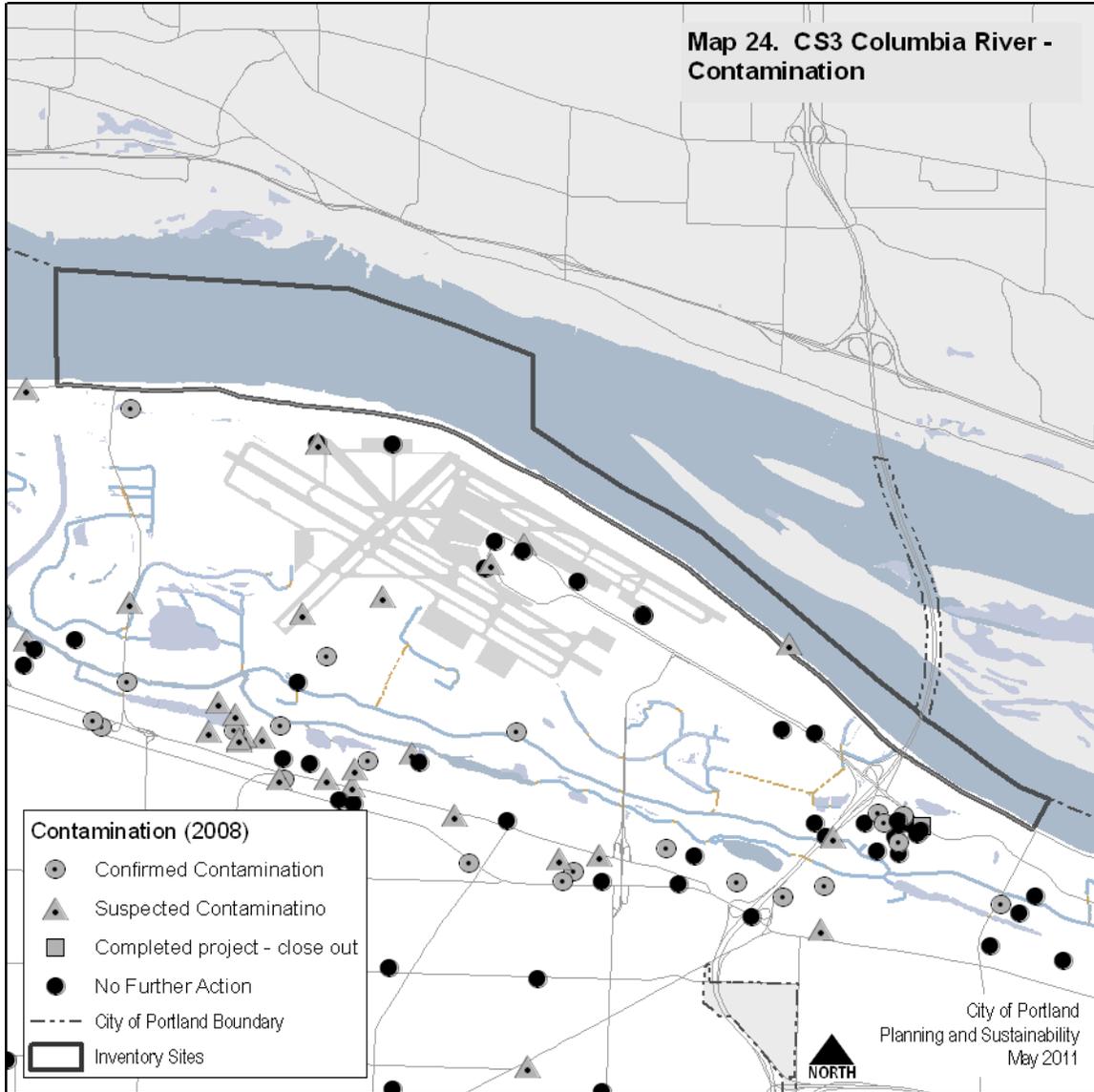
The 1,425-acre flood area includes 1,321 acres of open water, 62 acres of vegetated flood area and 42 acres of non-vegetated flood area (CS3 Map 2).

Vegetated areas at least ½ acre include approximately 1 acre of forest or dense tree canopy, 1 acre of shrubland and 68 acres of herbaceous cover (CS3 Map 3).

**Table 18:** Summary of Natural Resource Features in CS3: Columbia River

	<b>Study Area</b> (1,430 acres)
<b>Columbia River (miles/acres)</b>	(6.2/1,302)
<b>Wetlands (acres)</b>	0
<b>Flood Area (acres)*</b>	1,425
Vegetated (acres)	62
Non-vegetated (acres)	42
Open Water** (acres)	1,321
<b>Vegetated Areas &gt;= ½ acre (acres)+</b>	70
Forest (acres)	1
Woodland (acres)	0
Shrubland (acres)	1
Herbaceous (acres)	68
<b>Impervious Surfaces (acres)</b>	62
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the Columbia River within the site.	
+ 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 2006 aerial photography.	

The Oregon Department of Environmental Quality (DEQ) has identified one area of suspected contamination (Map 24). In December 2005, hundreds of rusty drums were located on the river bottom. In 2007, sediment samples were taken and found elevated concentrations of mercury, selenium, zinc, 4-methylphenol, bis(2-ethylhexyl)phthalate and actophenone. In 2008, a “No Future Action” determination was made by the Environmental Protection Agency. For more information regarding contamination, visit the DEQ website at <http://www.deq.state.or.us/lq/ecsi/ecsi.htm>.



## Natural Resource Description

The majority of the site, 1,302 acres, contains the Columbia River. The Columbia River is a 1,200 mile long river that drains a 259,000 square mile basin that includes territory in seven states (Oregon, Washington, Idaho, Montana, Nevada, Wyoming, and Utah) and portions of British Columbia in Canada.

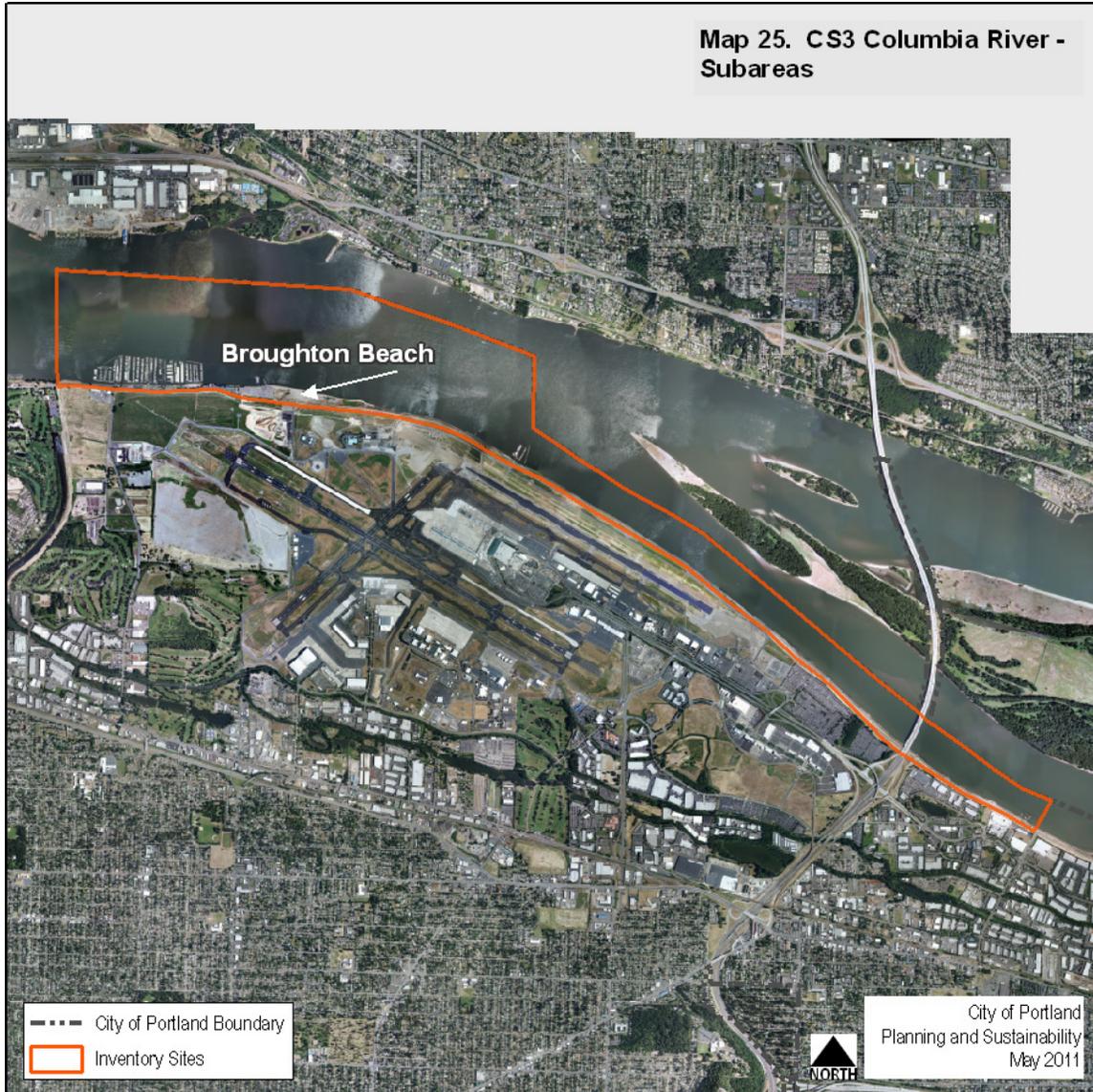
The Columbia River in this site is part of the upstream component of the Columbia tidal freshwater estuary. Columbia River flow is dominated by outflow from Bonneville Dam. Flows fluctuate, reflecting daily peaks in power generation. There is little tidal effect (less than one foot during low flows). The site contains are large islands, such as Government Island, which is crossed by the I-205 Bridge, Hayden Island, and smaller islands such as Lemon Island. The Sandy and Washougal Rivers directly upstream provide the major riverine inputs to the Columbia River estuary in this area.



The Lower Columbia River is currently on Oregon's Clean Water Act 303(d) list because it does not meet water quality standards for temperature, PCBs, PAHs, DDT metabolites (DDE), and arsenic. In addition, the Environmental Protection Agency has established Total Maximum Daily Loads (TMDLs) for the Columbia River for dioxin and dissolved gas. The volume of water in the Lower Columbia and the variety of pollution sources make it difficult to establish cause and affect relationships between pollution sources and general water quality. Columbia River flows also contain high levels of organic matter, the sources of which include: wastewater treatment plants, faulty septic systems, agricultural run-off, and fertilizer application.

The river is a migration channel for anadromous salmonids including Chinook, Coho, chum, sockeye, and steelhead. Near shore, shallow water areas and areas of sandy substrate, such as Broughton Beach which is located just east of the Metro boat launch, are utilized by juvenile salmonids during migration to the Pacific Ocean (Map 25). The Columbia River is designated by NOAA Fisheries as Critical Habitat for listed salmonids. The near-shore, shallow-water areas with sandy substrate are also important for lamprey.

The Columbia River is part of the Pacific Flyway, which is a significant corridor for migratory birds. Broughton Beach is used by shore birds, songbirds and migratory birds. Piscivorous diving birds use the near shore water for foraging: horned grebe, eared grebe, western grebe and common loon. The sandy beach provides habitat for migratory shorebirds and songbirds. Streaked Horned Lark, a candidate under the Endangered Species Act, uses the beach as a transient and wintering habitat. It may also use the area for breeding. Successful breeding by this species has been documented nearby on Portland International Airport. Other sub-species of horned sark (*merrilli* and possibly *alpina*, *arctica*, and *lamprochroma*) also use the site for winter and migratory stop-over habitat. Other Special Status Species using the site include red-necked grebe in shallow water, short-eared Owls that hunt and roost in the vegetation above the beach, and western meadowlarks.



The Columbia River and its beaches are designated a Special Habitat Area because the waterway and flood area has been designated by NOAA Fisheries as Critical Habitat for listed salmonids and it is an important wildlife corridor for migratory species including special status bird species.

The river bank is influenced by the location of the levee, which was built in 1919 to protect agricultural and residential uses located in the floodplain. In 1932, Marine Drive was built on top of the levee. A multiuse recreation path that is utilized by bikers and pedestrians is also located on top of the levee. Vegetation on the levee and at the toe of the levee is restricted to low structure species that will not compromise the structure of the levee. As a result the banks of the Columbia in this site are vegetated with grasses.

## 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 #). 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 the Methodology Overview section of this report and the *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2008).

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 Corridors

The riparian corridor in this site contains portions of the Columbia River, vegetated and non-vegetated flood area, and other vegetated areas, as detailed in the natural resource description. These landscape features provide one or more of the following riparian functions:

- 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

In general high relative functional ranks are assigned to the Columbia River, beaches and forested areas along the river bank. Medium and low ranks are assigned to lower structure riparian vegetation and to non-vegetated land within 50 feet of the river. Other areas are assigned a high, medium or low relative rank depending on the proximity and extent of vegetation relative to the water body (CS3 Map 4).

### Wildlife Habitat

A wildlife habitat patch is, for purposes of the inventory model, defined as forest and/or wetland areas, 2 acres in size or greater, plus adjacent woodland vegetation (note Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features). There are no forested or wetland areas 2 acres in size or greater in this inventory site.

### Special Habitat Areas (SHA) descriptions

SHAs 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 rank supersedes lower ranks generated by the GIS model. Therefore, all SHAs within the site rank high for wildlife habitat (CS3 Map 5).

The Columbia River channel and associated beaches are designated Special Habitat Areas (SHA). SHAs contain unique features and provide critical wildlife habitat for listed salmonids, as described in the Natural Resources Description section above. The Columbia River meets following SHA criteria: area critical to sensitive species including NOAA designated Critical Habitat (S) and connectivity corridor (C). SHAs receive a high relative rank for wildlife habitat.

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 (CS3 Map 6).

<b>Table 19: Summary of Ranked Resources in CS3: Columbia River</b>				
<b>Total Inventory Site</b>	= 1,430 acres			
<b>Terrestrial*</b>	= 88 acres			
<b>Columbia River</b>	= 1,302 acres			
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>				
acres	1,322	49	20	1,391
percent total inventory site area	92	3	1	96
<b>Wildlife Habitat</b>				
<b>Wildlife Habitat*</b>				
acres	0	0	0	0
percent total inventory site area	0	0	0	0
<b>Special Habitat Areas*</b>				
acres	1,325			
percent total inventory site area	93			
<b>Wildlife Habitat - adjusted by Special Habitat Areas **</b>				
acres	1,325	0	0	1,325
percent total inventory site area	93	0	0	93
<b>Combined Total***</b>				
acres	1,329	44	19	1,391
percent total inventory site area	93	3	1	97
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Willamette 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.				



**DRAFT**

## Site CS3a - Map 1: Central Columbia River

### 2007 Aerial Photography

-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

*Columbia River*

#### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'  
0' 400' 800' 1200'





## Site CS3a - Map 2: Central Columbia River

### Water-Related Features

#### Water Bodies

-  Stream/Drainage
-  Culvert or Piped

#### Other Features

-  Flood Area
-  Wetlands
- Outfalls**
-  Stormwater
-  Combined stormwater /sanitary
-  Abandoned

#### Bank Type

-  Beach
-  Bio-engineered
-  Vegetative Rip Rap
-  Non-vegetative Rip Rap
-  Unclassified Fill Bank
-  Rock Bank
-  Seawall
-  Pilings
-  Site Boundary
-  Urban Services

#### City Boundary

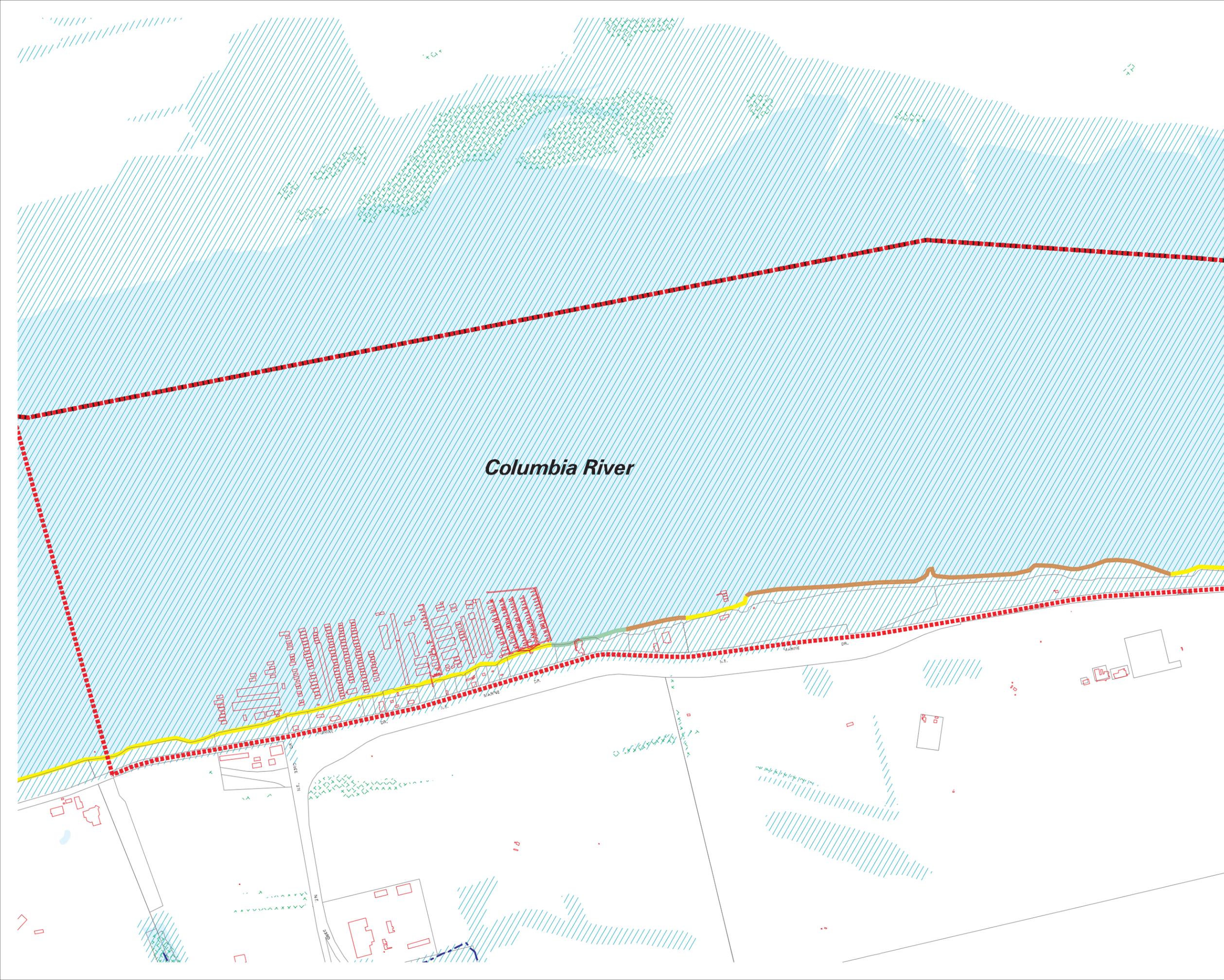
#### INFORMATION SOURCES:

**Water Bodies:**  
Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date.  
**Outfalls:** Maintained by BES (June 2008) Location is approximate and data may be incomplete.

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Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS3a - Map 3: Central Columbia River

### Vegetation Features

#### Vegetation Types

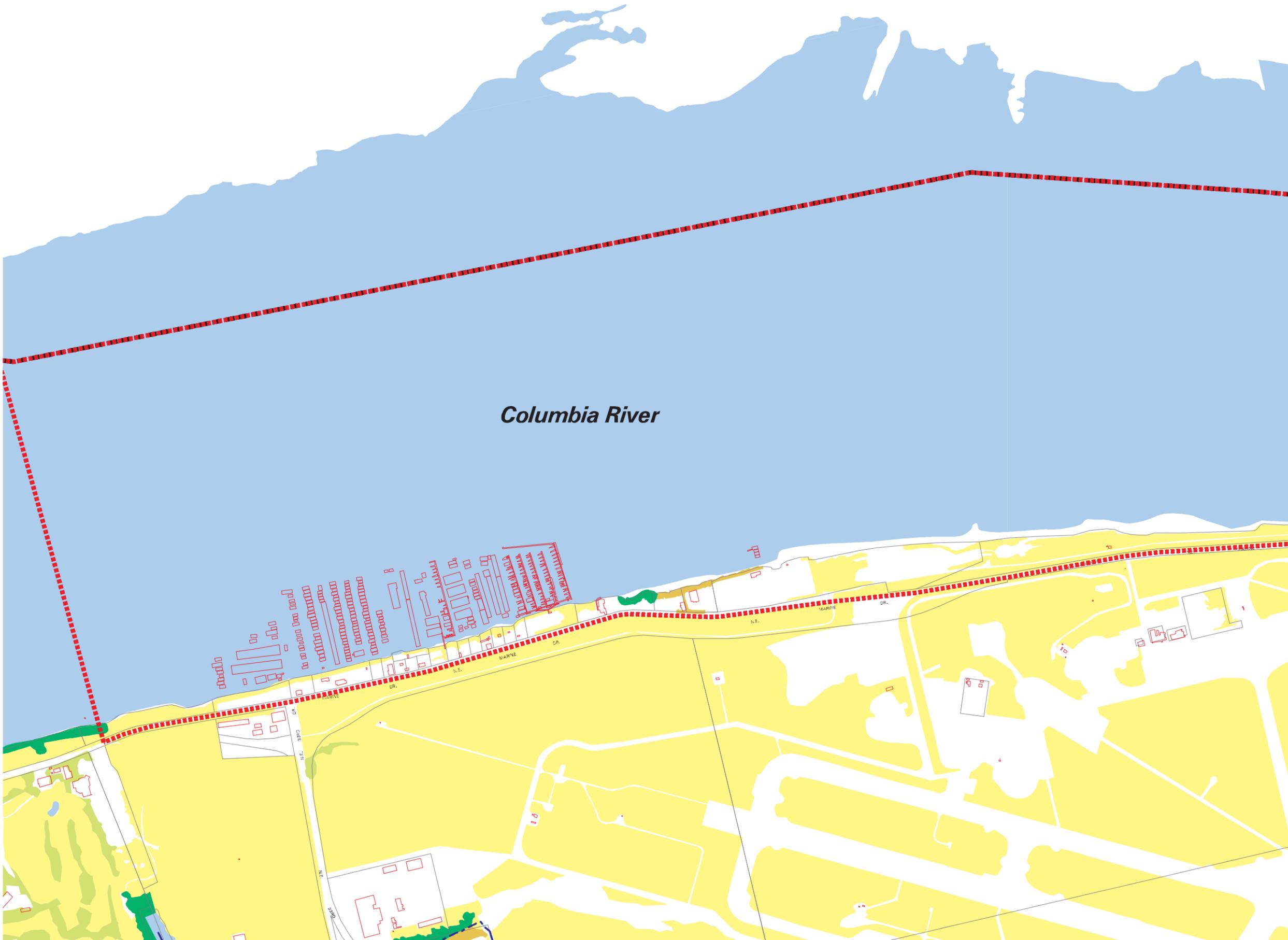
-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

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Scale: 1" = 800'  
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## Site CS3a - Map 4: Central Columbia River

### Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

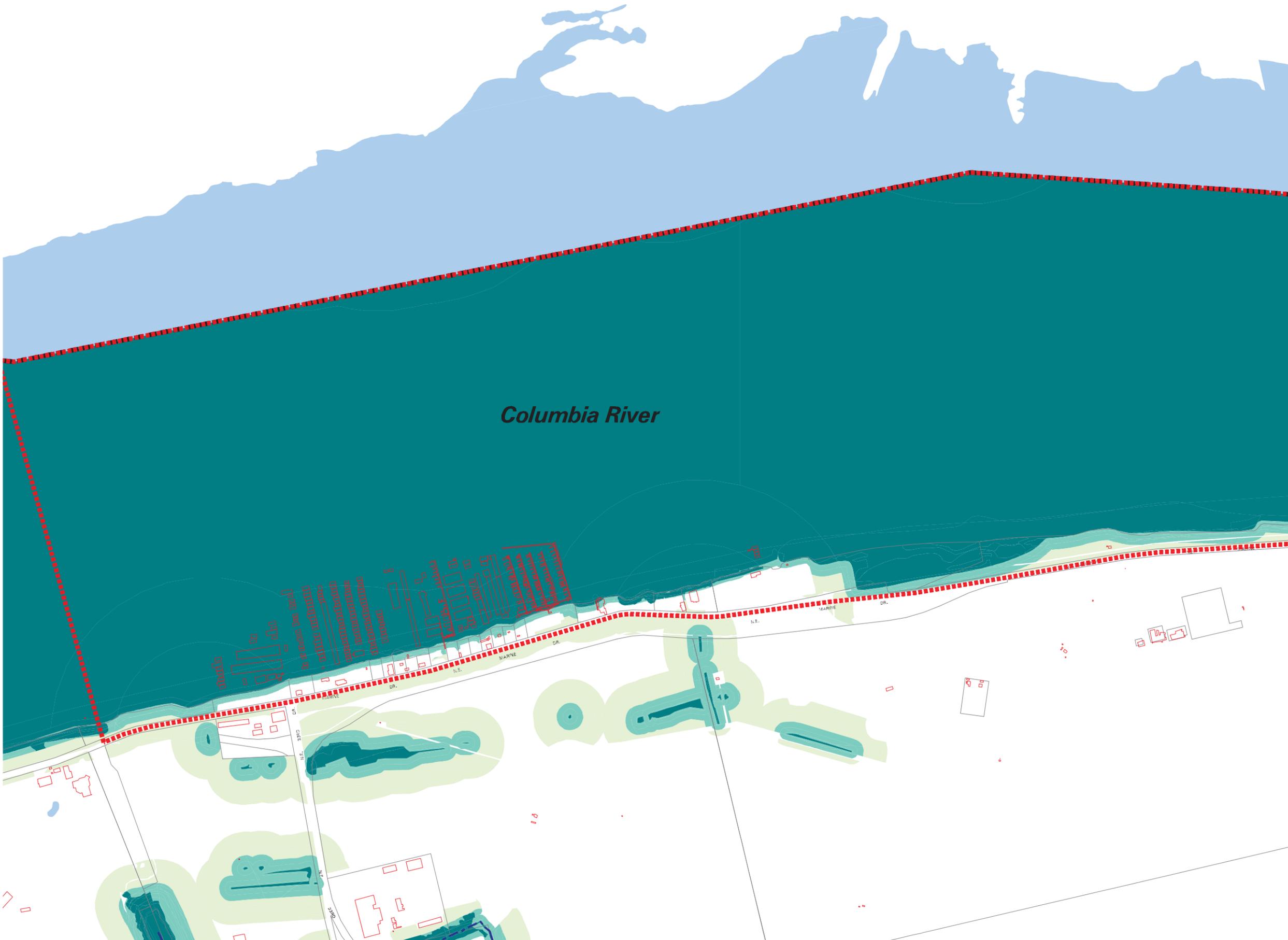
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Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS3a - Map 5: Central Columbia River

### Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

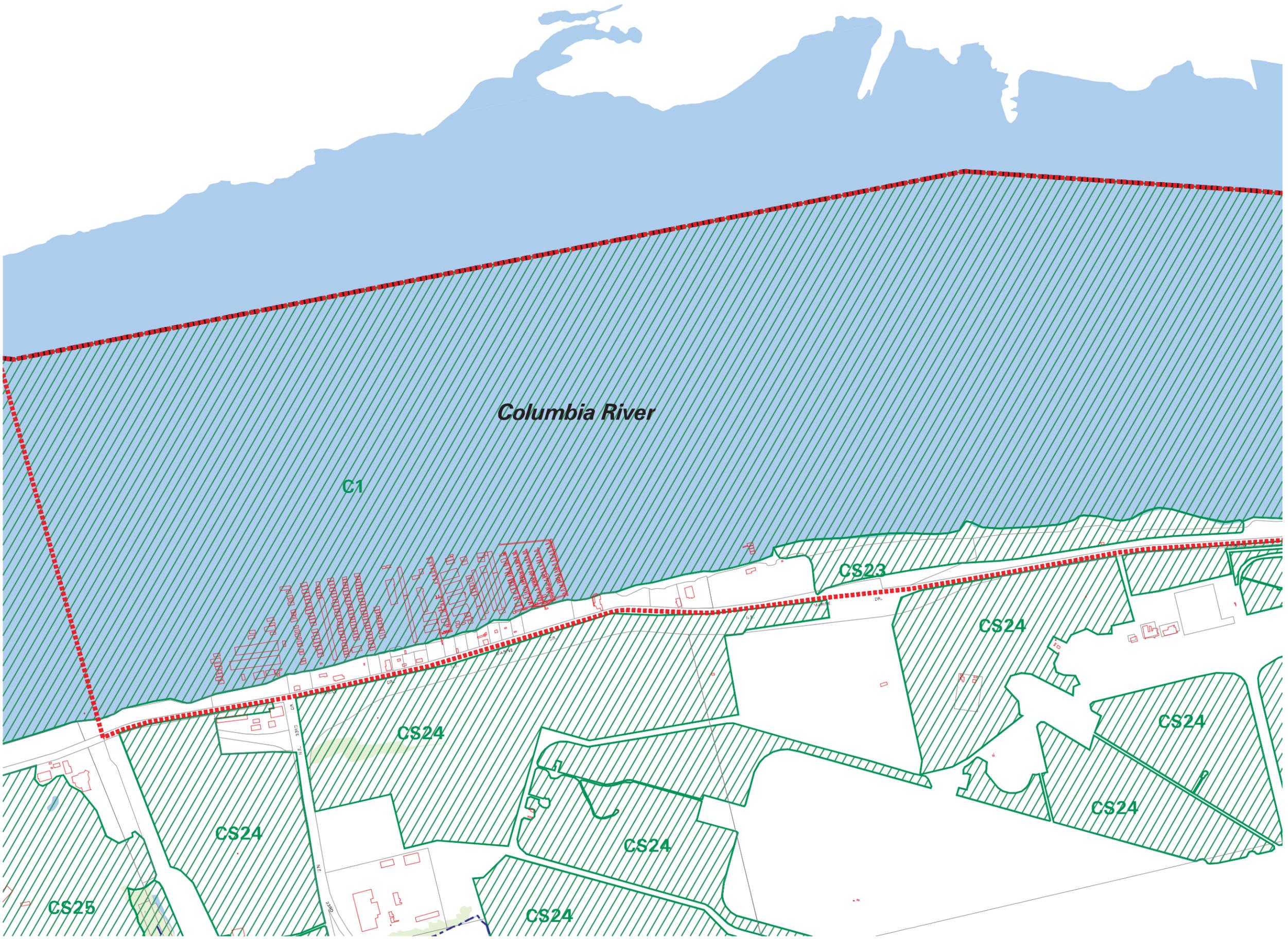
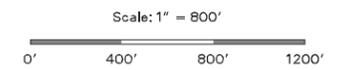
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## Site CS3a - Map 6: Central Columbia River

### Combined Riparian / Wildlife Habitat Relative Rankings

-  High relative value -  
Special Habitat Areas \*\*
-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

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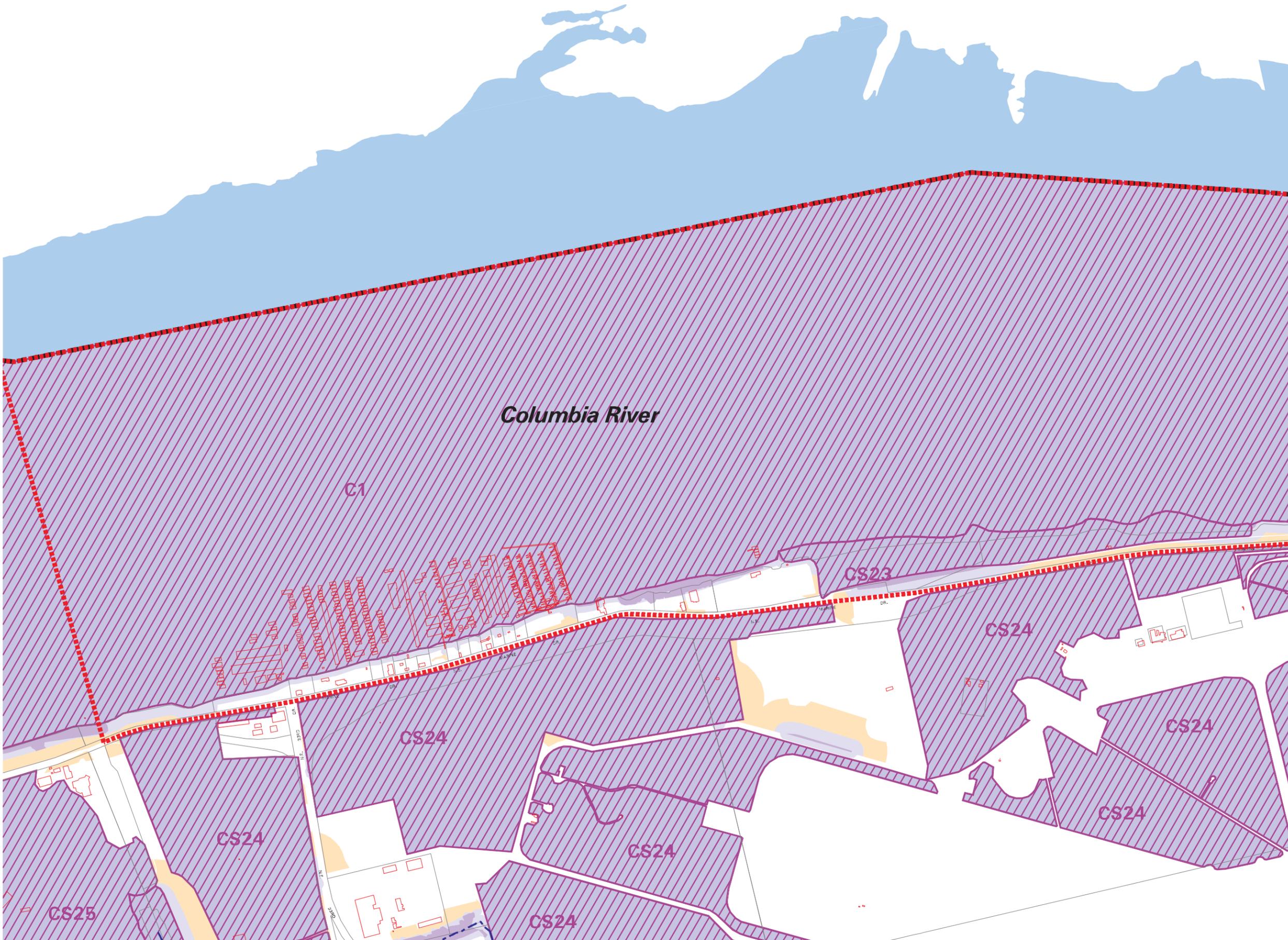
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## Site CS3b - Map 1: Central Columbia River

### 2007 Aerial Photography

-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary



#### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

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## Site CS3b - Map 2: Central Columbia River

### Water-Related Features

#### Water Bodies

 Stream/Drainage

 Culvert or Piped

 Flood Area

 Wetlands

#### Other Features

**Outfalls**

 Stormwater

 Combined stormwater /sanitary

 Abandoned

#### Bank Type

 Beach

 Bio-engineered

 Vegetative Rip Rap

 Non-vegetative Rip Rap

 Site Boundary

 City Boundary

 Unclassified Fill Bank

 Rock Bank

 Seawall

 Pilings

 Urban Services

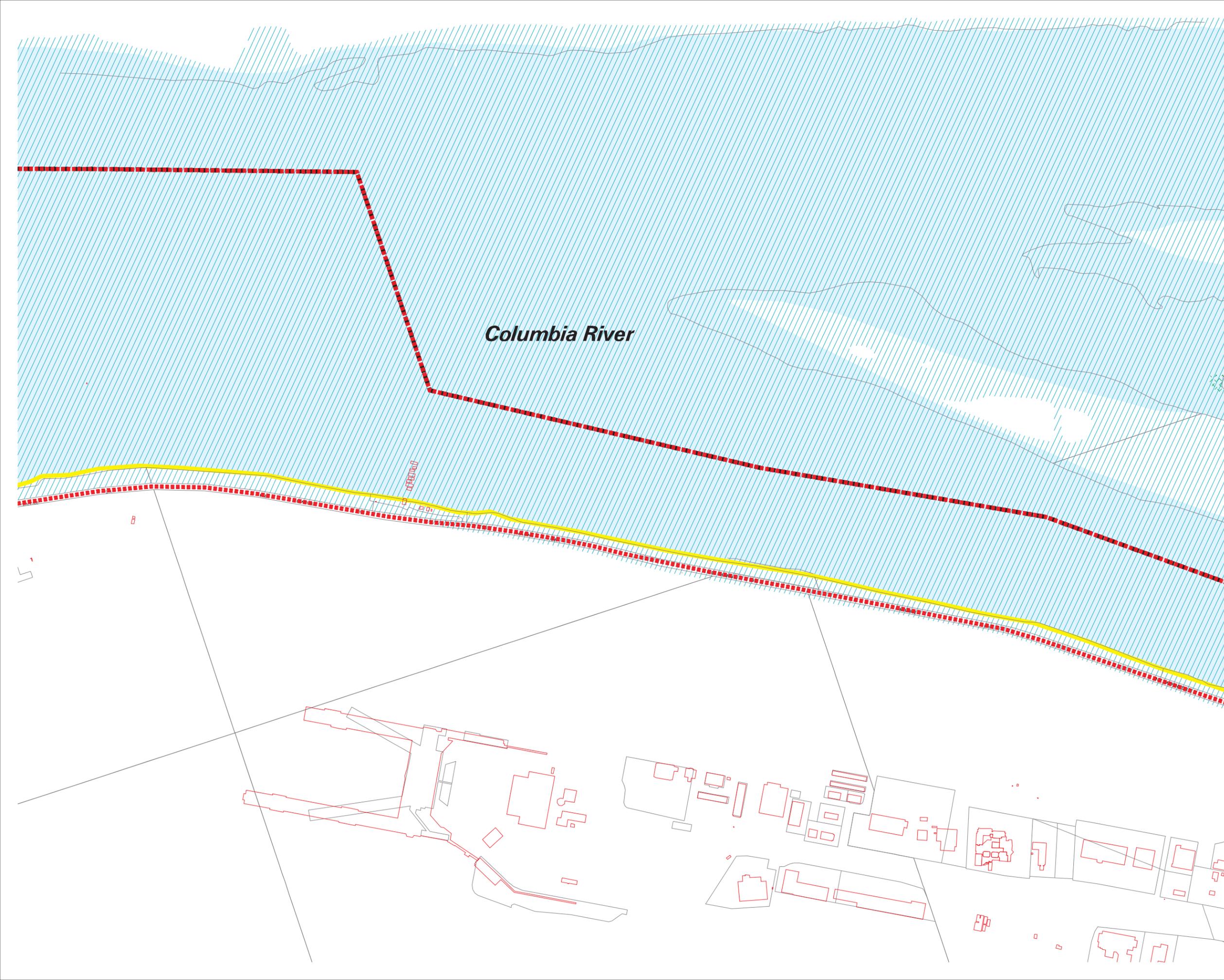
#### INFORMATION SOURCES:

**Water Bodies:**  
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0' 400' 800' 1200'





## Site CS3b - Map 3: Central Columbia River

### Vegetation Features

#### Vegetation Types

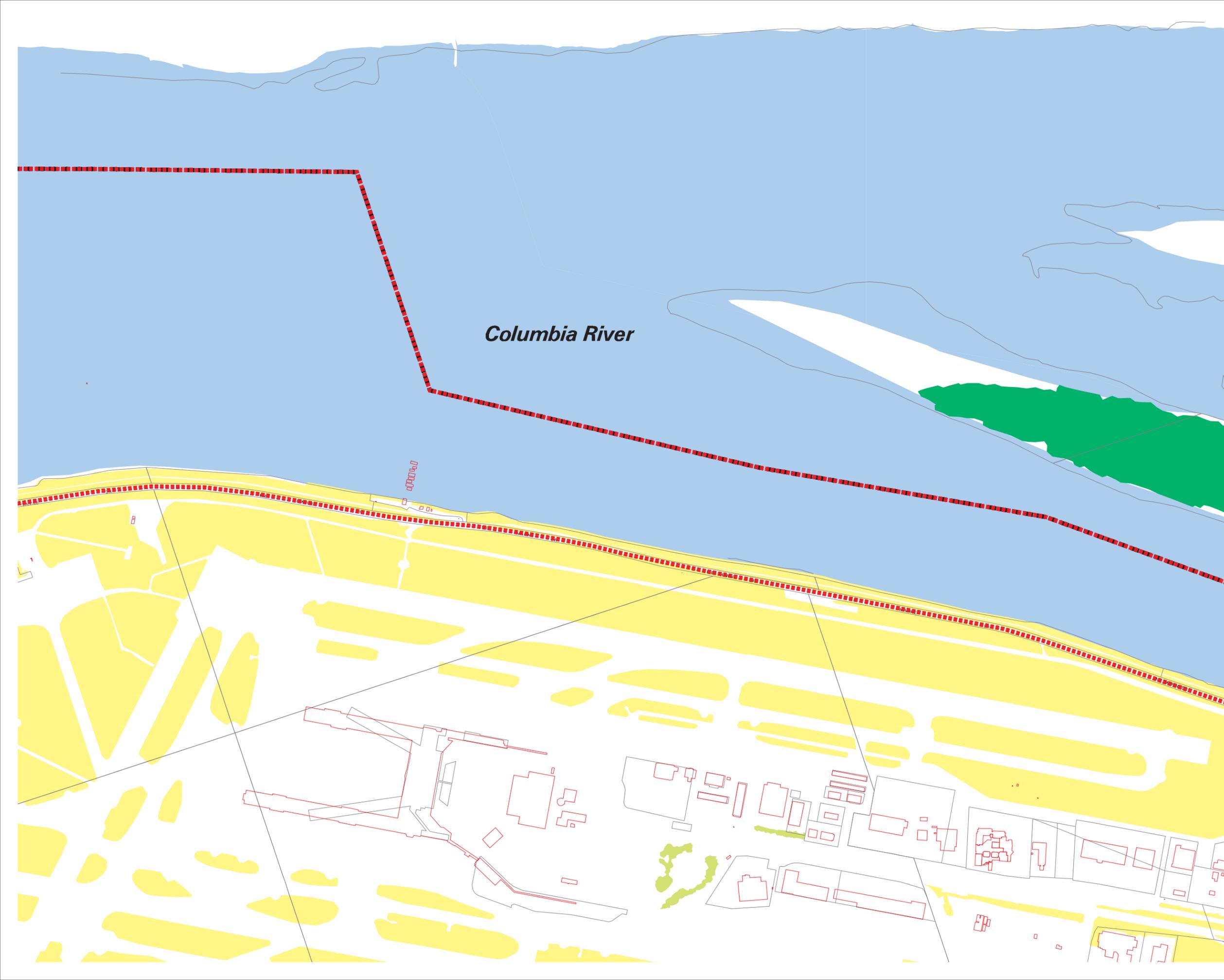
-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

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Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

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Scale: 1" = 800'  
0' 400' 800' 1200'





## Site CS3b - Map 4: Central Columbia River

### Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

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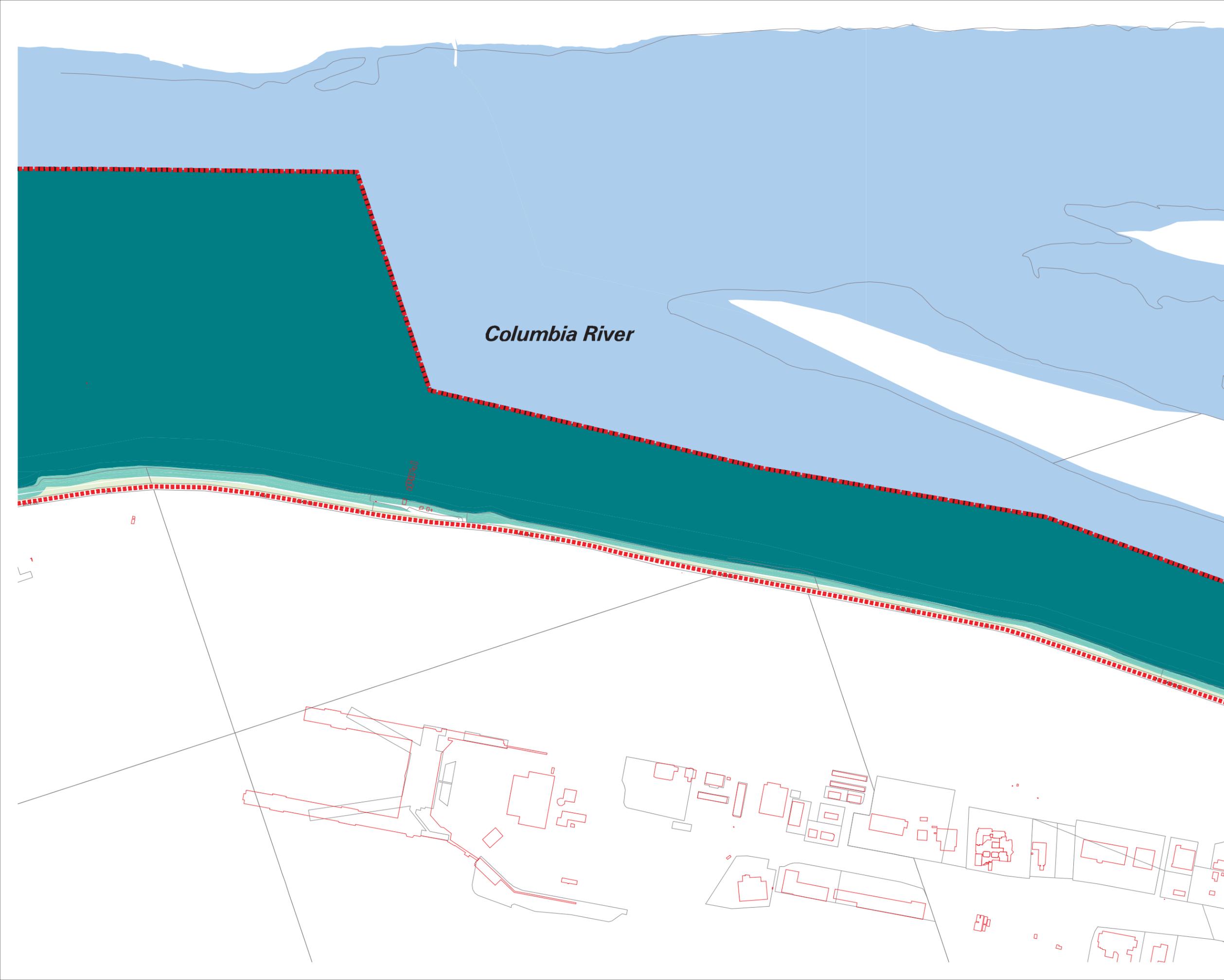
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Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS3b - Map 5: Central Columbia River

### Wildlife Habitat Relative Rankings

-  High relative value -  
Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

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\*\* SHA ranking supercedes lower relative values.

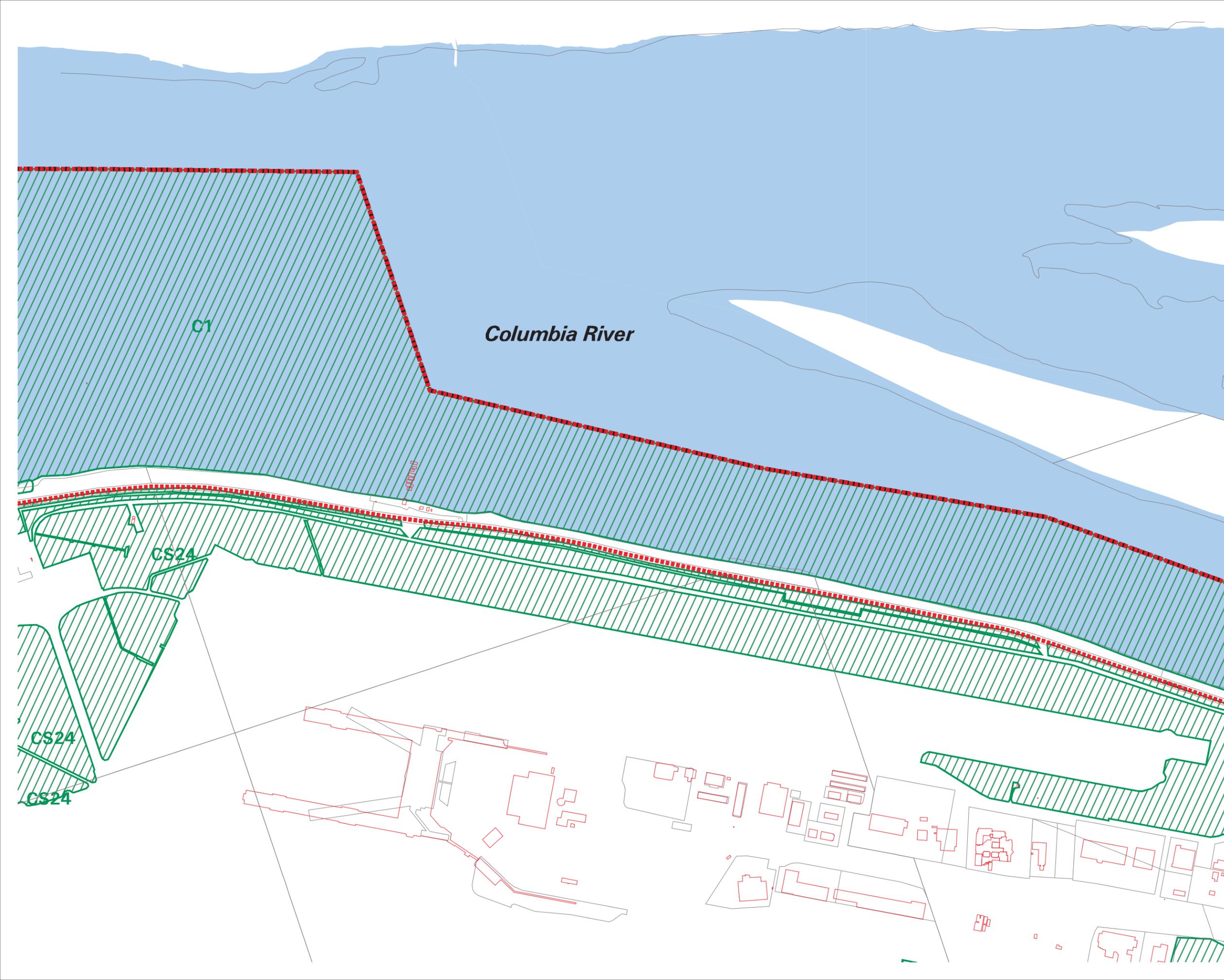
For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS3b - Map 6: Central Columbia River

### Combined Riparian / Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

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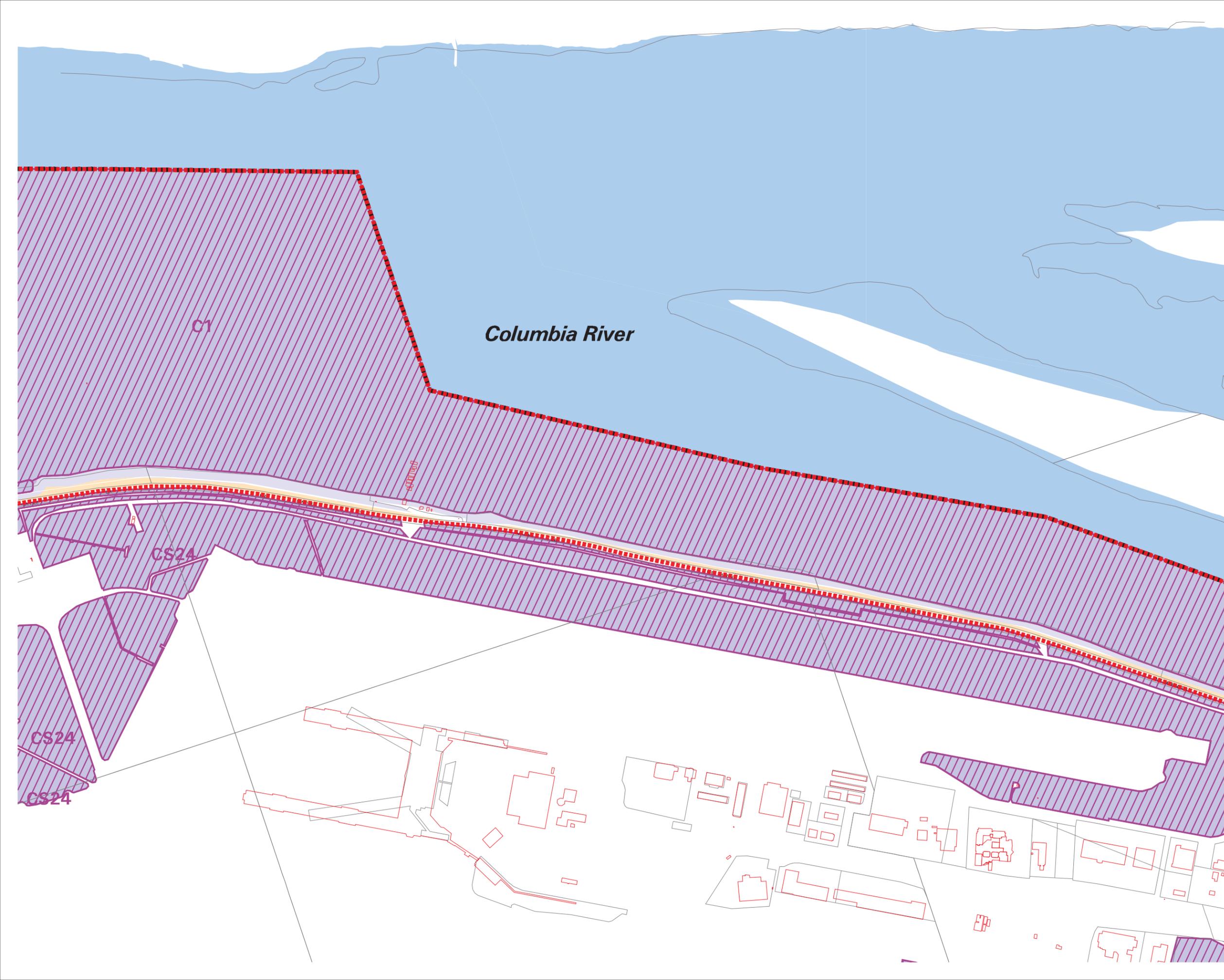
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Scale: 1" = 800'

0' 400' 800' 1200'



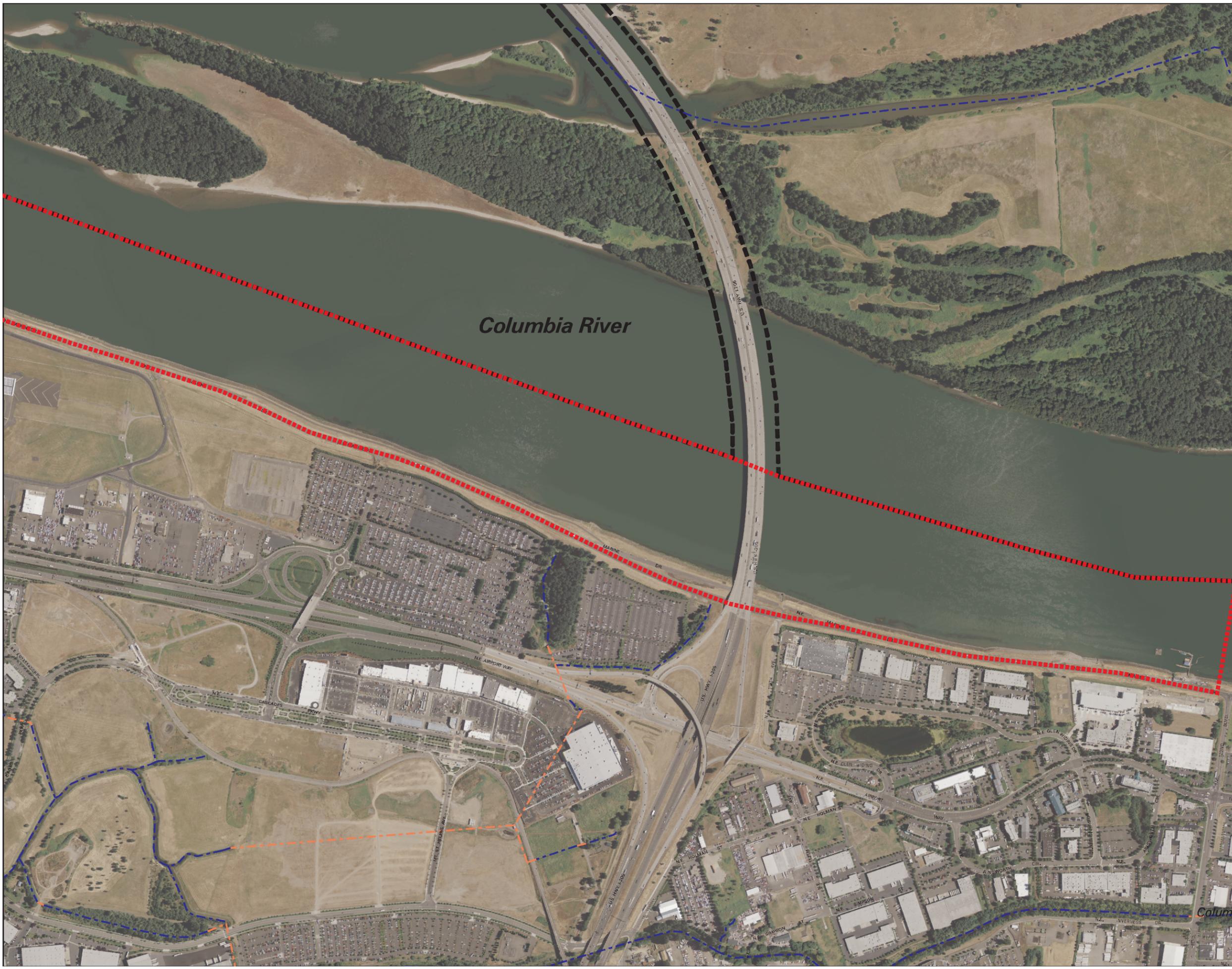


**DRAFT**

## Site CS3c - Map 1: Central Columbia River

### 2007 Aerial Photography

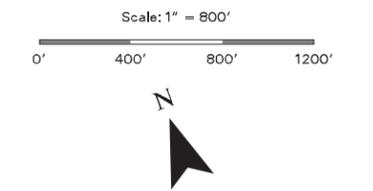
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary



#### INFORMATION SOURCES:

Aerial Orthophotographs:  
Natural color and color infrared ortho-rectified digital  
imagery from flight in June of 2007. Photography has  
been rectified to adjust for curvature of the earth.  
Not registered to taxlot base map.

All data compiled from source materials at different scales.  
For more detail, please refer to the source materials or  
City of Portland, Bureau of Planning & Sustainability.





## Site CS3c - Map 2: Central Columbia River

### Water-Related Features

#### Water Bodies

Stream/Drainage

Culvert or Piped

#### Other Features

Flood Area

Wetlands

#### Outfalls

Stormwater

Combined  
stormwater  
/sanitary

Abandoned

#### Bank Type

Beach

Bio-engineered

Vegetative  
Rip Rap

Non-vegetative  
Rip Rap

Site Boundary

City Boundary

Unclassified  
Fill Bank

Rock Bank

Seawall

Pilings

Urban Services

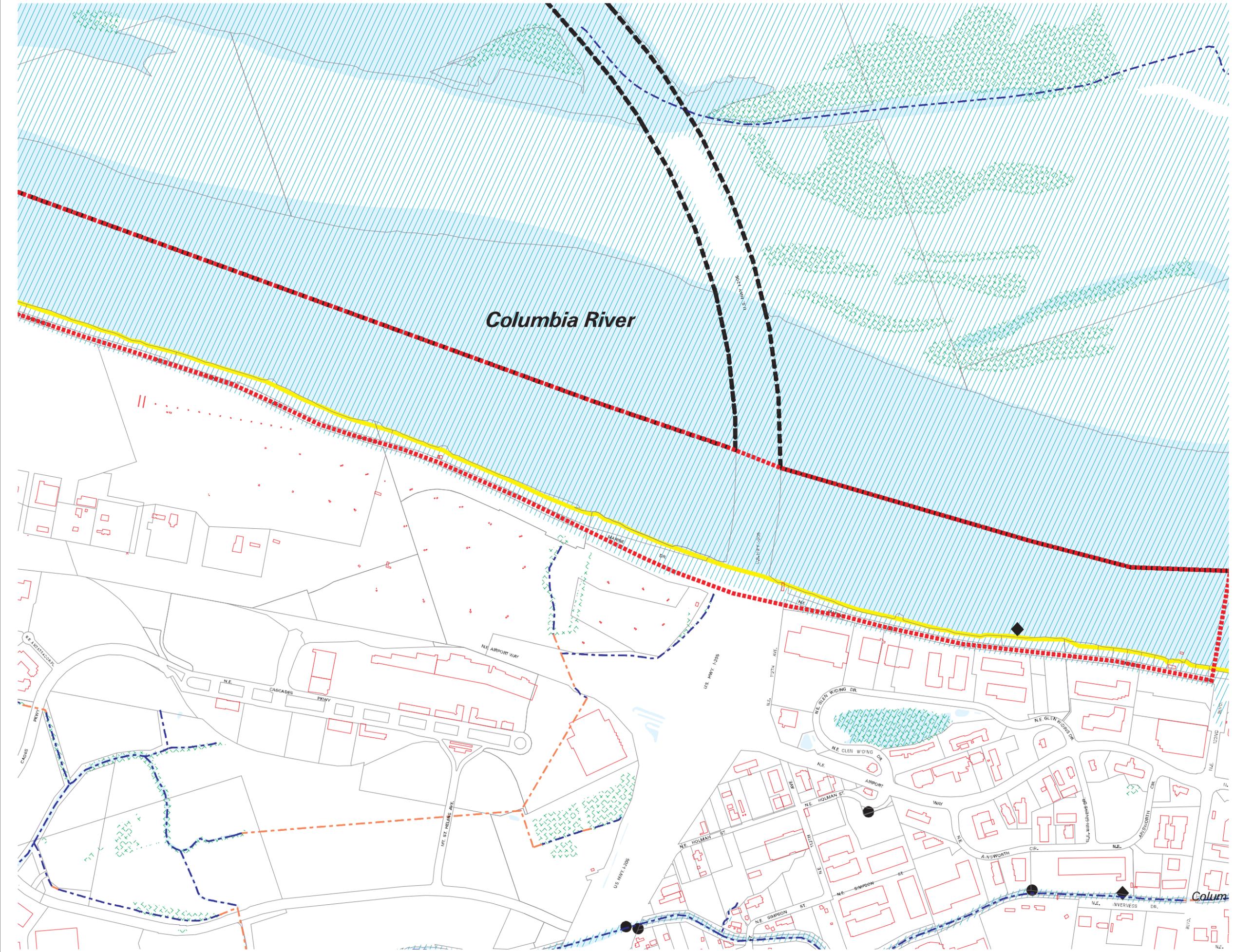
#### INFORMATION SOURCES:

**Water Bodies:**  
Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date. Outfalls: Maintained by BES (June 2008) Location is approximate and data may be incomplete.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS3c - Map 3: Central Columbia River

### Vegetation Features

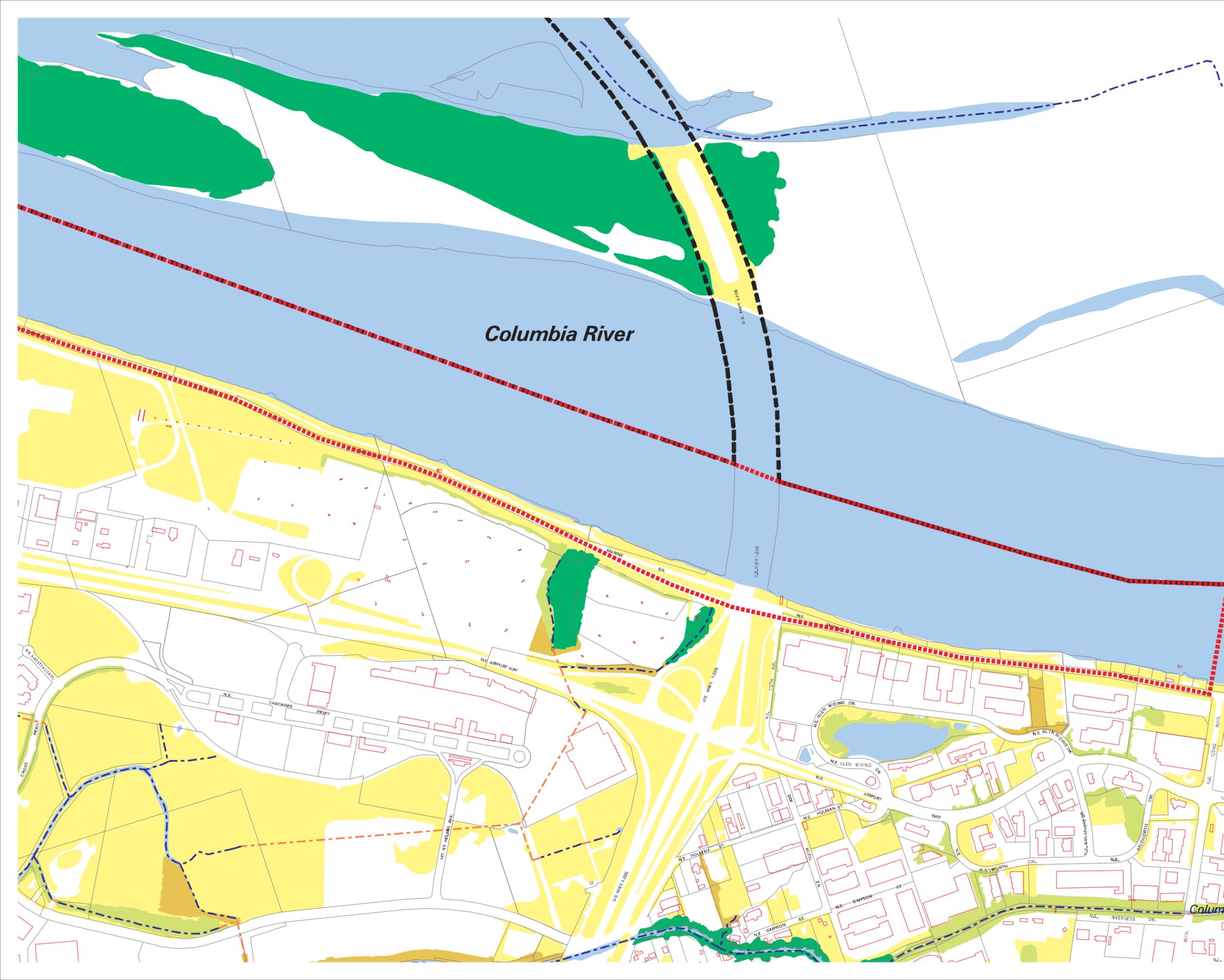
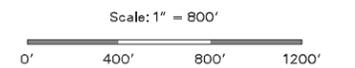
#### Vegetation Types

-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.





## Site CS3c - Map 4: Central Columbia River

### Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

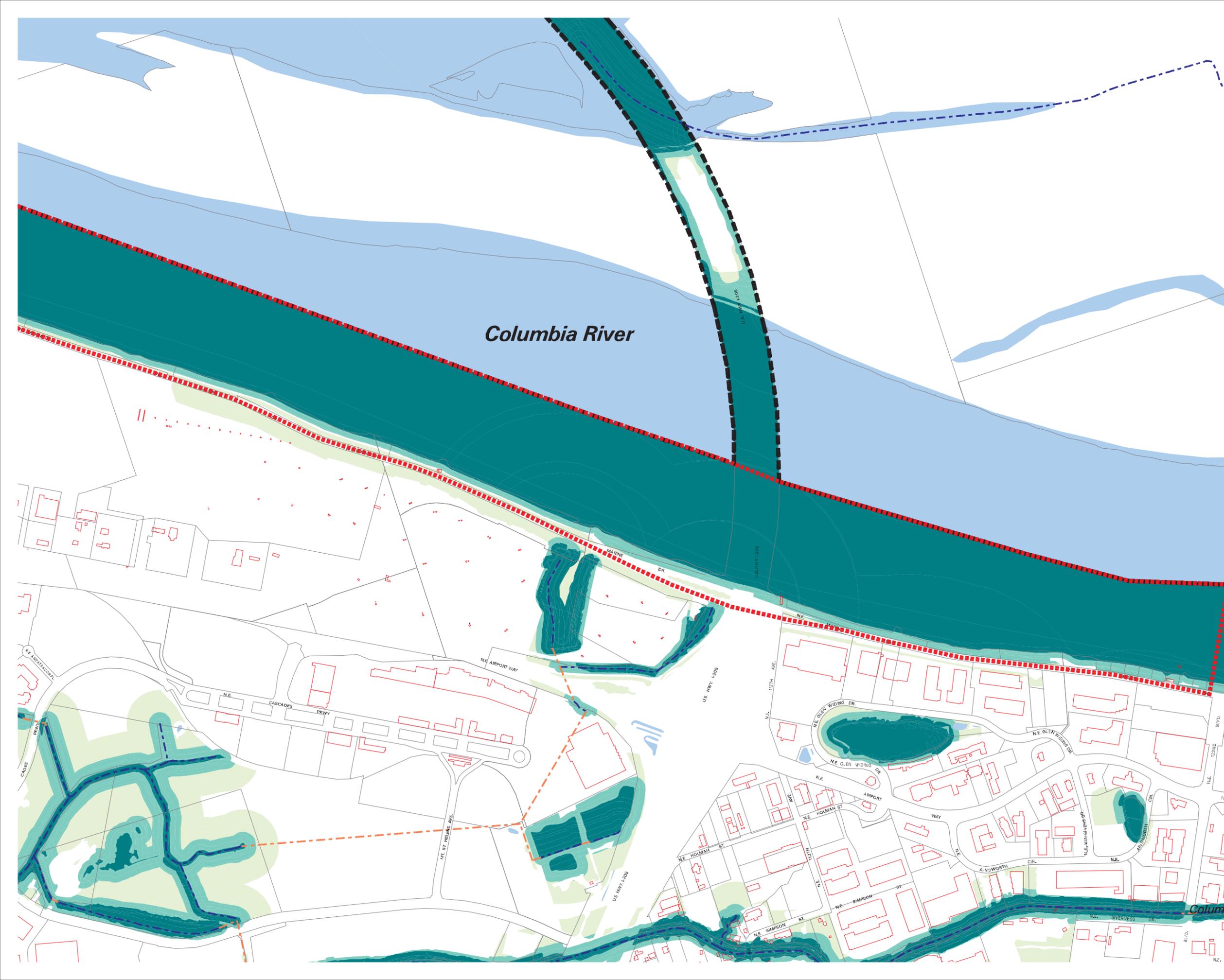
For more information, please visit our website:  
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Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS3c - Map 5: Central Columbia River

### Wildlife Habitat Relative Rankings

-  High relative value -  
Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

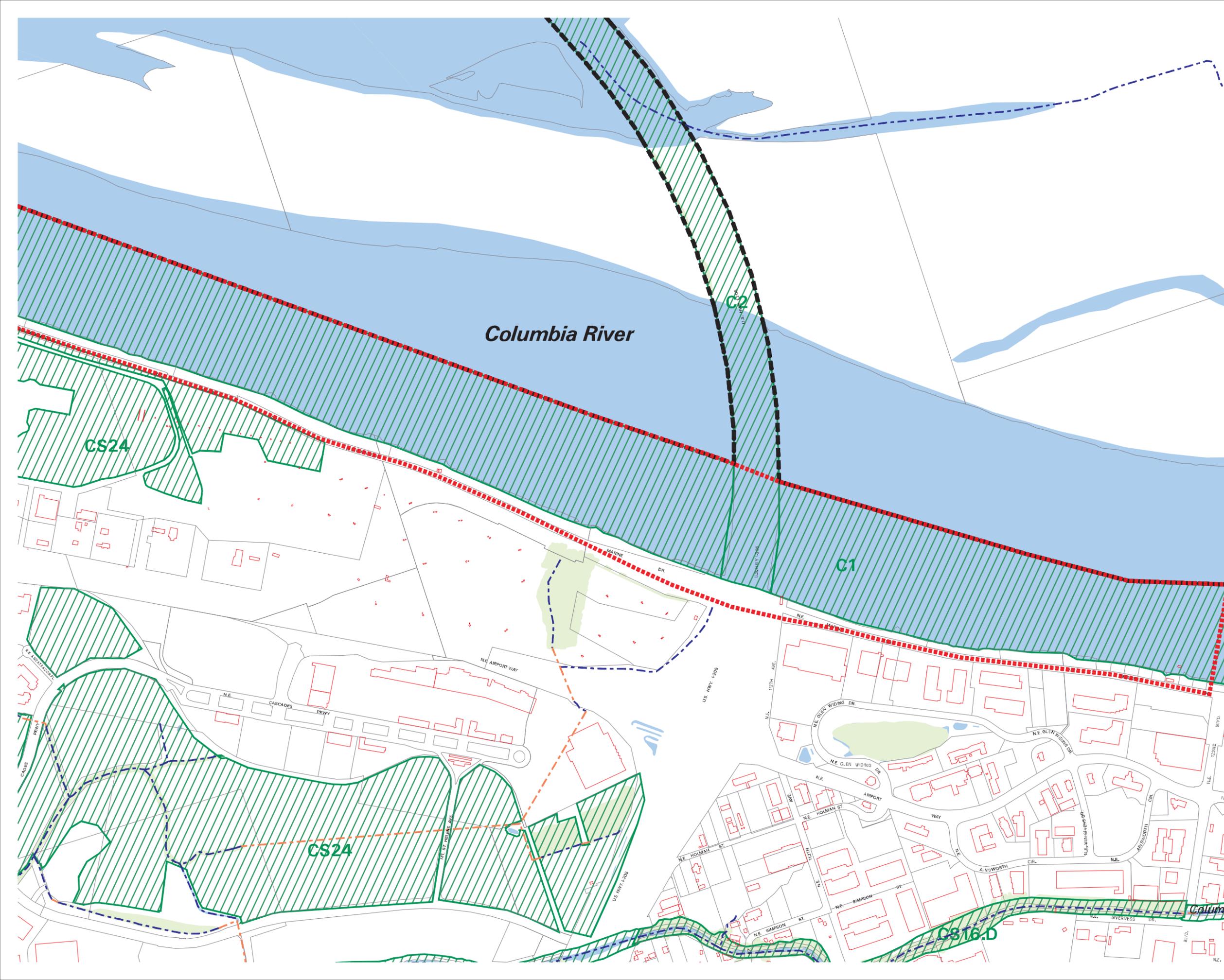
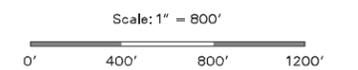
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## Site CS3c - Map 6: Central Columbia River

### Combined Riparian / Wildlife Habitat Relative Rankings

-  High relative value -  
Special Habitat Areas \*\*
-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

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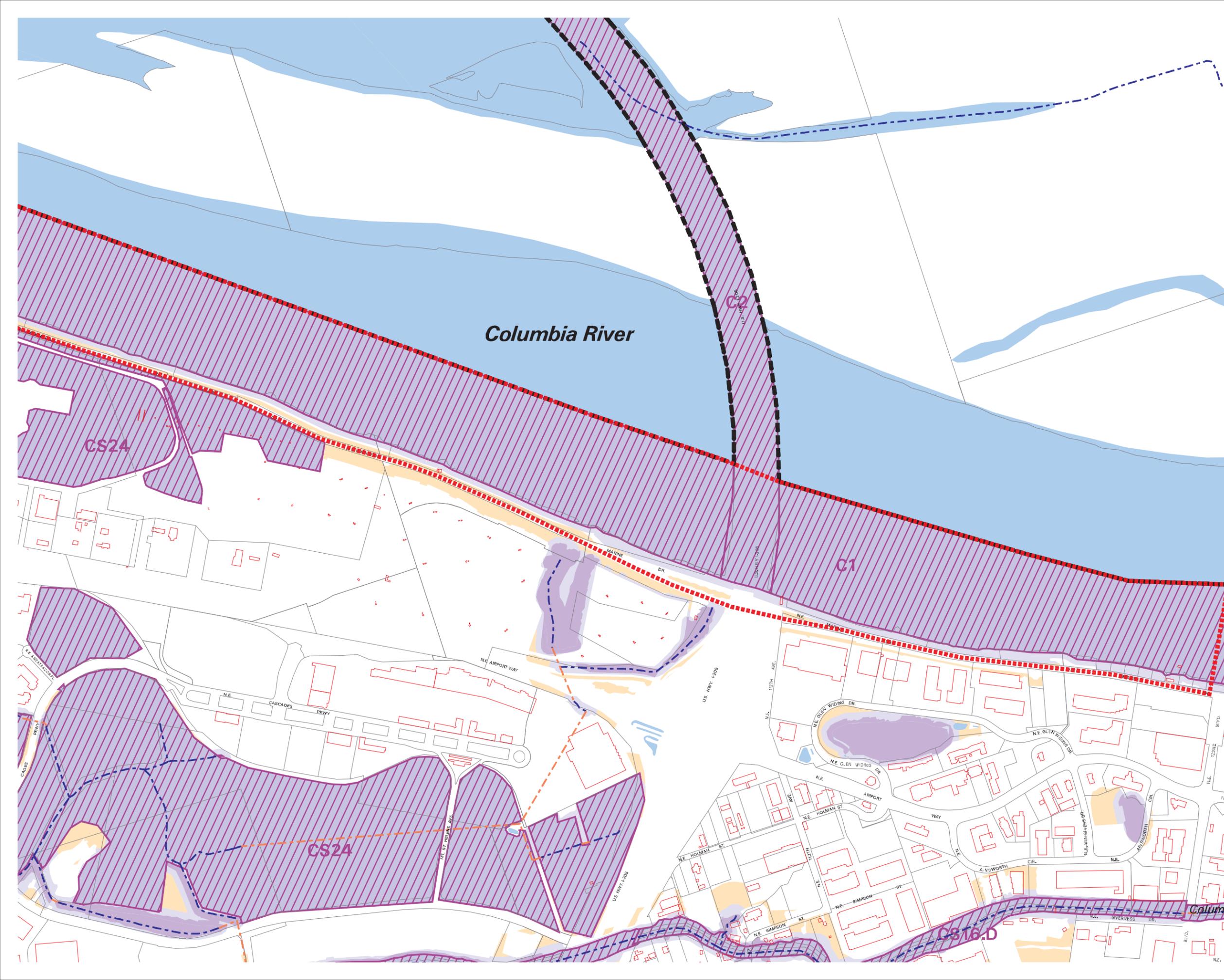
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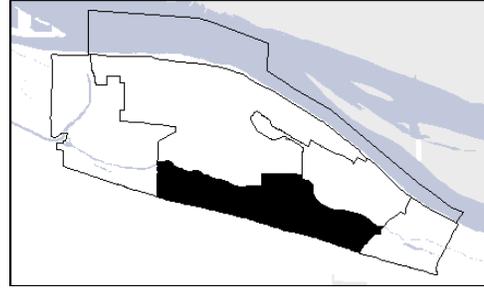
Scale: 1" = 800'

0' 400' 800' 1200'





## INVENTORY SITE CS4: Middle Slough and Whitaker Slough



### Summary Information

Watershed: Columbia Slough

Neighborhood: Cully, Sumner, Parkrose

USGS quadrangle and quarter section maps: 1N2E07, 1N2E15, 1N2E16, 1N2E17, 1N2E18, 1N2E21

River Mile: 10.2-13.7 (beginning at the confluence of Whitaker Slough and the Columbia Slough main channel and extending to the Interstate 205 bridge over the Columbia Slough)

Site Size: 1,097 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: General Industrial 2 (IG2)  
Open Space (OS)  
Single Dwelling Residential (RF and R20)  
General Employment (EG2)  
Aircraft Landing overlay (h)  
Airport Noise overlay (x)  
Environmental Conservation overlay (c)  
Environmental Protection overlay (p)

Existing Land Use: industrial; golf course; residential; natural area

General Description: This site includes most of the main channel of the Middle Columbia Slough and Whitaker Slough, Whitaker Ponds and Johnson Lake. The site also contains a few wetlands and secondary drainageways, primarily found in and around the Colwood Golf Course. Narrow riparian gallery forest habitat, dominated by black cottonwood and Pacific willow, surrounds the open water features. The understory contains red osier dogwood and alder but is dominated by Himalayan blackberry and other invasive species. Much of the riparian areas have been revegetated by the Bureau of Environmental Services. The natural resources are generally degraded by extensive industrial development, Cornfoot Road and multiple culvert crossings.

Resource Features: open water stream/drainageway channels; open-water, scrub-shrub and forested wetlands; vegetated flood area; bottomland hardwood forest; grasslands

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:

- *CS16: Whitaker Slough* – bottomland hardwood forest (B); wildlife habitat connectivity corridor (C); resources or structure that provides unique habitat function in natural or built environment (U)
- *CS16.B: Whitaker Ponds* – wetland (W); bottomland hardwood forest (B); migratory stopover habitat (M); area critical to sensitive species (S)
- *CS16.C: Johnson Lake* - bottomland hardwood forest (B); wildlife habitat connectivity corridor (C); migratory stopover habitat (M); resources or structure that provides unique habitat function in natural or built environment (U)

- *CS29: Colwood Golf Course Forested Wetland* - wetland (W); bottomland hardwood forest (B); wildlife habitat connectivity corridor (C); migratory stopover habitat (M)
- *CS30: Middle Slough* – area vital to at risk species including Western painted turtle and Northern red-legged frog (S); migratory stopover habitat (M); and wildlife connectivity corridor (C)

Special Status Species:

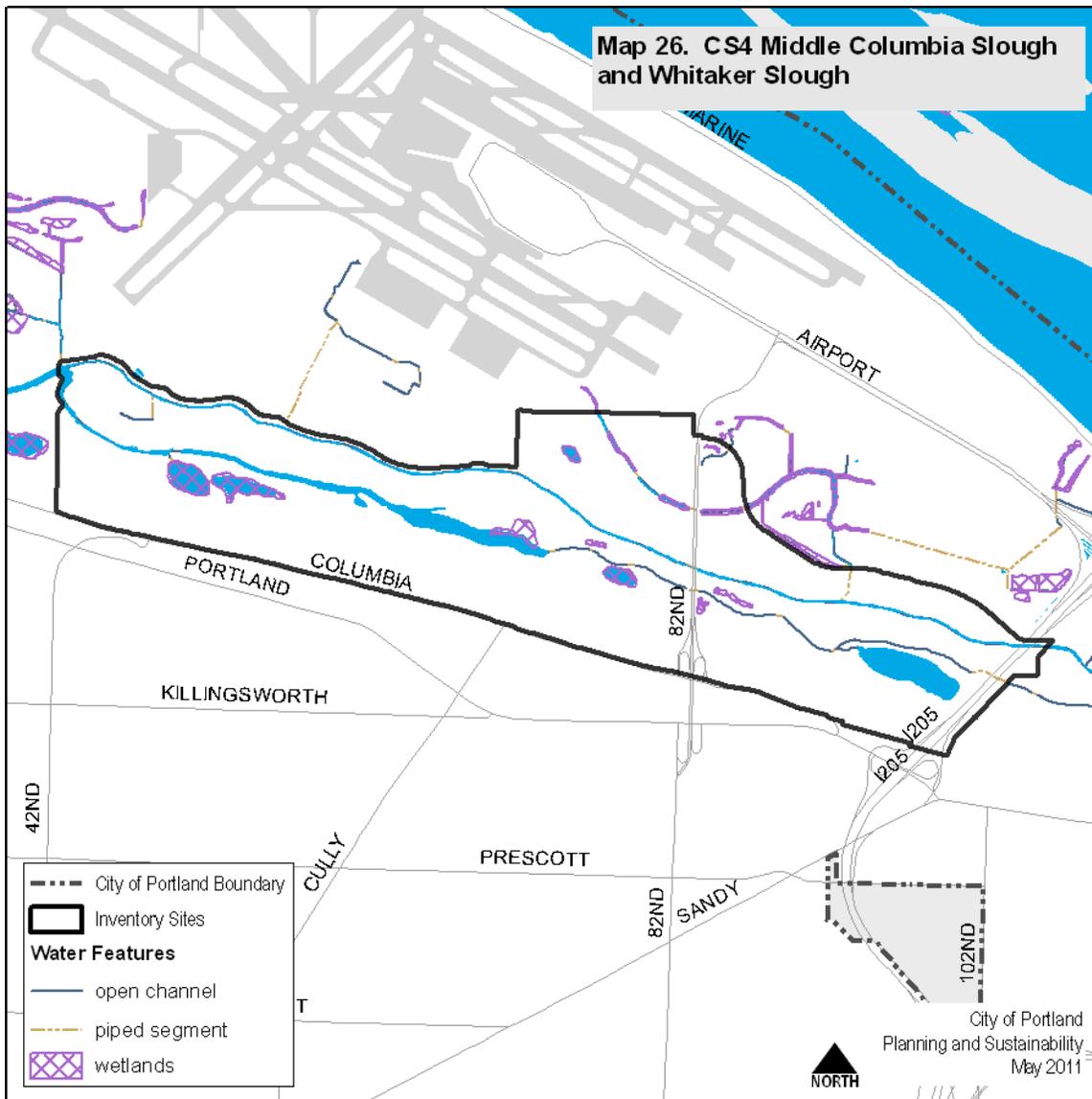
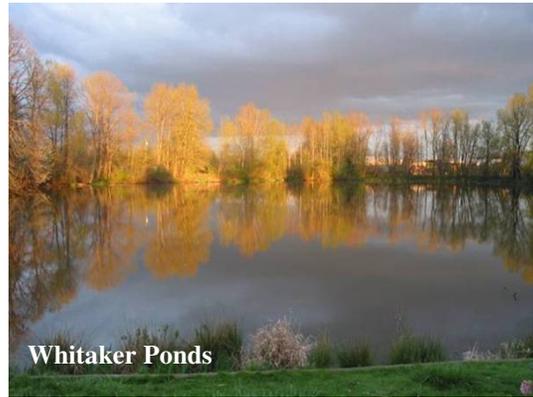
- *Birds:* willow flycatchers, belted kingfishers, great blue herons, common merganser
- *Reptiles:* Western painted turtle
- *Mammals:* American beaver, northern river otter, California myotis, yuma myotis and silver-haired bat

Natural Hazards: flood area

Contamination: Yes

### Site Description

The Middle Columbia Slough inventory site is 1,097 acres in size. The southern boundary of the site is formed by Columbia Boulevard. The eastern boundary is Interstate 205 and the western boundary is NE 42<sup>nd</sup> Avenue. The northern boundary generally follows NE Cornfoot Road and Alderwood Drive (Map 26). The site includes industrial land uses around the Columbia Slough and Whitaker Slough including Costco, Native American Youth and Family Center and Early College Academy; Colwood Golf Course; a few residential areas; and vacant lands. There are approximately 501 acres of impervious area, including 17.2 miles of roads, located the site. Site CS4 Map 1 shows an aerial view of the Middle Columbia Slough inventory site.



A roughly 3.5-mile long section of the Columbia Slough main arm, the confluence of Whitaker Slough to I-205, Whitaker Slough, Whitaker Ponds and Johnson Lake are part of this site. There are also 26 acres of wetland and 2,220 linear feet of secondary drainageways, located in the site. The 173-acre flood area includes 66 acres of open water, 56 acres of vegetated flood area and 51 acres of non-vegetated flood area. (CS4 Map 2). The Multnomah County Drainage District (MCDD) maintains the levees and water levels in the Columbia Slough to provide flood protection and stormwater conveyance. The management of the Columbia Slough waterways riparian reduces flooding and affects the riparian functions. The inventory models have been adjusted to reflect a lesser level of function than assigned to more active flood areas in the rest of the City.

Vegetated areas at least ½ acre include approximately 98 acres of forest or dense tree canopy, 40 acres of woodland, 29 acres of shrubland and 214 acres of herbaceous cover.

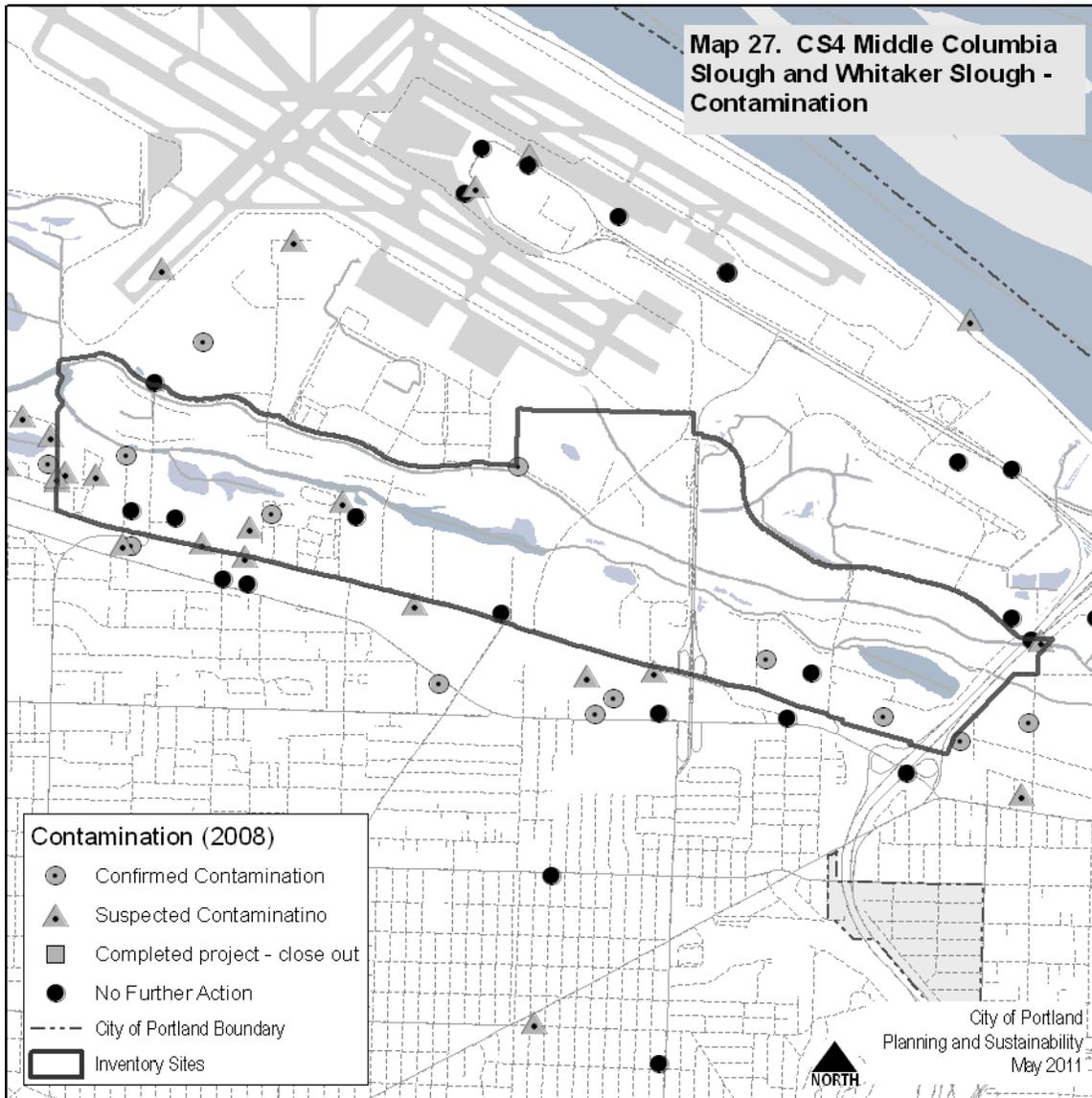
<b>Table 20: Summary of Natural Resource Features in CS4: Middle Slough and Whitaker Slough</b>	
	<b>Study Area</b> (1,097)
<b>Stream/Drainageway (miles)</b>	8.2
<b>Wetlands (acres)</b>	26
<b>Flood Area (acres)*</b>	173
Vegetated (acres)	56
Non-vegetated (acres)	52
Open Water** (acres)	66
<b>Vegetated Areas &gt;= ½ acre (acres)<sup>+</sup></b>	381
Forest (acres)	98
Woodland (acres)	40
Shrubland (acres)	29
Herbaceous (acres)	214
<b>Impervious Surfaces (acres)</b>	501
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the Columbia Slough within the site.	
+ 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 2006 aerial photography.	

The City of Portland Bureau of Environmental Services (BES) has conducted revegetation around the slough. The site contains ten active, eleven completed and two prospective revegetation sites. Much of the revegetation has occurred in riparian areas around the Columbia Slough, Whitaker Slough, Whitaker Ponds and Johnson Lake.

The Multnomah County Drainage District (MCDD) maintains the levees and water levels in the Columbia Slough to provide flood protection and stormwater conveyance for developed lands.

The Oregon Department of Environmental Quality (DEQ) has identified confirmed and suspected contaminated areas within the site (Map 27). Soil, groundwater and surface water within the site contain contamination resulting from past and current activities including oil tank leaks, pressure washing, waste discharge to dry wells, oil refining processes, electroplating operations, oil and diesel spills, fill materials, buried equipment debris, and solvent releases. Types of pollutants found in the site included petroleum hydrocarbons, PCBs, trichloroethylene, chloroform, dichloroethylene, 1,2-CIS, tetrachloroethylene, trichloroethylene, benzene, benzo(a)anthracene, ethylbenzene, methylene chloride, toluene, vinyl chloride, xylenes, acetone, cadmium, chromium, copper, cyanide, lead, nickel and zinc. Potential environmental and health risks include exposure to contaminated soil, consumption of fish, water contact recreation, agricultural plant uptake. 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>.



## Natural Resource Description

The natural resources are described for subareas of the inventory site (Map 28).



### Middle Columbia Slough

The site contains approximately 3.5 miles of the Columbia Slough main channel; this section of the Columbia Slough is called the Middle Slough. The portion of the Middle Slough within the site is characterized by a low gradient channel and excess macrophyte growth that can impact flow and water quality. The riparian area adjacent to the Middle Slough is generally one to two trees in width. These areas are generally bottomland hardwood forest comprised of black cottonwood and red alder. Other native vegetation species present include Douglas-fir, western red cedar, snowberry, red-flowering currant, red-osier dogwood, Indian plum, Oregon grape, Nootka and swamp rose, and vine maple. Invasive plant species found throughout in the riparian area include Himalayan blackberry, Japanese knotweed and reed canary grass.



The Middle Slough and associated waterways are completely surrounded by levees and are within the Multnomah County Drainage District (MCDD). As a result, the water can only reach the Lower Slough if pumped or allowed to flow through the levee's gravity gates in the MCDD levee. In an average year, MCDD is able to allow Middle Slough water to flow through the floodgates into the Lower Slough by gravity for several months (generally late fall to early winter). During the other months, or when water levels in the Lower Slough are higher than those in the Middle Slough, water must be pumped against the gradient. Pump Station No. 1 has a pumping capacity of 250,000 gallons per minute (gpm).

The width of the Middle Slough mainstem waterway varies in general from 30-100 feet. A section just upstream of MCDD Pump Station No. 1 (where the Vanport Flood broke the levee and gouged out the channel) was 90 feet deep after the 1948 flood, but now is approximately 10 to 16 feet deep. The average channel depth in the Middle Slough ranges is 6 to 8 feet (CH2M Hill 1995). Estimates of groundwater inflow in the Slough vary from 50 to 100 cubic feet per second (cfs).

The Columbia Slough is water quality limited for multiple parameters including bacteria, temperature, dissolved oxygen and biochemical oxygen demand (BOD), eutrophication (phosphorus, chlorophyll a, pH), heavy metals and total suspended solids. In general, the Middle Slough has better water quality than the Upper and Lower Slough. Water temperatures are generally cooler in the Middle Slough, due in large part to cool groundwater inputs. Macrophyte and algae growth is extensive in the Middle Slough. This is a result of slow flows, solar access (lack of shading) and high concentration of nutrients. Macrophytes and algae produce oxygen during the day but at night they respire using oxygen and producing carbon dioxide. This can result in the dissolved oxygen concentration and pH becoming low during the morning hours and creating inhospitable conditions for some species of fish, amphibians and macroinvertebrates.

The Middle Slough provides habitat for numerous fish and wildlife species including willow flycatchers, belted kingfishers, great blue herons, common merganser, western, painted turtle, river otter, nutria and beaver are some of the wildlife species that routinely use this riparian area.

Habitat in the Middle Slough is affected by nearby development. Industrial development, including buildings, loading areas and parking lots, encroach into the riparian area fragmenting habitat and reducing shade potential from riparian vegetation. Cornfoot Road, north of the Middle Slough between NE 47<sup>th</sup> Avenue and Alderwood Road, is in close proximity (between 25 and 100 feet) of the waterway and impacts riparian vegetation, wildlife habitat and water quality.

#### Whitaker Slough

Whitaker Slough is a southern arm of the Middle Columbia Slough. Approximately 3.5 miles of Whitaker Slough, from the confluence with the Middle Slough to I-205, is located in this inventory site. There are multiple ponds (e.g. Whitaker Ponds, Johnson Lake) and inlets that are hydrologically connected to Whitaker Slough. Whitaker Slough has significant areas of groundwater upwelling. The cool groundwater helps to moderate summer water temperatures. Cool water is a basic requirement for many aquatic species. The surrounding land uses are primarily industrial and commercial with a few remnant residences along the north bank of Whitaker Slough.

A narrow strip of riparian vegetation, two to three trees deep, surrounds Whitaker Slough. The dominant tree species include black cottonwood and red alder along with a heavily mixed understory of planted native trees and shrubs. Species present include: Douglas-fir, western red cedar, snowberry, red-

flowering currant, red-osier dogwood, Indian plum, Oregon grape, Nootka and swamp rose, and vine maple. Some naturally-occurring western hazel, red-osier dogwood, and Pacific ninebark are additionally scattered in the understory. Invasive plant species found throughout in the riparian area including Himalayan blackberry, Japanese knotweed and reed canary grass. Leaf litter is the primary ground cover component, along with some grass, palmate coltsfoot, shining geranium, creeping buttercup, and English ivy. The established tree canopy and overhanging shrubs shade the waterway, reducing in-water water temperatures during the summer and creating a localized microclimate affect that is beneficial for many wildlife species.

Wildlife using Whitaker Slough and the riparian area include beaver, nutria, coyote, Great Blue Heron, Great Horned Owl, goldfinch, black cap chickadee, Oregon junco, American robin, violet-green swallow, Cooper's hawk and American widgeon. Migratory birds using Whitaker Slough include Western Tanager, Cassin's Vireo, and Black-throated Gray Warbler. Fish found in Whitaker Slough include Three-spined Stickleback, Mosquitofish, and Prickly Sculpin.



Whitaker Slough

In November 1996 a survey of aquatic macroinvertebrates in Whitaker Slough was performed by Parametrix, Inc. Five samples were taken along the vegetative edge, and four samples were taken from open water benthic sediments (Wisseman, 2001). Diversity was higher in the vegetative edge and included Gastropoda (snails), Pelecypoda (clams), Ephemeroptera (mayfly), Sialis (alderfly), Trichoptera (caddisfly), and Gyrinidae (whirligig beetle). Other species found included Chironomid midges, ostracods, oligochaete worms, Amphipoda (scuds-crustacea), Copepoda (microcrustaceans), Cladocera (microcrustaceans), and Corixidae (water boatmen).

Whitaker Slough has been designated Special Habitat Area CS16:A South Arm Complex – Whitaker Slough because it is an active groundwater upwelling areas with visible springs; is surrounded by a bottomland hardwood forest; and provides a wildlife habitat connectivity corridor.

### Whitaker Ponds

Whitaker Ponds consist of two ponds and surrounding riparian vegetation totaling about 14 acres just east of NE 47<sup>th</sup> Avenue. The western ponds and most of the eastern pond are owned and operated by City of Portland Bureau of Parks and Recreation and Metro Regional Government. The western pond is home to the Columbia Slough Watershed Council headquarters.



Columbia Slough Watershed Council

The forested banks of Whitaker Ponds are predominantly black cottonwood and red alder along with a heavily mixed understory of planted native trees and shrubs. Species present include: Douglas-fir, western red cedar, snowberry, red-flowering currant, red-osier dogwood, Indian plum, Oregon grape, Nootka and swamp rose, and vine maple. Some naturally-occurring western hazel, red-osier dogwood, and Pacific ninebark are additionally scattered in the understory. Leaf litter is the primary ground cover component with some grass, palmate coltsfoot, shining geranium, creeping buttercup, and ivy. Poison hemlock is also locally abundant in the wetter areas.

The southeastern forested area is primarily composed of black cottonwood with a western hazel and sword fern understory. The eastern end of the pond is populated mostly with willow species and red-osier dogwood, including one huge European weeping willow, and the ground cover is downed wood and

water. Areas without tree canopy are almost entirely covered in Himalayan blackberry. The northern two patches have been cut however. There is virtually no ground cover layer in these parts.

The southwest corner of ponds complex is a native shrubland comprised of young red alder, Douglas spiraea, and willow which surround a small wetland containing small-fruited bulrush, common rush, and slough sedge. Along NE 47<sup>th</sup> Avenue, in front of the Columbia Slough Watershed Council headquarters, is a maintained turf grass field.



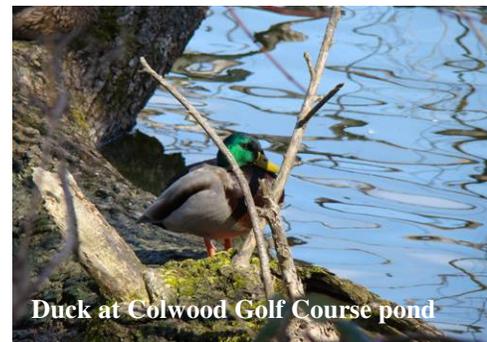
The ponds provide habitat for Western painted turtles, wintering waterfowl, songbirds, nesting great horned owls, and other wildlife species. During a spring 2009 site visit many birds were observed: great blue heron, goldfinch, black cap chickadee, Oregon junco, American robin, violet-green swallow, Cooper's hawk, ringneck duck, American widgeon, western merganser, mallard, and Canada goose. There was evidence of heavy beaver work on the cottonwoods on the north shore of east pond and on the red cedars just upslope. Coyote scat was also observed. Bat species that use Whitaker Ponds include California myotis, yuma myotis and dilver-haired nat.

Whitaker Ponds has active groundwater upwelling areas, with visible springs, that helps keep the water temperatures cool during the summer. Cool water is a basic requirement for many aquatic species.

Whitaker Ponds is designated Special Habitat Area CS16.B: South Arm Complex – Whitaker Ponds because is it is a wetland surrounded by bottomland hardwood forest; is an active groundwater upwelling area with visible springs; provides stopover habitat for migratory birds; and it provides habitat critical to sensitive species including Western painted turtles.

#### Colwood Golf Course

Colwood Golf Course is a 115-acre open-space site located along the Columbia Slough and Whitaker Slough. Colwood is located halfway between two regionally significant and publicly-owned natural areas: Whitaker Ponds to the west and Johnson Lake to the east. Stretches of both the Middle Slough and Whitaker Slough flow through the golf course and there are four wetlands located here. The predominant vegetation type in the golf courses is maintained turf grasses with narrow strips of large trees. Several mature Oregon white oaks are present. The grassy areas are utilized by migratory geese and red tailed hawk.

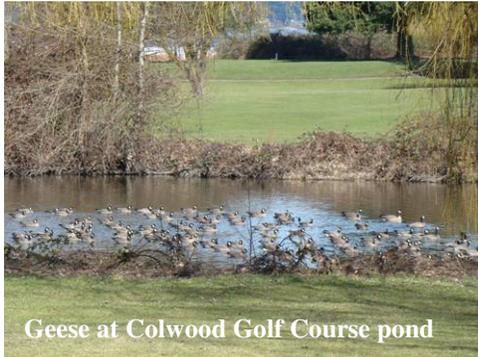


The southeastern most wetland is an open pond with riparian vegetation. The woodland vegetation contains mostly black cottonwood and red alder with a heavy Himalayan blackberry understory. Red-osier dogwood is additionally present. Buildings and access roads are in very close proximity (50-60 feet) of the wetland.

The eastern small remnant forested wetland, which is designated as Special Habitat Area CS17: Colwood Golf Course Forested Wetland, provides excellent foraging, nesting, perching and roosting habitat for flycatchers, which are a species of concern, warblers, woodpeckers, reptiles, and amphibians. The vegetation is dominated an ash-cottonwood forest with a robust snowberry-gooseberry understory. Red-osier dogwood and Pacific ninebark are present here as well, along with a stand of paper birch near the southern slough branch. Nettles and fringe-cup form the native ground cover. There are also trace amounts of ivy, Himalayan blackberry, and holly within this area. The wetland and forest vegetation provides habitat connectivity between the Middle Slough and Whitaker Slough. The wetland can provide flood storage capacity during large rain events.

The western small forested wetland is included in Special Habitat Area CS16.B: South Arm Complex – Whitaker Slough. The in the wetland and along Whitaker Slough is predominantly ash-cottonwood with a strong presence of Himalayan blackberry and some wild clematis. The wetland provides foraging, nesting, perching and roosting habitat.

Wildlife observed using the slough arms and the southern wetlands include American robin, marsh wren, redwing blackbird, Oregon junco, song sparrow, Anna's hummingbird, mourning dove, mallard, ringneck duck, American widgeon, beaver and nutria.



In the northern portion of the golf course there is a 1-acre pond. The western edge of the pond is surrounded by establish trees including black cottonwood and willow. A line of trees, one tree deep, exist along the southern bank and the northern bank is dominated by turf grasses. During a site visit in March 2009, migratory Alaskan Geese were observed in the pond.

The wetlands and arms of the slough are likely impacted by golf course maintenance including fertilizers, herbicides, pesticides and mowing.

Colwood Golf Course, along with other locations in the study area, were recently surveyed by US Fish and Wildlife Services for bat use (2009). *Myotis lucifugus* (MYLU) was documented at the golf course. The bats utilize water bodies for drinking and foraging and the trees for roosting, both day and night. MYLU can roost in varying structures from buildings to snags. The complex of habitat features at Colwood Golf Course (Middle Slough, Whitaker Slough, multiple wetlands and riparian tree canopy) provide habitat for MYLU.

Colwood Golf Course is designated a Special Habitat Area (CS29) because it provides migratory stopover habitat (M), is a connectivity corridor between the Columbia Slough and Whitaker Slough (C) and provides habitat for at risk bat species (S).

#### Johnson Lake

Johnson Lake is a 42-acre remnant lake that is characteristic of historic lakes and wetlands in the Columbia Slough Watershed. It is the largest and most natural lake in Middle or Upper Columbia Slough. Johnson Lake discharges into Whitaker Slough. The lake experiences significant groundwater upwelling that introduces cold water into Whitaker Slough.



The forested areas surrounding Johnson Lake are composed of black cottonwood, red alder, and Oregon ash, some quite large. Several old snags are found throughout. Some western red cedar is also present (planted). The understory is quite diverse with native shrubs including: red elderberry, snowberry, Pacific ninebark, western hazel, wild gooseberry, tall Oregon grape, Douglas spirea, red-osier dogwood, and black hawthorn. Much of the area was planted; however, there are some naturally-occurring shrub thickets particularly along the south side of the lake.

Extending north from Johnson Lake is forest vegetation approximately 300 feet wide that provides a wildlife habitat corridor between the lake, Whitaker Slough and the Middle Slough. This is a high quality patch of ash-cottonwood forest with a snowberry-gooseberry understory and a nettle-fringecup herb layer. There are some bird cherry and holly trees within the site as well as ivy, wild clematis, and blackberry.

Johnson Lake and forested riparian area are important remnant habitats and home to nesting great horned owl, Osprey, numerous neotropical migratory songbirds and wintering waterfowl. Bird species found here include bufflehead, ring-necked duck, gadwall, American widgeon, lesser scaup, Wood Duck, Canvasback, Pied-billed Grebe, Double-crested Cormorant, goldfinch, scrub jay, song sparrow, American robin, European starling, downy woodpecker, mallard, juvenile bald eagle, and great blue herons and loons. Downed and floating logs in the pond provide turtle habitat.

There are multiple homeless camps around Johnson Lake and some trash accompanies these sites.

The lake and riparian vegetation is designated Special Habitat Area CS16.C: South Arm Complex – Johnson Lake because it is an active groundwater upwelling areas with visible springs; provides stopover habitat for migratory birds; is surrounded by a bottomland hardwood forest; and provides a wildlife habitat connectivity corridor.

#### McBride Slough

Located to the west of NE 82<sup>nd</sup> Avenue is a secondary drainageway called McBride Slough. McBride Slough flows under NE 82<sup>nd</sup> where it connects up with another secondary drainageway called the PIC Ditches.<sup>1</sup> There are multiple remnant channels, located outside this inventory site, that make up the PIC Ditches. All of the drainageways are hydrologically connected and flow to the Columbia Slough at approximately NE 92<sup>nd</sup> Avenue.

Riparian vegetation west and south of McBride Slough is composed of black cottonwood and Oregon ash with a dense understory of snowberry and wild gooseberry. Several large oaks between 24-36 inches in diameter are present on the golf course edge of the forest. Ground cover is primarily moss and nettles. The east and north riparian vegetation is primarily Himalayan blackberry and reed canary grass. During a site visit in March 2009, coyote, great horned owl, Cooper's hawk and red tailed hawk were observed.

The portion of the PIC Ditches located within the site has similar vegetation assemblages along its banks as McBride Slough: black cottonwood, Oregon ash, snowberry, gooseberry, Himalayan blackberry, nettles and reed canary grass.

Buildings, parking lots and roads are in close proximity to both drainageways, encroaching into the riparian area and impacting natural resource functions.

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<sup>1</sup> Portions of the PIC Ditches are also know as Green Heron Slough.

## 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 21). 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 the Methodology Overview section of this report and the *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2008).

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 Corridors

The site contains portions of the Columbia Slough, multiple wetlands, vegetated and non-vegetated flood area, riparian forest with associated shrub and groundcover, as well as other types of vegetation that contribute to the riparian functions as detailed in the natural resource description. These landscape features provide the following riparian functions:

- 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 assigned to the Columbia Slough, Whitaker Slough, wetlands, and secondary drainageways. Riparian forests and areas of dense tree canopy receive a high or medium relative ranks depending on proximity to open water. Medium and low relative ranks are generally assigned to lower structure riparian vegetation. Other areas are assigned a high, medium or low relative rank depending on the proximity and extent of vegetation relative to the water body (CS4 Map 4).

### Wildlife Habitat

A wildlife habitat patch is, for purposes of the inventory model, defined as forest and/or wetland areas, 2 acres in size or greater, plus adjacent woodland vegetation (note Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features).

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

Based on the wildlife habitat model criteria, a medium relative rank is assigned to the forest/wetland patches because of patch size, interior area and proximity to water and other patches.

### Special Habitat Areas (SHA) descriptions

SHAs 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 (CS4 Map 5).

There are four SHAs designated within the site.

- *CS16: Whitaker Slough* – bottomland hardwood forest (B); wildlife habitat connectivity corridor (C); resources or structure that provides unique habitat function in natural or built environment (U)
- *CS16.B: Whitaker Ponds* – wetland (W); bottomland hardwood forest (B); migratory stopover habitat (M); area critical to sensitive species (S)
- *CS16.C: Johnson Lake* - bottomland hardwood forest (B); wildlife habitat connectivity corridor (C); migratory stopover habitat (M); resources or structure that provides unique habitat function in natural or built environment (U)
- *CS29: Colwood Golf Course Forested Wetland* - wetland (W); bottomland hardwood forest (B); wildlife habitat connectivity corridor (C); migratory stopover habitat (M)
- *CS30: Middle Slough* – area vital to at risk species including Western painted turtle and Northern red-legged frog (S); migratory stopover habitat (M); and wildlife connectivity corridor (C)

Combined Relative Riparian/Wildlife Habitat Ranking

Where areas 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 (WR1 Map 6).

<b>Table 21: Summary of Ranked Resources in CS4: Middle Slough and Whitaker Slough</b>					
<b>Total Inventory Site</b>		= 1,097 acres			
		<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>					
acres		198	99	87	383
percent total inventory site area		18	9	8	35
<b>Wildlife Habitat</b>					
<b>Wildlife Habitat*</b>					
acres		0	115	4	119
percent total inventory site area		0	10	<1	11
<b>Special Habitat Areas**</b>					
acres		322			
percent total inventory site area		29			
<b>Wildlife Habitat - adjusted by Special Habitat Areas ***</b>					
acres		322	18	3	342
percent total inventory site area		29	2	<1	31
<b>Combined Total</b>					
acres		348	61	38	446
percent total inventory site area		32	6	4	42
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Willamette 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.					



# Site CS4a - Map 1: Middle Slough/ Whitaker Slough

## 2007 Aerial Photography

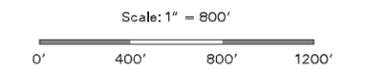
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary



### INFORMATION SOURCES:

Aerial Orthophotographs:  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.





# Site CS4a - Map 2: Middle Slough/ Whitaker Slough

## Water-Related Features

### Water Bodies

- Stream/Drainage
- Culvert or Piped

### Other Features

- Flood Area
- Wetlands
- Outfalls
  - Stormwater
  - Combined stormwater/sanitary
  - Abandoned

### Bank Type

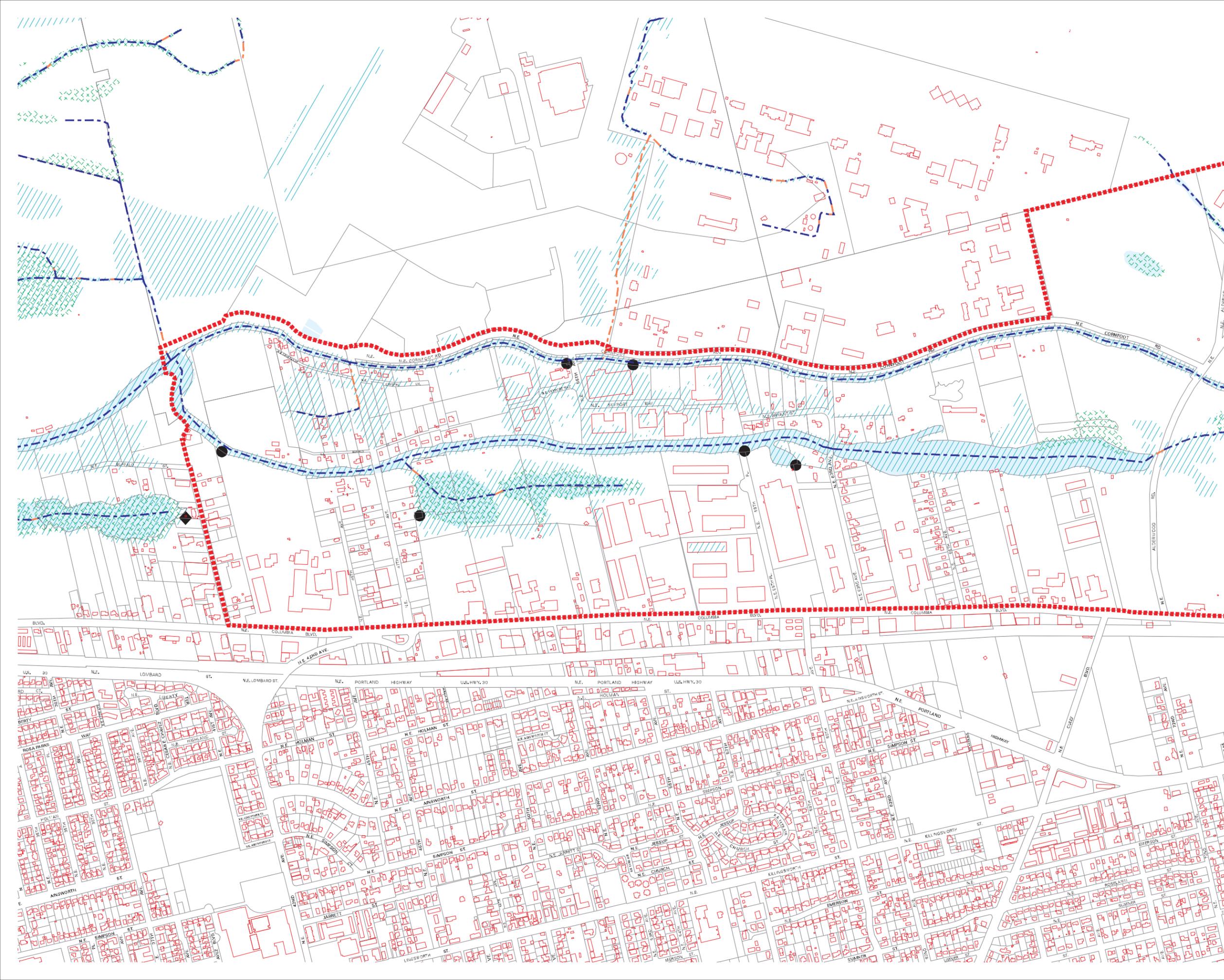
- Beach
- Bio-engineered
- Vegetative
- Non-vegetative Rip Rap
- Site Boundary
- City Boundary
- Unclassified Fill Bank
- Rock Bank
- Seawall
- Pilings
- Urban Services

### INFORMATION SOURCES:

Water Bodies: Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date. Outfalls: Maintained by BES (June 2008) Location is approximate and data may be incomplete.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'





# Site CS4a - Map 3: Middle Slough/ Whitaker Slough Vegetation Features

## Vegetation Types

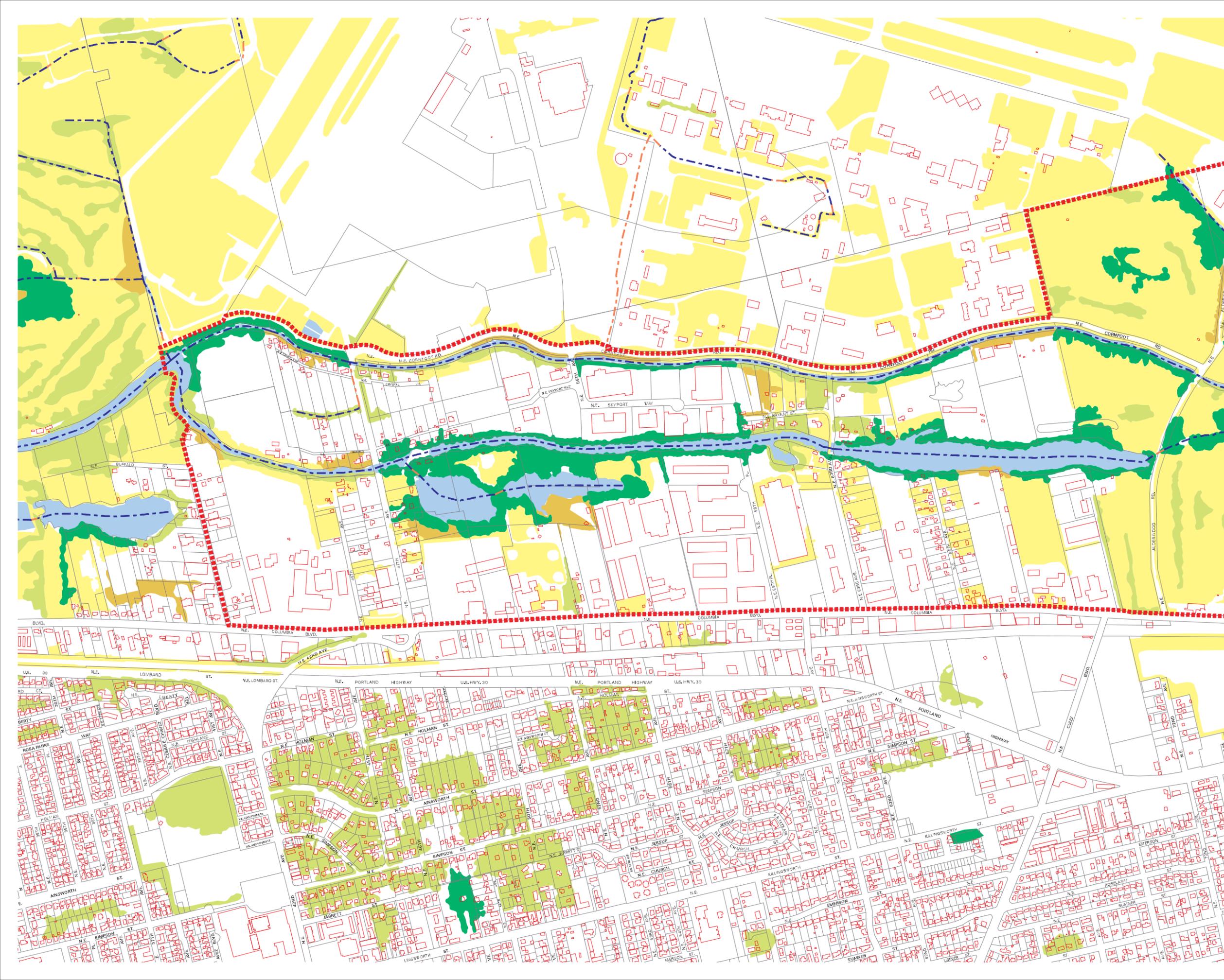
-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

## INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'  
0' 400' 800' 1200'





# Site CS4a - Map 4: Middle Slough/ Whitaker Slough

## Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

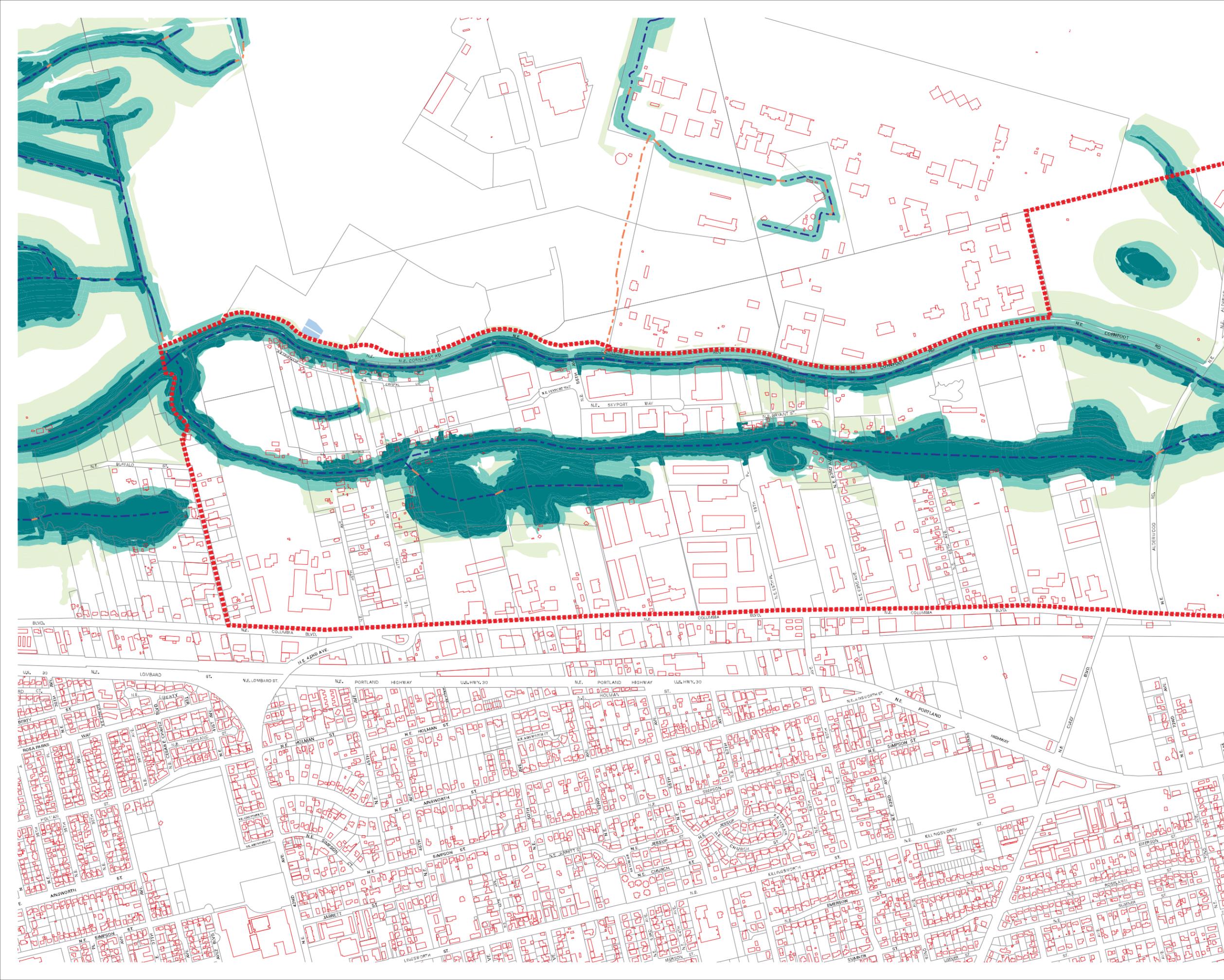
For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'

0' 400' 800' 1200'





# Site CS4a - Map 5: Middle Slough/ Whitaker Slough Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

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\*\* SHA ranking supercedes lower relative values.

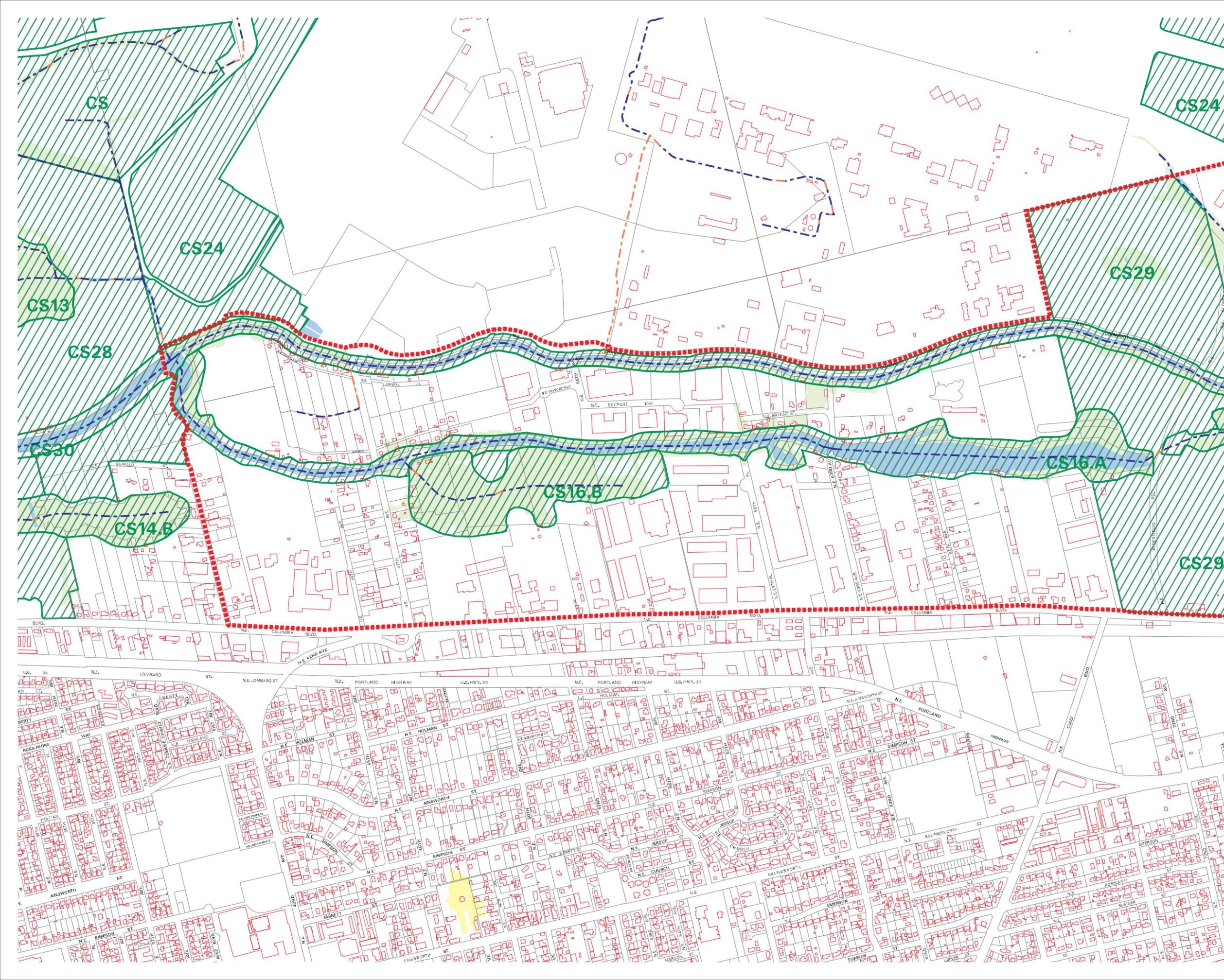
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Scale: 1" = 800'

0' 400' 800' 1200'





# Site CS4a - Map 6: Middle Slough/ Whitaker Slough

## Combined Riparian / Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

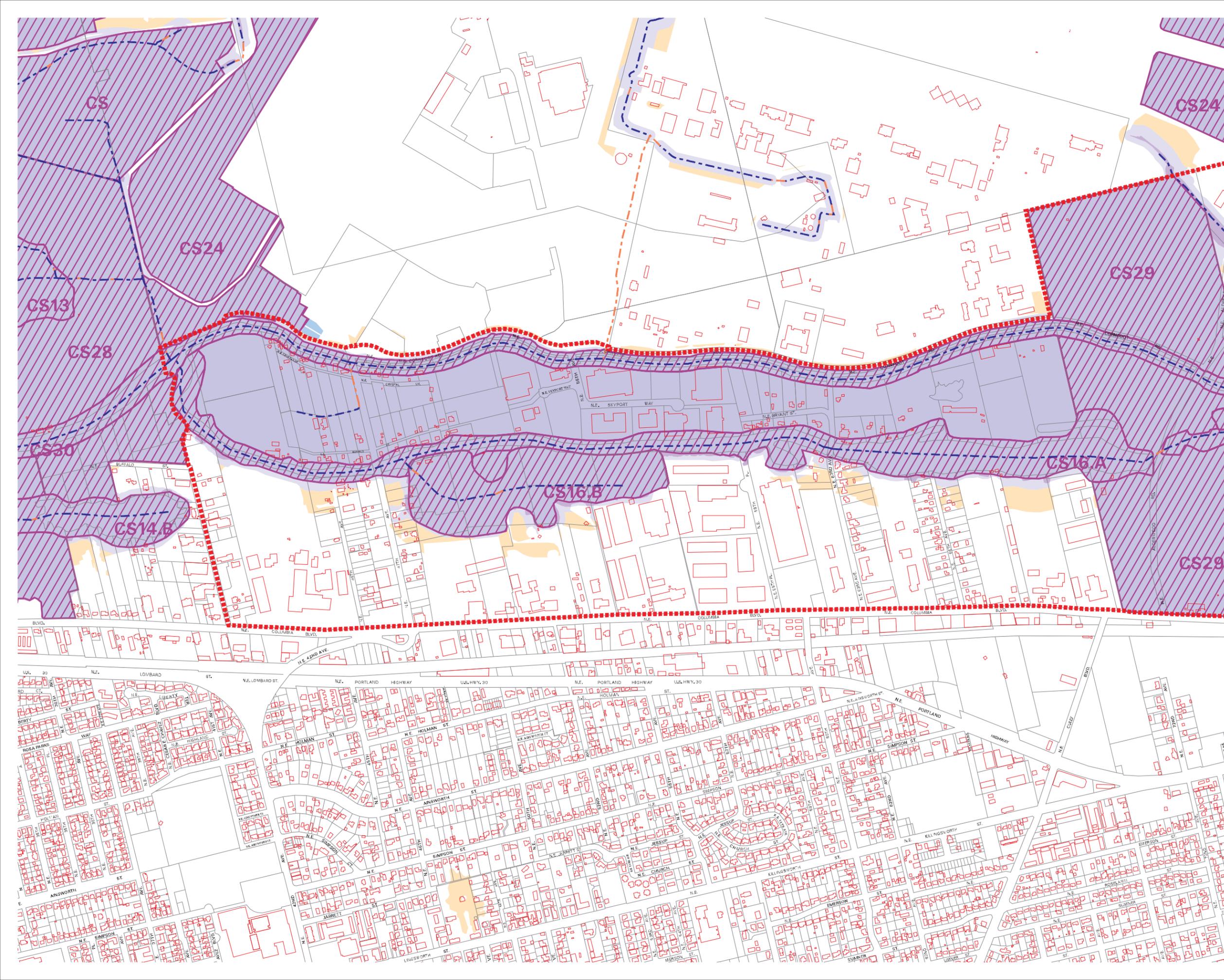
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Scale: 1" = 800'

0' 400' 800' 1200'





# Site CS4b - Map 1: Middle Slough/ Whitaker Slough

## 2007 Aerial Photography

-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'  
0' 400' 800' 1200'





# Site CS4b - Map 2: Middle Slough/ Whitaker Slough

## Water-Related Features

### Water Bodies

-  Stream/Drainage
-  Culvert or Piped

### Other Features

-  Flood Area
-  Wetlands
-  Stormwater
-  Combined stormwater/sanitary
-  Abandoned

### Bank Type

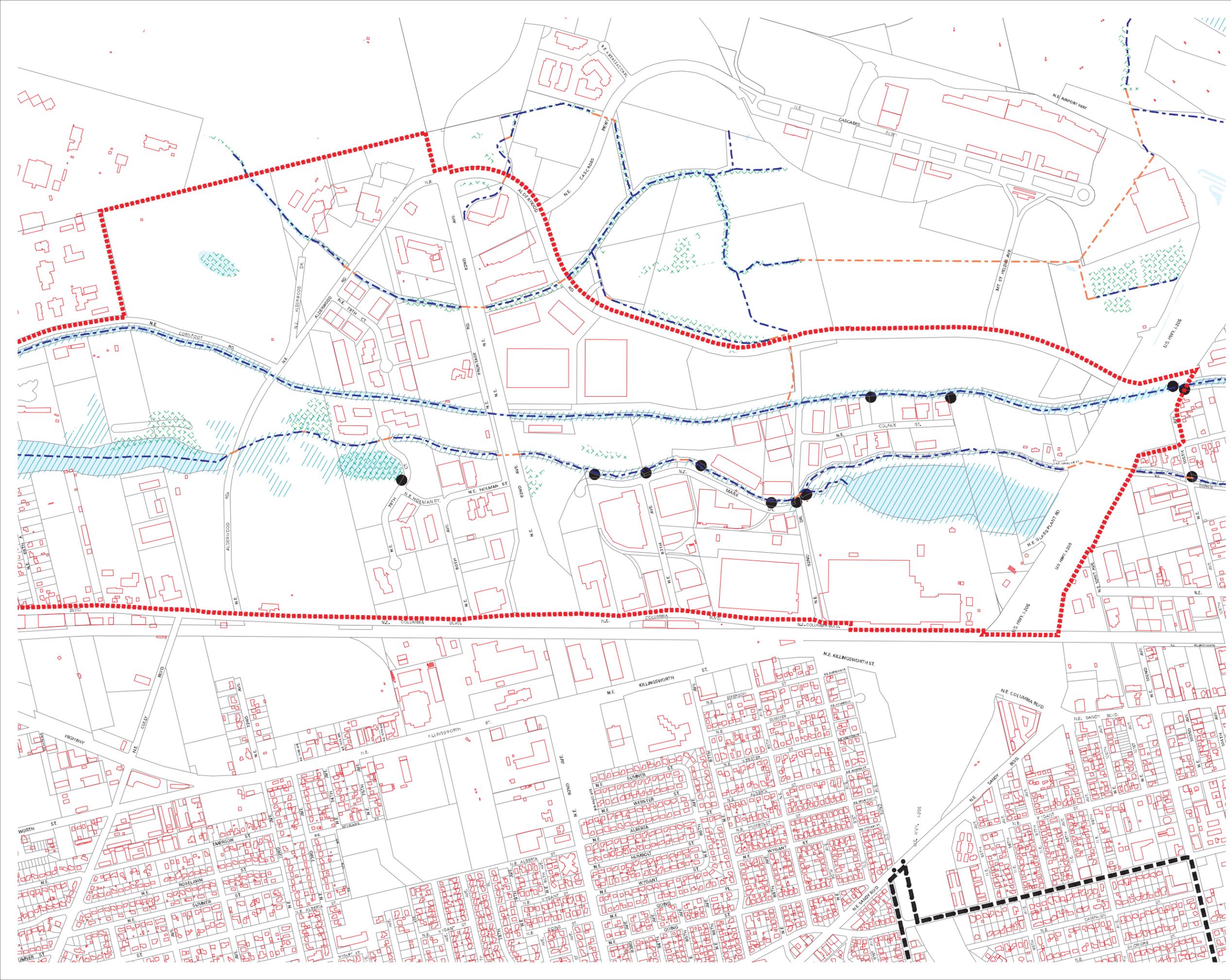
-  Beach
-  Bio-engineered
-  Vegetative Rip Rap
-  Non-vegetative Rip Rap
-  Site Boundary
-  City Boundary
-  Unclassified Fill Bank
-  Rock Bank
-  Seawall
-  Pilings
-  Urban Services

### INFORMATION SOURCES:

Water Bodies: Rivers, lakes and other water features. Originally digitized by Metro (1994). Data collection scale: 1:100' - 1:400'. City of Portland and Multnomah County pockets updated by City of Portland, Bureau of Planning, to refine waterbody geometry, remove erroneously mapped waterbodies, and add missing waterbodies. Aerial photos were the primary data source used as reference for re-mapping waterbodies. This is an interim dataset reflecting all work completed to date. Outfalls: Maintained by BES (June 2008) Location is approximate and data may be incomplete.

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Scale: 1" = 800'





# Site CS4b - Map 3: Middle Slough/ Whitaker Slough

## Vegetation Features

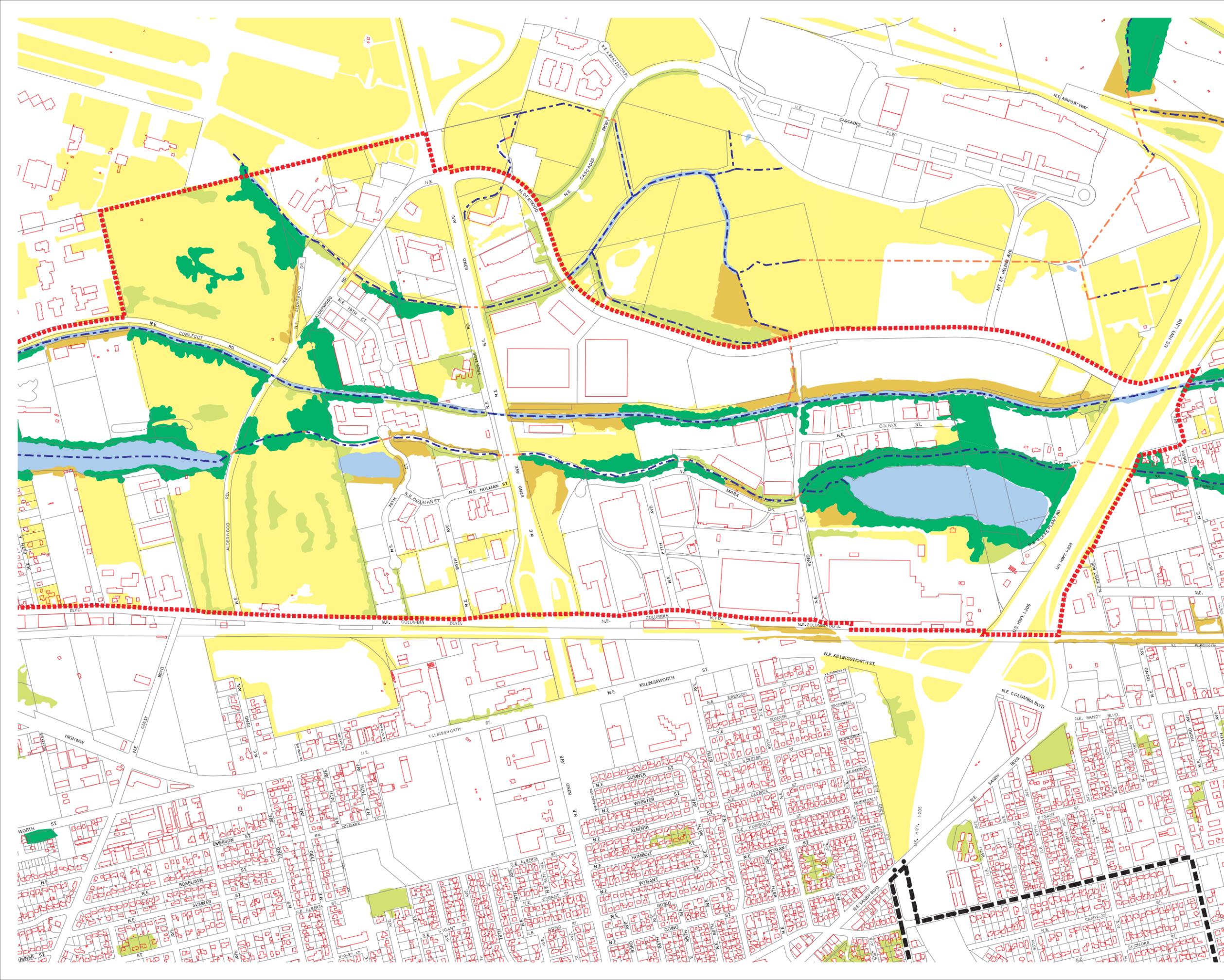
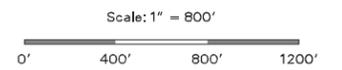
### Vegetation Types

-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

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# Site CS4b - Map 4: Middle Slough/ Whitaker Slough Riparian Resources Relative Rankings

-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

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Scale: 1" = 800'





# Site CS4b - Map 5: Middle Slough/ Whitaker Slough Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

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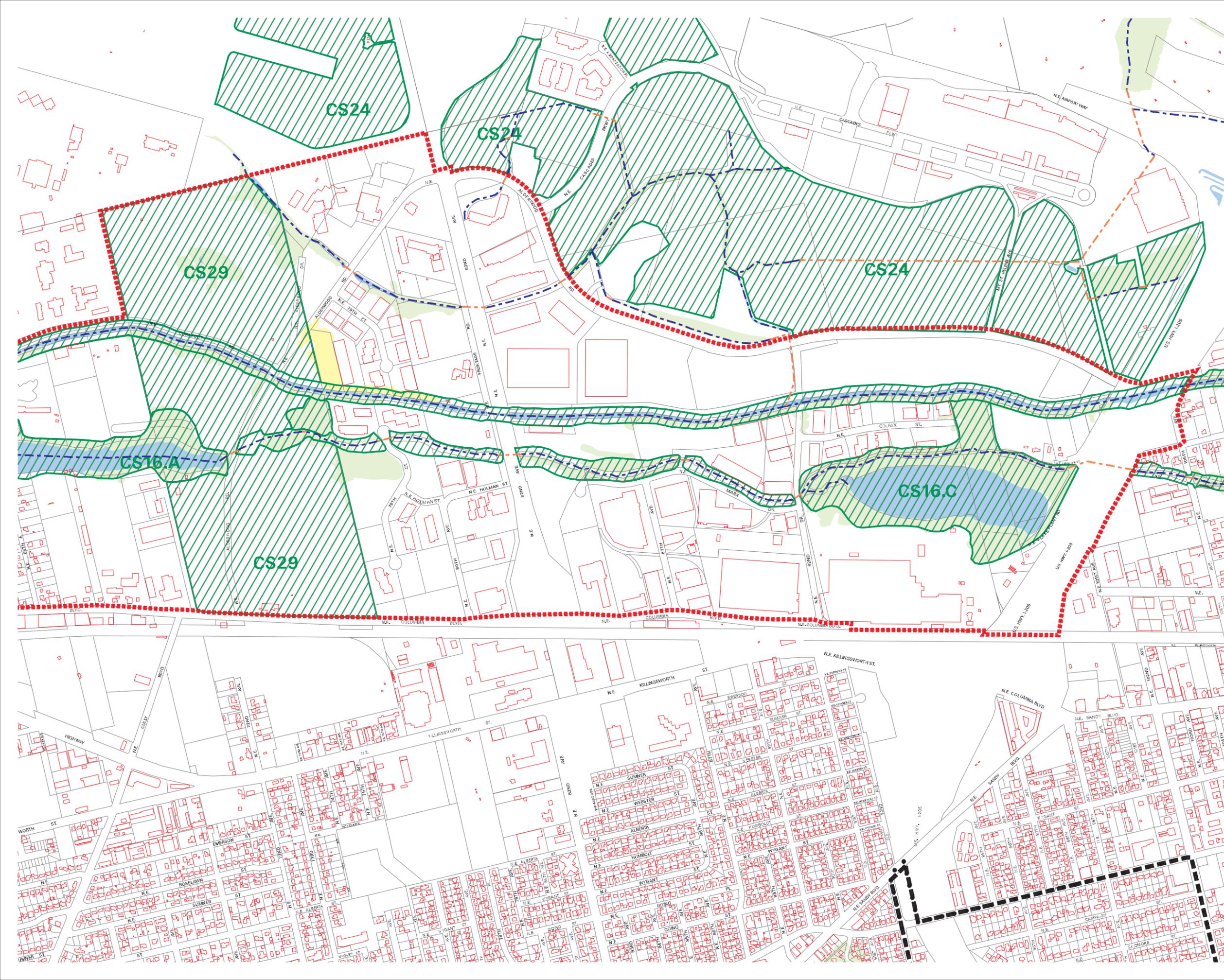
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Scale: 1" = 800'





# Site CS4b - Map 6: Middle Slough/ Whitaker Slough Combined Riparian / Wildlife Habitat Relative Rankings

- High relative value - Special Habitat Areas \*\*
- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

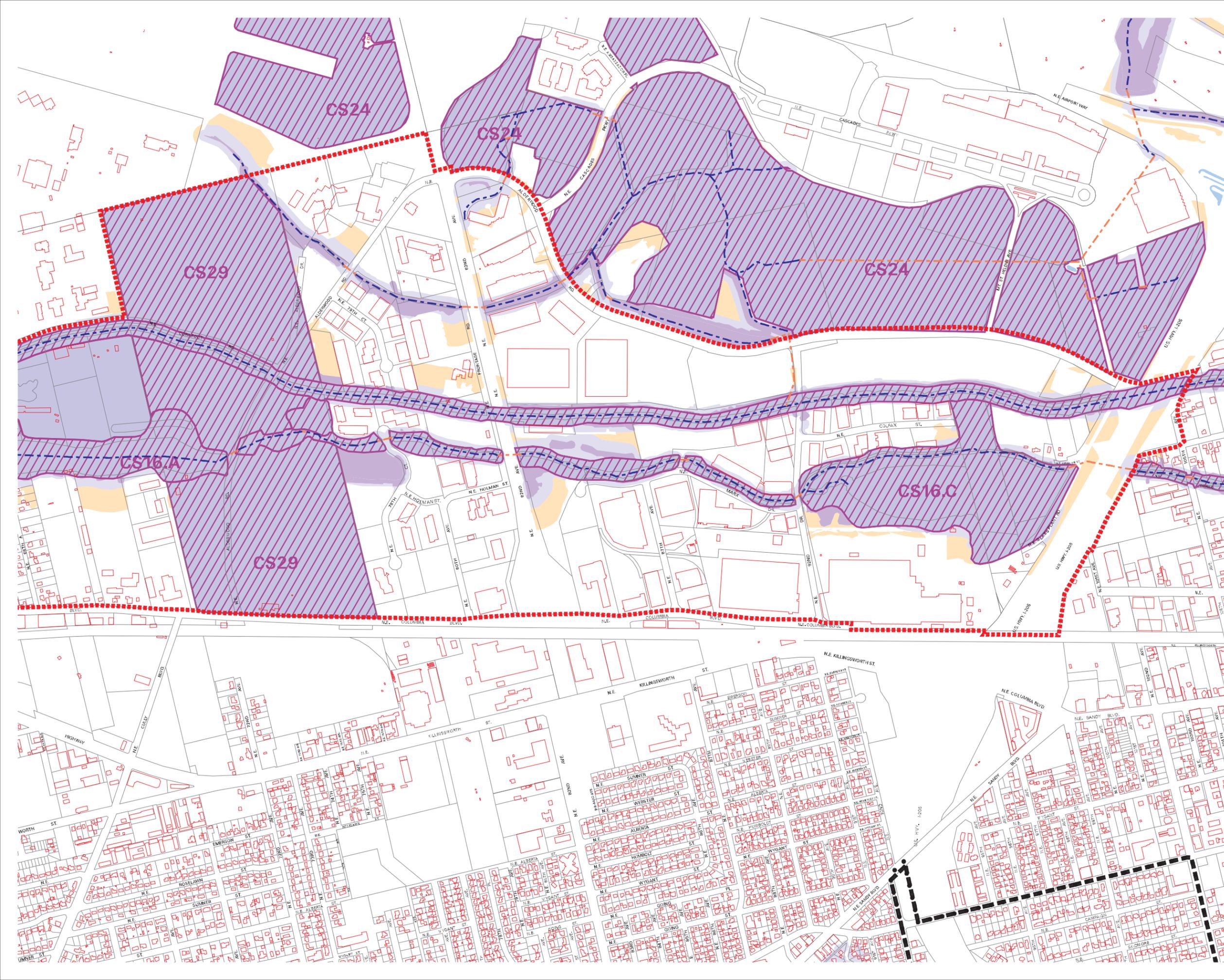
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Scale: 1" = 800'



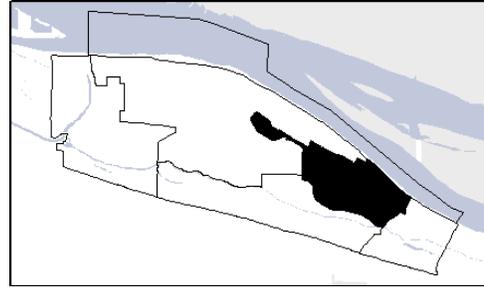


## INVENTORY SITE CS5: Airport Way

### Summary Information

Watershed: Columbia Slough

Neighborhood: Parkrose



USGS quadrangle and quarter section maps: 1N2E08, 1N2E09, 1N2E10, 1N2E15, 1N2E16

River Mile: none

Site Size: 734 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: General Industrial 2 (IG2)  
General Employment (EG2)  
Open Space (OS)  
Aircraft Landing height overlay (h)  
Airport Noise overlay (x)  
Environmental Conservation overlay (c)  
Environmental Protection overlay (p)  
Scenic overlay (s)

Existing Land Use: industrial; commercial

General Description: This site is located between the Middle Columbia Slough and Columbia River, west of I-205. The site contains secondary drainageways known as the PIC Ditches, multiple wetlands and upland grassland habitat. There is also a Port mitigation site located here.

Resource Features: open water stream channels; herbaceous and forested wetlands; vegetated flood area; bottomland hard wood forest; grasslands

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):

- *CS24: Upland Grassland* - area critical to sensitive species (S); upland meadow important to grassland-associated species (G); migratory stopover habitat (M); and wildlife connectivity corridor (C)

#### Special Status Species:

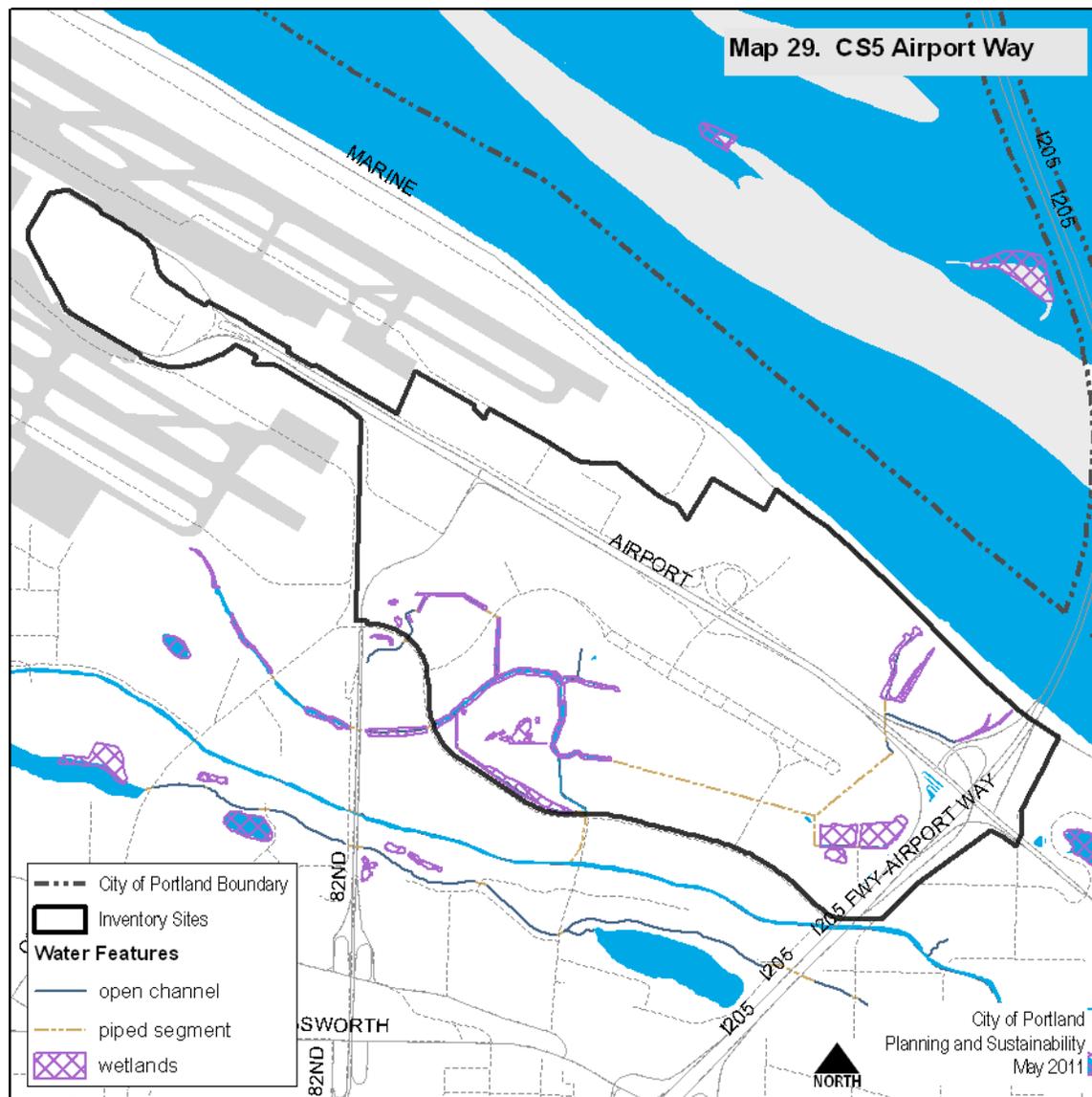
- *Bird:* American kestrel, bald eagle, bushtit, common yellowthroat, downy woodpecker, great blue heron, green heron, hooded merganser, northern harrier, Vaux's swift, western meadowlark, western wood peewee, willow flycatcher, and wood duck
- *Mammal:* American Beaver

Natural Hazards: flood area

Contamination: Yes

## Site Description

The Airport Way inventory site is 734 acres in size and is located between the Middle Columbia Slough and Columbia River. The site begins at the eastern edge of the I-205 right-of-way, extends west down Airport Way, and ends at the airport terminal building (Map 29). The site includes the Portland International Airport long-term and economy parking lots, hotels, car rental lots, and other commercial and aviation related uses along Airport Way and NE 82<sup>nd</sup> Avenue. The Portland International Center (PIC) is also within the site which includes IKEA and other commercial businesses. The site includes a portion of I-205 and associated right-of-way including the on and off ramps for Airport Way. There are approximately 339 acres of impervious area, including 16.8 miles of roads, located the site. Site CS5 Map 1 shows an aerial view of the Airport Way inventory site.

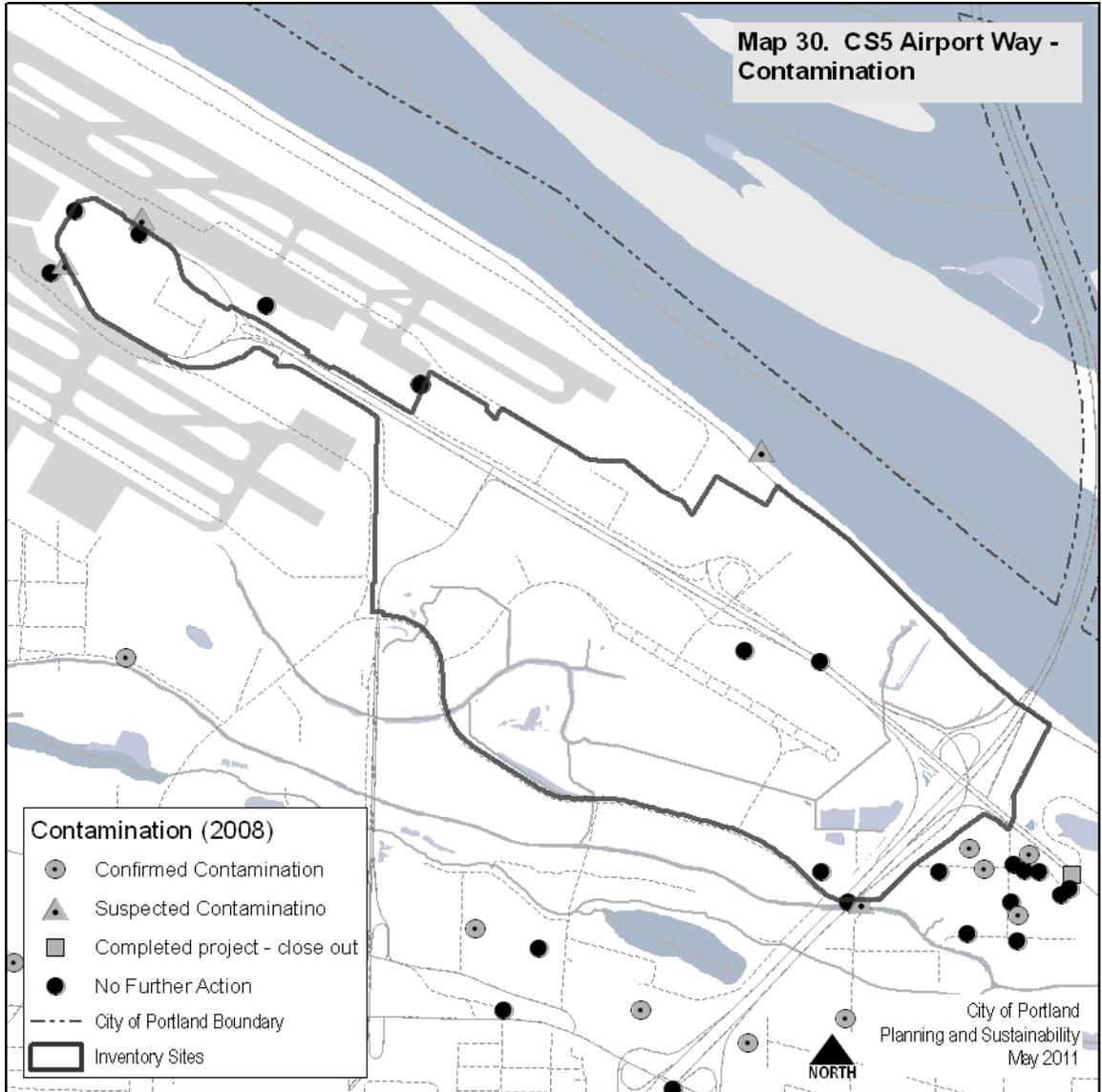


The site contains 2.4 miles of secondary drainageways, including the PIC ditches, and 8 wetlands totaling 19 acres. (CS5 Map 2). The 6-acre flood area includes 4 acres of vegetated flood area and 2 acres of non-vegetated flood area (CS5 Map 2). The Multnomah County Drainage District (MCDD) maintains the water levels in the secondary drainageways to provide flood protection and stormwater conveyance for developed lands.

Vegetated areas of at least ½ acre include approximately 8 acres of forest or dense tree canopy, 17 acres of woodland, 6 acres of shrubland and 233 acres of herbaceous cover (CS5 Map 3).

<b>Table 22: Summary of Natural Resource Features in CS5: Airport Way</b>	
	<b>Study Area (734)</b>
<b>Stream (miles)</b>	2.4
<b>Wetlands (acres)</b>	19
<b>Flood Area (acres)*</b>	6
Vegetated (acres)	4
Non-vegetated (acres)	2
Open Water (acres)	0
<b>Vegetated Areas &gt;= ½ acre (acres)**</b>	264
Forest (acres)	8
Woodland (acres)	17
Shrubland (acres)	6
Herbaceous (acres)	233
<b>Impervious Surfaces (acres)</b>	339
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** 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 2006 aerial photography.	

The Oregon Department of Environmental Quality (DEQ) has identified confirmed and suspected contaminated areas within the site (Map 30). Soil and groundwater within the site contain contamination resulting from past and current activities auto wrecking yards and electrical equipment warehouse. Types of pollutants found in the site included benzo(a)pyrene, PCBs, total petroleum hydrocarbons (TPH), acetone, chloroform, ethylbenzene, toluene, methyl ethyl ketone, and xylenes. Potential environmental and health risks include direct contact and groundwater migration. For more information regarding contamination, visit the DEQ website at <http://www.deq.state.or.us/lq/ecsi/ecsi.htm>.



## Natural Resource Description

The natural resources are described for subareas of the inventory site (Map 31).



### Portland International Center

The Portland International Center (PIC) is located between Alderwood Drive and Cascade Station. PIC is 151 acres in size and includes drainageways, known as the PIC ditches, wetlands, upland grasslands and a Port mitigation site.

#### *PIC Ditches and Wetlands*

Within the site there are roughly 1.7 miles of secondary drainageways that collectively referred to by MCDD and the Port of Portland as the “PIC Ditches.”<sup>1</sup> The PIC Ditches include remnants of historic drainageways and man-made agricultural ditches. The PIC Ditches are actively maintained by the

<sup>1</sup> Portions of the PIC Ditches are also known as Green Heron Slough.

Multnomah County Drainage District (MCDD) for stormwater flow and conveyance. Maintenance includes mowing the bank, removing woody debris from the water and periodic dredging. The channels of the PIC Ditches are deeply incised, with steep banks.

Much of the riparian area around the secondary drainageways is dominated by grasses, predominantly reed canary grass, and Himalayan blackberry with some areas of willow and red-osier dogwood. The banks are routinely mowed, reducing structural diversity and wildlife habitat. A Port of Portland mitigation site is located along the southern most secondary drainageway – PIC E-Zone Mitigation Site.

Just south of the IKEA parking lot and east of the Trimet MAX light rail tracks are three herbaceous wetlands and an associated drainageway. The northern two wetlands are 2.24 and 2.7 acres. Between the wetlands and Interstate 205 there are a few large trees. The predominant vegetation type in all three wetlands is reed canary grass. The following species were documented utilizing this area by Port of Portland staff between 2002 and 2009.

**Table 23: Port of Portland Wildlife Species Observations in the PIC Wetland Site 2002-2009**

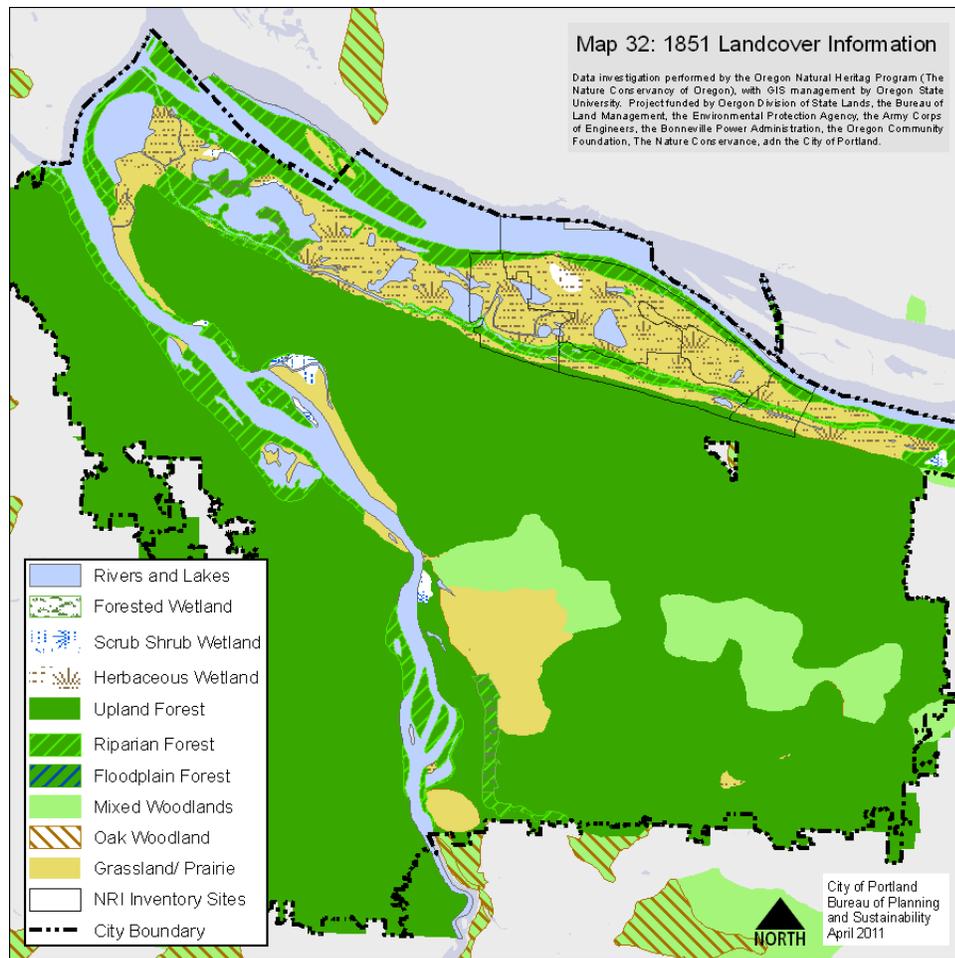
Birds		
American wigeon	Great blue heron	Red-tailed hawk
California gull	Mallard	White-crowned sparrow
Canada goose	Northern pintail	

*PIC Upland Grasslands*

Roughly 151 acres of Special Habitat Area (SHA) CS24: Airport Upland Grasslands is located within this site. In total, SHA CS24 encompasses roughly 1,000 acres of low herbaceous vegetation directly surrounding the Portland International Airport (PDX). Although the vegetation communities within this inventory site are not representative of a native grassland or prairie, the combination of the size of the open area, vegetation type, sandy fill and management activities causes the site to mimic some characteristics of a native grassland or prairie. Until roughly 150 years ago upland prairie and savannah habitats covered much of the Columbia Slough watershed (Map 22). Today, native grassland and prairie habitats throughout the region have been reduced to less than one percent of their historic extent and are now defined as an imperiled habitat (Metro, 2009)



**PIC Upland grasslands**



**Map 32. 1851 Landcover Information**

As such, while this inventory site does not contain native grassland or prairie vegetation, the cumulative effect of all the grassy and sparsely vegetated areas around the airport, and absence of vertical structures, creates a contiguous 1,200-acre flat grassland-like habitat adjacent to the Columbia River that attracts a high diversity and concentration of migratory and grassland-associated wildlife species. Over 100 species of birds, including grassland specialists, occur in this site annually. Some of these species, such as savannah sparrows and European starlings, occur in great numbers in the inventory site; while other species, such as Osprey occur in smaller numbers. Rare species that occur annually on migration include long-billed curlew and loggerhead shrike. While much of the resource function is attributed to the grasslands as a whole, there is some differentiation between different locations, five of which are addressed in inventory site CS2: Portland International Airport: 33<sup>rd</sup> Fields, Southwest Quadrant (SW Quad), Deicing Field, Fuel Farm and Airfield.

The Portland International Center (PIC) upland grasslands are located within this inventory site. Vegetation varies more in this location than in others, but is primarily made up of weedy herbaceous and shrubby plants. Invasive weeds such as thistle, teasel and Himalayan blackberry are common. The area is mowed once a year and targeted weed species are sprayed as needed.

PIC provides limited habitat for generalist species such as moles, voles, and other small mammals. Predators such as coyotes and raptors use them extensively for hunting grounds. A population of Western meadowlarks, a City of Portland *at risk* species, occurs at the site (Port, AIRMAN; Audubon). Non-special status birds that use the upland grassland habitat include savannah sparrow, American pipit, Lazuli bunting, barn swallow, cliff swallow, Western kingbird, red-winged blackbird and yellow-headed

blackbird. The following wildlife species were documented by the Port of Portland in the area between 2002 and 2009:

**Table 24: Port of Portland Wildlife Species Observations in the Upland Grasslands 2002-2009**

<b>Birds</b>		
American crow	European starling	Osprey
American goldfinch	Glaucous-winged gull	Red-tailed hawk
American kestrel	Great-blue heron	Red-winged blackbird
Bald eagle	Great egret	Rock dove
Barn swallow	Great horned owl	Savannah sparrow
Brewer's blackbird	House finch	Short-eared owl
Brown-headed cowbird	House sparrow	Tree swallow
California gull	Killdeer	Turkey vulture
Canada goose	Mallard	Vaux's swift
Cliff swallow	Northern harrier	Western meadowlark
<b>Mammals</b>		
Coyote	Squirrel	

All of the upland grassland areas, including PIC, are part of one Special Habitat Area, CS24: Airport Upland Grasslands, because the habitats meet the criteria for migratory stopover (M), grassland-associated species use (G), area vital for at risk species (S) and a connectivity corridor with the Columbia River (C).

#### *PIC E-Zone Mitigation Site*

Along NE Alderwood Road is a Port of Portland mitigation site. The PIC E-zone Mitigation Site is located along one of the PIC Ditches addressed in the previous section. The mitigation site is comprised of a woodland containing black cottonwood, willow and ash. Reed canary grass, rushes and cattails are common at the water's edge. Wildlife observed in this section of the PIC Ditches and the surrounding riparian vegetation include American crow, American kestrel, Canada goose, European starling, great blue heron, great egret, great horned owl, mallard, pileated woodpecker, red-tailed hawk, western scrub jay, coyote and raccoon. The following wildlife species were documented utilizing the site by Port of Portland staff from 2001 thru 2008.



**Table 25: Port of Portland Wildlife Species Observations in the PIC E-zone Mitigation Site 2001-2008**

<b>Birds</b>		
Accipiter, unidentified	European starling	Ruby-crowned kinglet
American crow	Golden-crowned sparrow	Savannah sparrow
American goldfinch	Great blue heron	Sharp-shinned Hawk
American kestrel	Great egret	Sparrow, unidentified
American robin	Great horned owl	Spotted towhee
American wigeon	Green heron	Song sparrow
Bald eagle	Green-winged Teal	Swallow, unidentified
Barn swallow	Gull, unidentified	Tree swallow
Belted kingfisher	Hooded merganser	Turkey vulture
Bewick's wren	House finch	Vaux's swift
Black-capped chickadee	Hummingbird, unidentified	Violet-green swallow
Black-headed grosbeak	Killdeer	Warbler, unidentified
Brewer's blackbird	Lazuli bunting	Warbling vireo
Bushtit	Mallard	Western kingbird
Cackling goose	Mourning dove	Western meadowlark

Canada goose	Northern flicker	Western scrub jay
Cedar waxwing	Northern harrier	western wood peewee
Cinnamon teal	Northern shrike	white-breasted nuthatch
Cliff swallow	Osprey	White-crowned sparrow
Common yellowthroat	Red-tailed hawk	Willow flycatcher
Dark-eyed junco	Red-winged blackbird	Wilson's snipe
Double-crested cormorant	Ring-necked duck	Wood duck
Downy woodpecker	Ring-necked pheasant	Yellow-rumped Warbler
<b>Mammals</b>		
Beaver	Gray fox	Raccoon
Cottontail rabbit	Mole	Rodent, unidentified
Coyote	Mouse	Vole
<b>Reptiles and Amphibians</b>		
Bullfrog	garter snake	Pacific treefrog
common garter snake	Long-toed salamander	
<b>Fish</b>		
Carp	Fish, unidentified	

**Economy Parking Forested Wetland**

Located in the middle of the Portland International Airport economy parking lot is a wetlands and associated drainageways. This forested area contains 50 to 60 year old cottonwood trees. This area is within the FAA regulated approach surface of the north runway (Runway 28R). Objects with heights that penetrate into this surface must be removed or maintained to protect the critical airspace; as a result, trees in this area are routinely topped as they grow into the protected airspace. The understory is dominated by Himalayan blackberry but willow and red-osier dogwood are also present. Emergent vegetation is present in the wetland.



**Economy Parking Forested Wetland**

An unnamed remnant slough channel is present on the western part of the site. It is isolated from the Columbia River by the levee but is hydrologically connected to the Columbia Slough via the Port's stormwater conveyance system. The unnamed slough receives flow from a secondary drainage that exists along the southern end of the site. A stormwater swale present on the eastern edge of the site drains the economy parking lot and flows into the secondary drainage at the south end of the site. These water features are classified as forested wetlands and total 1.85 acres. The wetlands and forest provide food, roosting, perching and nesting opportunities for waterfowl, shorebirds, songbirds, woodpecker and raptor. Reptile and amphibian utilization is also likely. Due to the proximity of the forest to the Columbia River, the area is likely used by migratory birds. Table 25 provides a list of wildlife species observed in this forested wetland complex.

**Table 26: Port of Portland Wildlife Species Observations in the Economy Parking Forested Wetland 2002-2009**

<b>Birds</b>		
American crow	Bushtit	Northern flicker
American goldfinch	Canada goose	Red-tailed hawk
American kestrel	Cedar waxwing	Ruby-crowned kinglet
Anna's hummingbird	Downy woodpecker	Song sparrow
American robin	European starling	Western scrub jay
Black-capped chickadee	Great blue heron	Wood duck
Bewick's wren	Mallard	Yellow-rumped warbler
Brown creeper	Mourning dove	
<b>Mammals</b>		
Beaver	Coyote	Rabbit
<b>Reptiles and Amphibians</b>		
Bullfrog		

**I-205 Forested Area**

Between Interstate 205 and the economy parking lot is forested area that contains a drainageway and wetland. The vegetation assemblage along the I-205 southbound off-ramp to Airport Way includes cottonwood with a predominantly Himalayan blackberry understory. During spring 2009 site visits, Cooper's hawk and coyote were observed in the forested area. Along the I-205 northbound off-ramp to Airport Way the drainageway is surrounded by grasses, predominantly reed canary grass,, Himalayan blackberry and a strip of planted trees along the parking lot.

## 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 27). 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 the Methodology Overview section of this report and the *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2008).

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 portions of the Columbia Slough secondary drainageways, wetlands, riparian vegetation, as detailed in the natural resource description. These landscape features provide the following riparian functions:

- 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 assigned to the Columbia Slough, Whitaker Slough, wetlands, and secondary drainageways. Riparian forests and areas of dense tree canopy receive a high or medium relative ranks depending on proximity to open water. Medium and low relative ranks are generally assigned to lower structure riparian vegetation. Other areas are assigned a high, medium or low relative rank depending on the proximity and extent of vegetation relative to the water body (CS5 Map 4).

### Wildlife Habitat

A wildlife habitat patch is, for purposes of the inventory model, defined as forest and/or wetland areas, 2 acres in size or greater, plus adjacent woodland vegetation (note Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features).

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

Based on the wildlife habitat model criteria, a medium relative rank is assigned to forests and/or wetlands because of the size, interior area and proximity to water and other patches (CS5 Map 5).

### Special Habitat Areas (SHA) descriptions

SHAs 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 (CS4 Map 5). There is one SHA within this inventory site, CS24.B: Upland Grassland,

which meets the following criteria: area critical to sensitive species (S); upland meadow important to grassland-associated species (G); migratory stopover habitat (M); and wildlife connectivity corridor (C).

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 (CS5 Map 6).

**Table 27: Summary of Ranked Resources in CS5: Airport Way**

<b>Total Inventory Site = 734 acres</b>				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources*</b>				
acres	32	51	64	147
percent total inventory site area	4	7	9	20
<b>Wildlife Habitat</b>				
<b>Wildlife Habitat*</b>				
acres	0	22	0	22
percent total inventory site area	0	3	0	3
<b>Special Habitat Areas*</b>				
acres	199			
percent total inventory site area	27			
<b>Wildlife Habitat - adjusted by Special Habitat Areas **</b>				
acres	199	12	0	211
percent total inventory site area	27	2	0	29
<b>Combined Total</b>				
acres	217	12	15	244
percent total inventory site area	30	2	2	34
** High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Willamette 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.				

# Site CS5 - Map 1: Portland International Airport

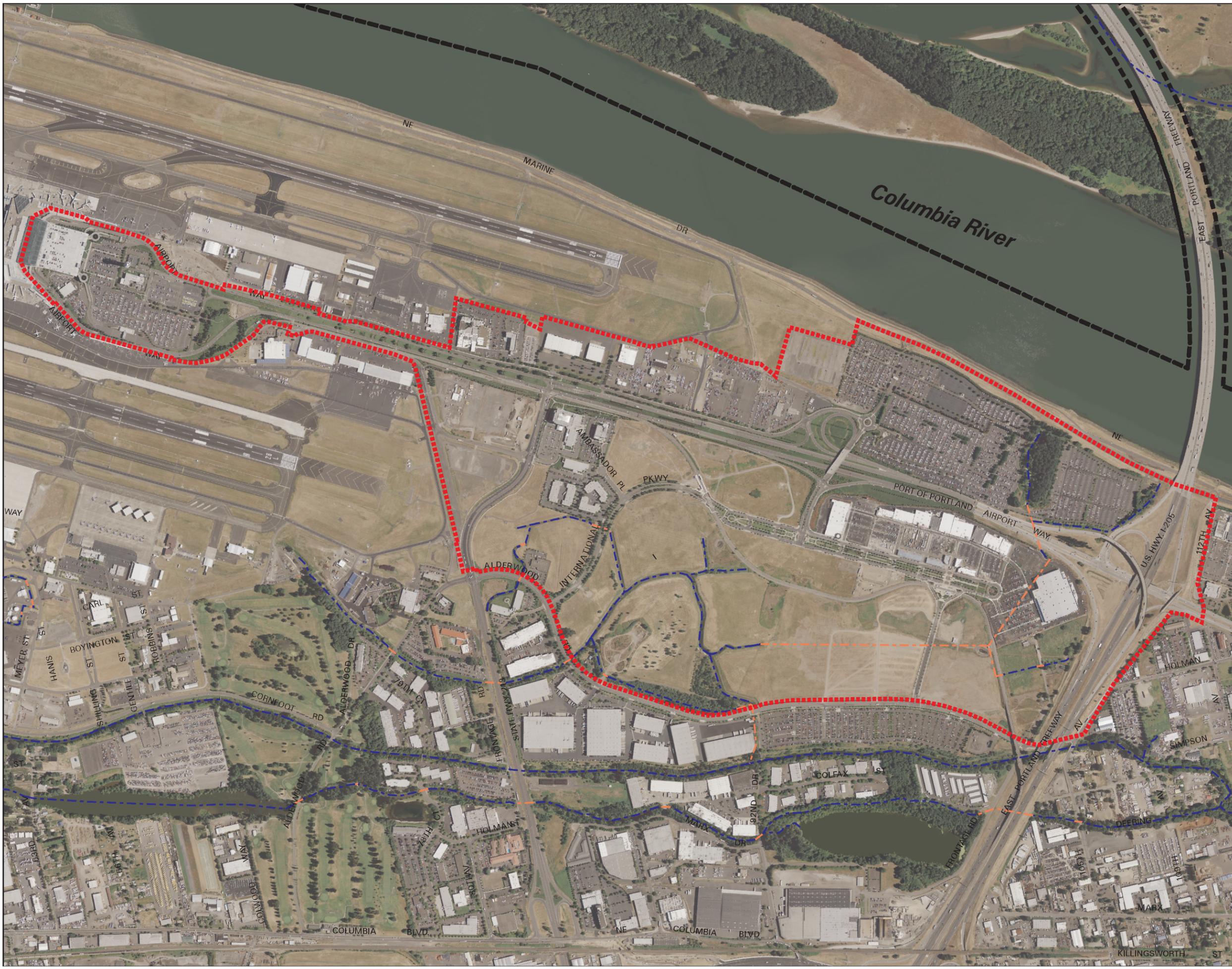
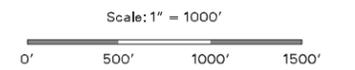
## 2007 Aerial Photography

-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.









# Site CS5 - Map 3: Portland International Airport

## Vegetation Features

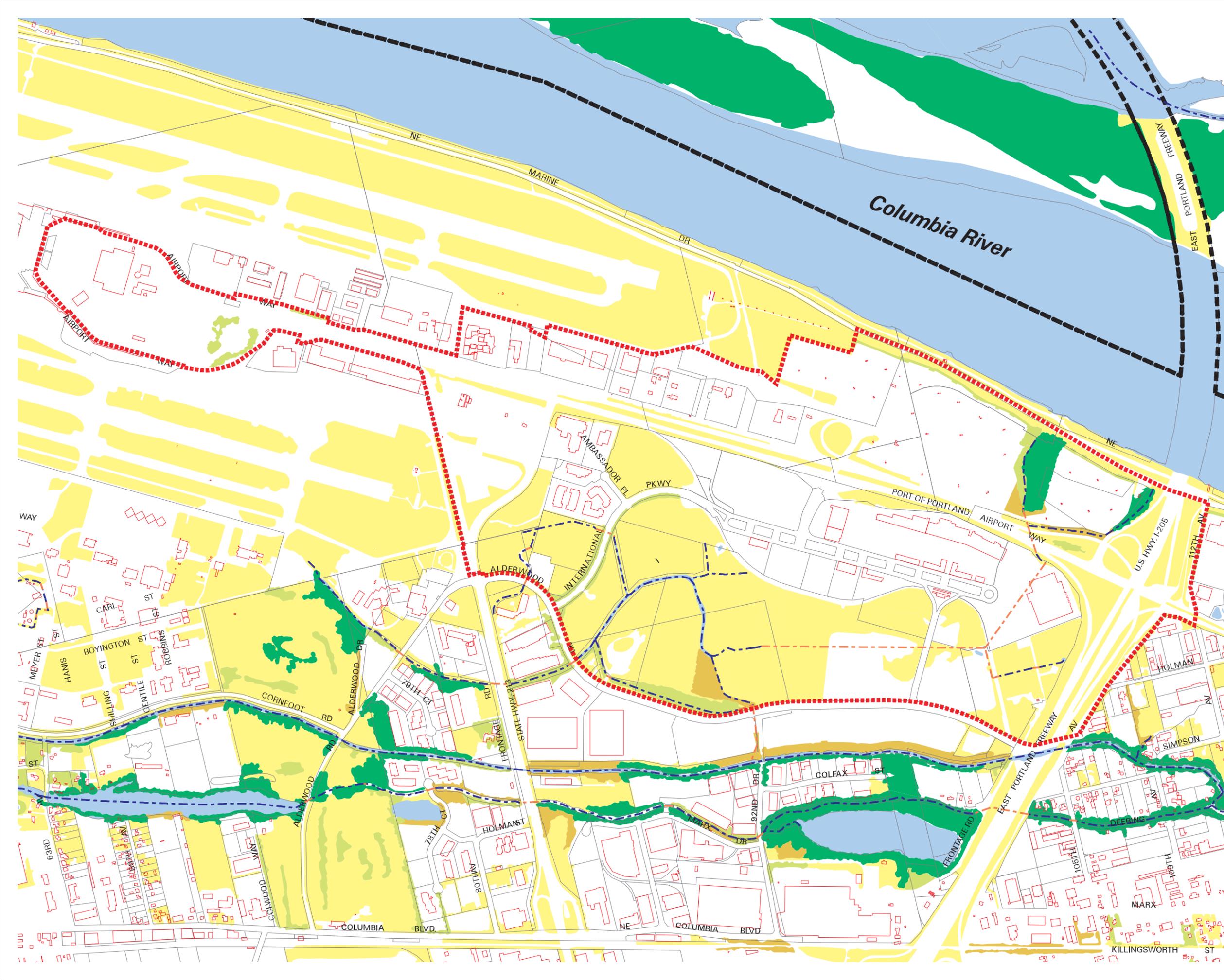
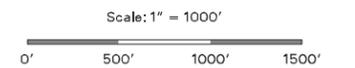
### Vegetation Types

-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.





# Site CS5 - Map 4: Portland International Airport Riparian Resources Relative Rankings

- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

**INFORMATION SOURCES:**

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

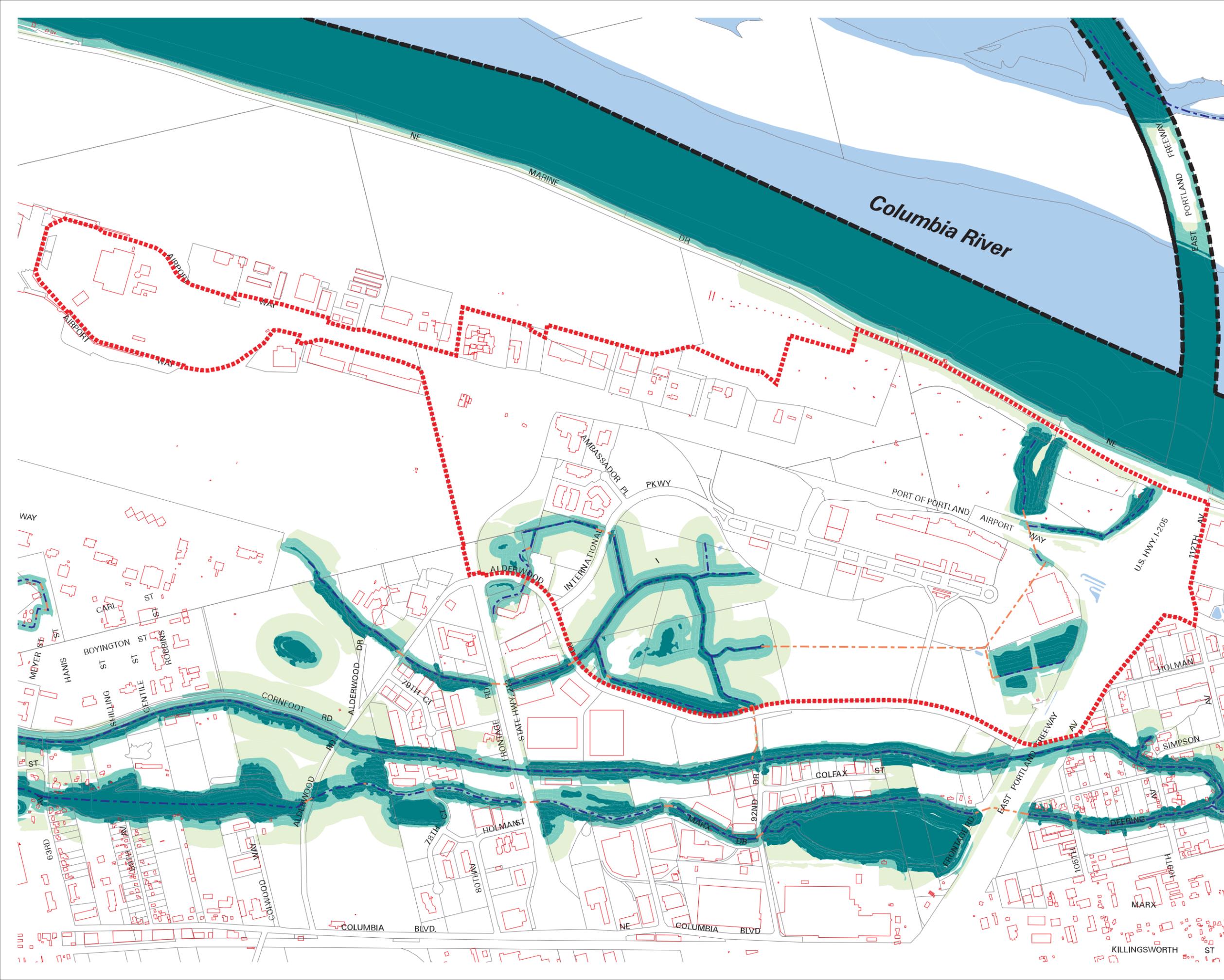
\*\* SHA ranking supercedes lower relative values.

For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 1000'  
0' 500' 1000' 1500'





# Site CS5 - Map 5: Portland International Airport Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

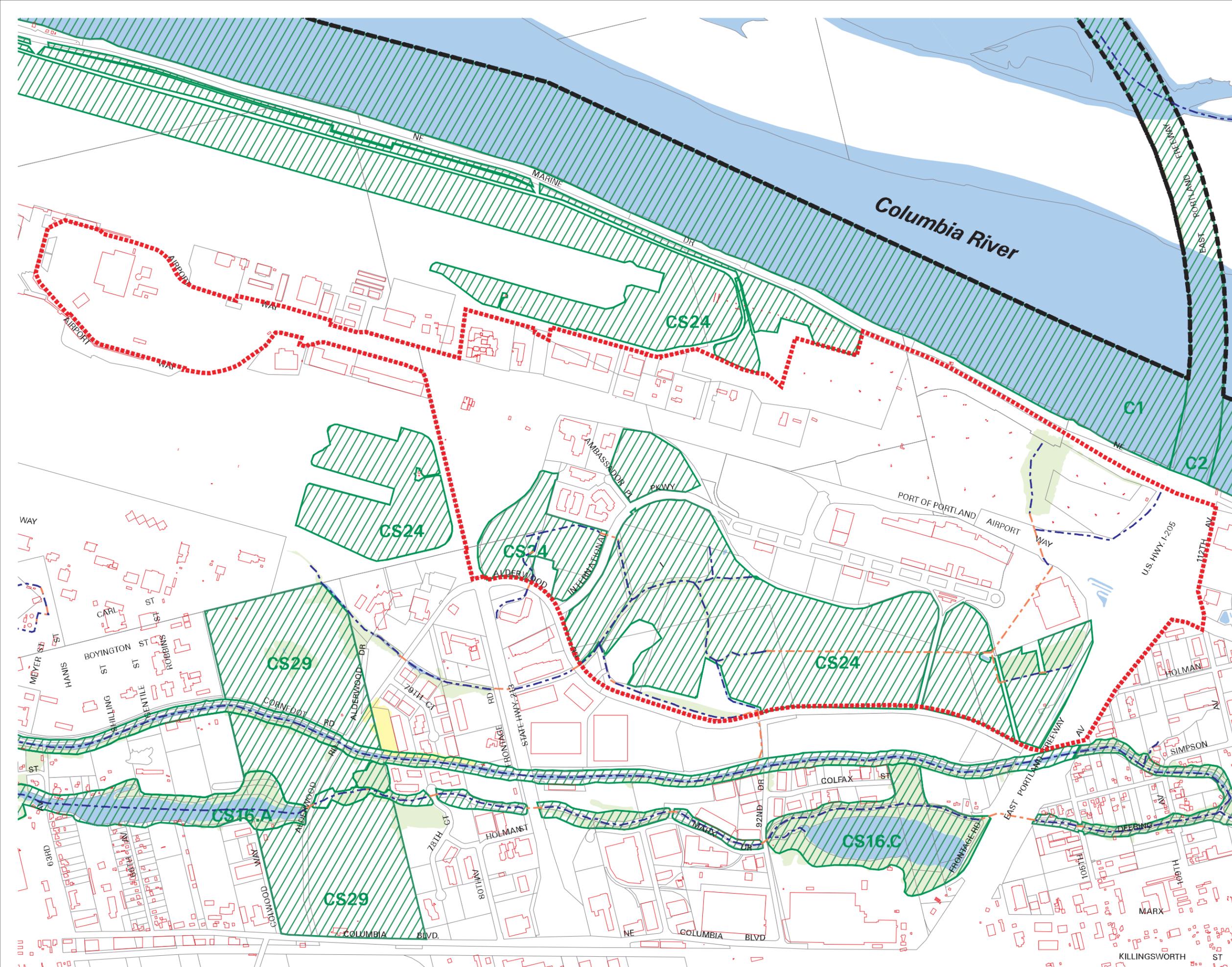
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Scale: 1" = 1000'





# Site CS5 - Map 6: Portland International Airport

## Combined Riparian / Wildlife Habitat Relative Rankings

- High relative value - Special Habitat Areas \*\*
- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

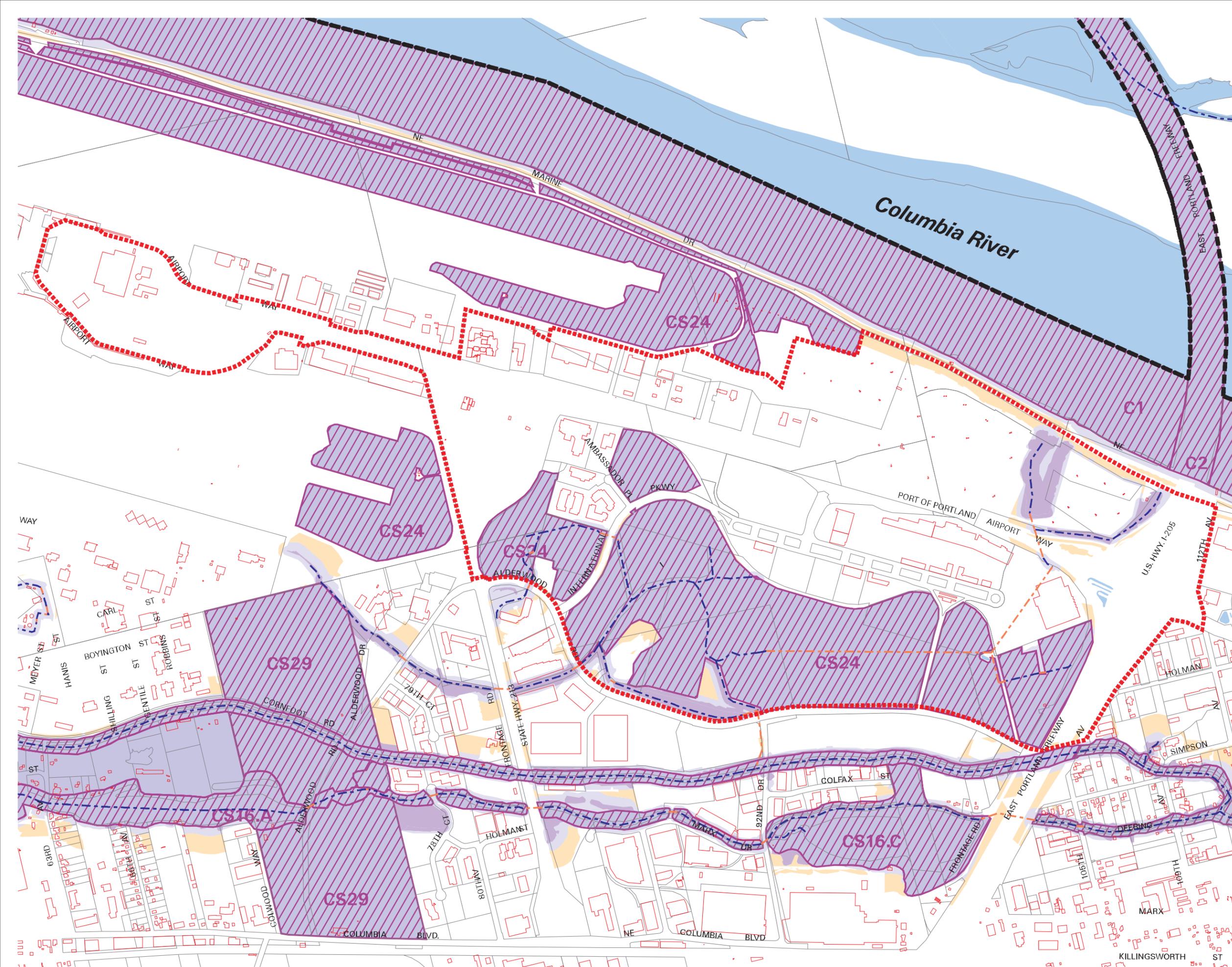
For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

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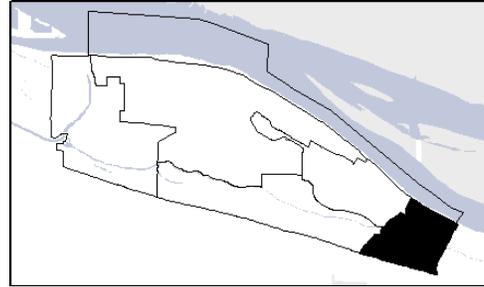
Scale: 1" = 1000'

0' 500' 1000' 1500'





## INVENTORY SITE CS6: Little Four Corners



### Summary Information

Watershed: Columbia Slough

Neighborhood: Parkrose

USGS quadrangle and quarter section maps: 1N2E14, 1N2E15, 1N2E22, 1N2E23 and 1N2E24

River Mile: 13.7-14.6 (beginning at the Interstate 205 Bridge over the Columbia Slough and extending to NE 122<sup>nd</sup> Avenue)

Site Size: 522 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: General Industrial 2 (IG2)  
General Employment (EG2)  
Aircraft Landing height overlay (h)  
Airport Noise overlay (x)  
Environmental Conservation overlay (c)  
Environmental Protection overlay (p)  
Scenic overlay (s)

Existing Land Use: industrial; commercial

General Description: This site includes part of the Middle Slough and Whitaker Slough, which join at an area know as Little Four Corners. To the east of Little Four Corners is Prison Pond, which is the most upstream section of Whitaker Slough. There are a couple secondary drainageways in the site and two remnant wetlands – Mays Lake and Ainsworth Wetland.

Resource Features: open water stream/drainageway channels; herbaceous, scrub-shrub and forested wetlands; vegetated flood area; bottomland hard wood forest

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):

- *CS16.D: Little Four Corners* – bottomland hardwood forest (B); migratory stopover habitat (M); wildlife connectivity corridor (C); resources or structure that provides unique habitat function in natural or built environment (U).

### Special Status Species:

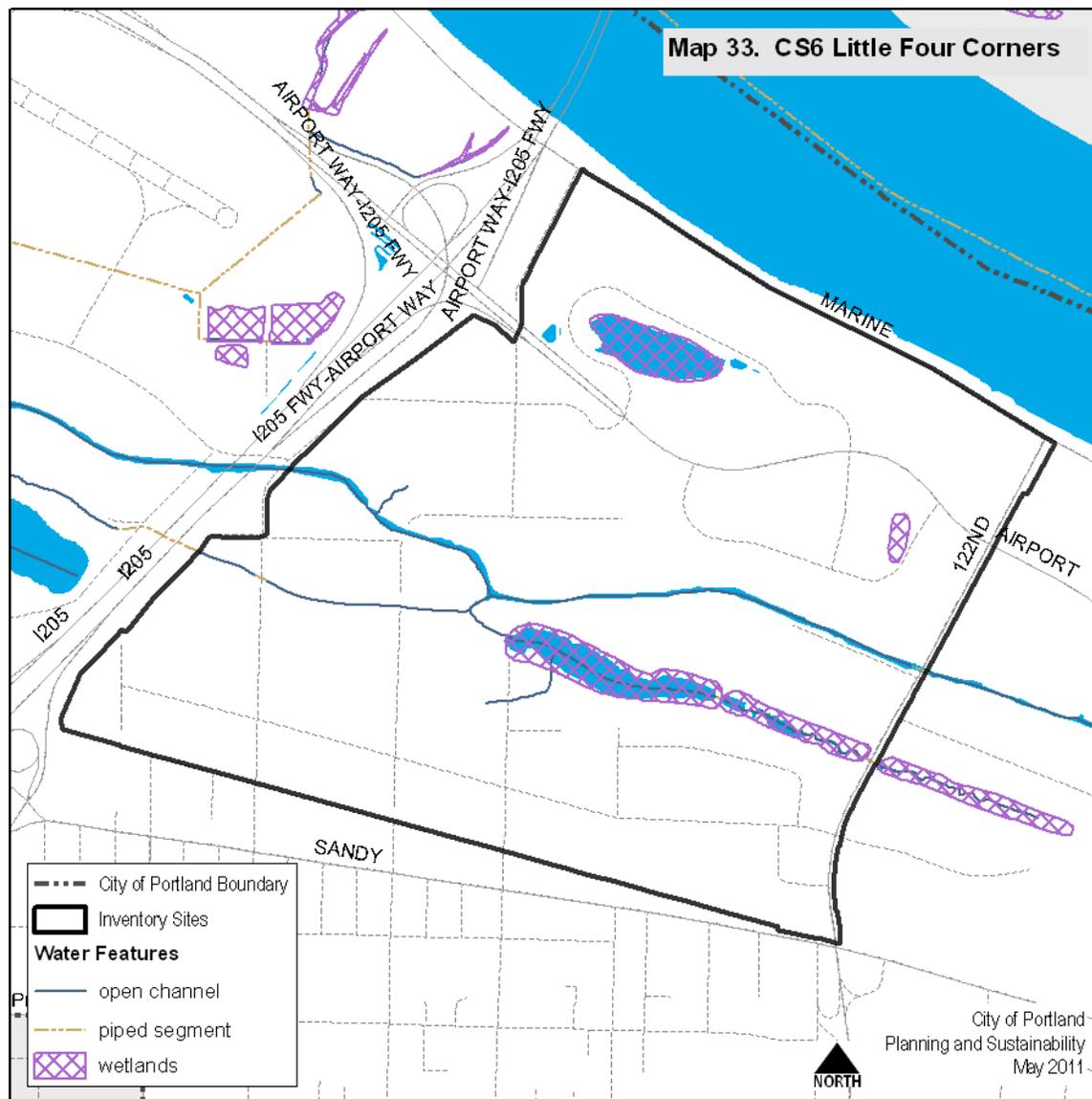
- *Birds:* willow flycatchers, belted kingfishers, great blue herons, common merganser
- *Reptiles:* Western painted turtle
- *Mammals:* American beaver, northern river otter

Natural Hazards: flood area

Contamination: Yes

## Site Description

Little Four Corners is the informal name given to the area where the Middle Columbia Slough, Whitaker Slough and Prison Pond join (Map 33). This inventory site is 522 acres in size and includes industrial land uses around the Columbia Slough; and commercial land. There are approximately 298 acres of impervious area, including 8.1 miles of roads, located the site. The western boundary of the site is Interstate 205; the southern boundary is Columbia Boulevard; the eastern boundary is NE 122<sup>nd</sup> Avenue; and the northern boundary is the Marine Drive. Site CS6 Map 1 shows an aerial view of the Little Four Corners inventory site.



A roughly 1-mile long section of the Columbia Slough main arm extends from the Interstate 205 Bridge to NE 122<sup>nd</sup> Avenue. The site contains two small secondary drainageways totaling 1,140 linear feet and 3 wetlands totaling 21 acres. The 39-acre flood area includes 13 acres of open water, 16 acres of vegetated flood area and 9 acres of non-vegetated flood area (CS6 Map 2). The Multnomah County Drainage District (MCDD) maintains the levees and water levels in the Columbia Slough to provide flood protection and stormwater conveyance. The management of the Columbia Slough waterways riparian reduces flooding and affects the riparian functions. The inventory models have been adjusted to reflect a lesser level of function than assigned to more active flood areas in the rest of the City.

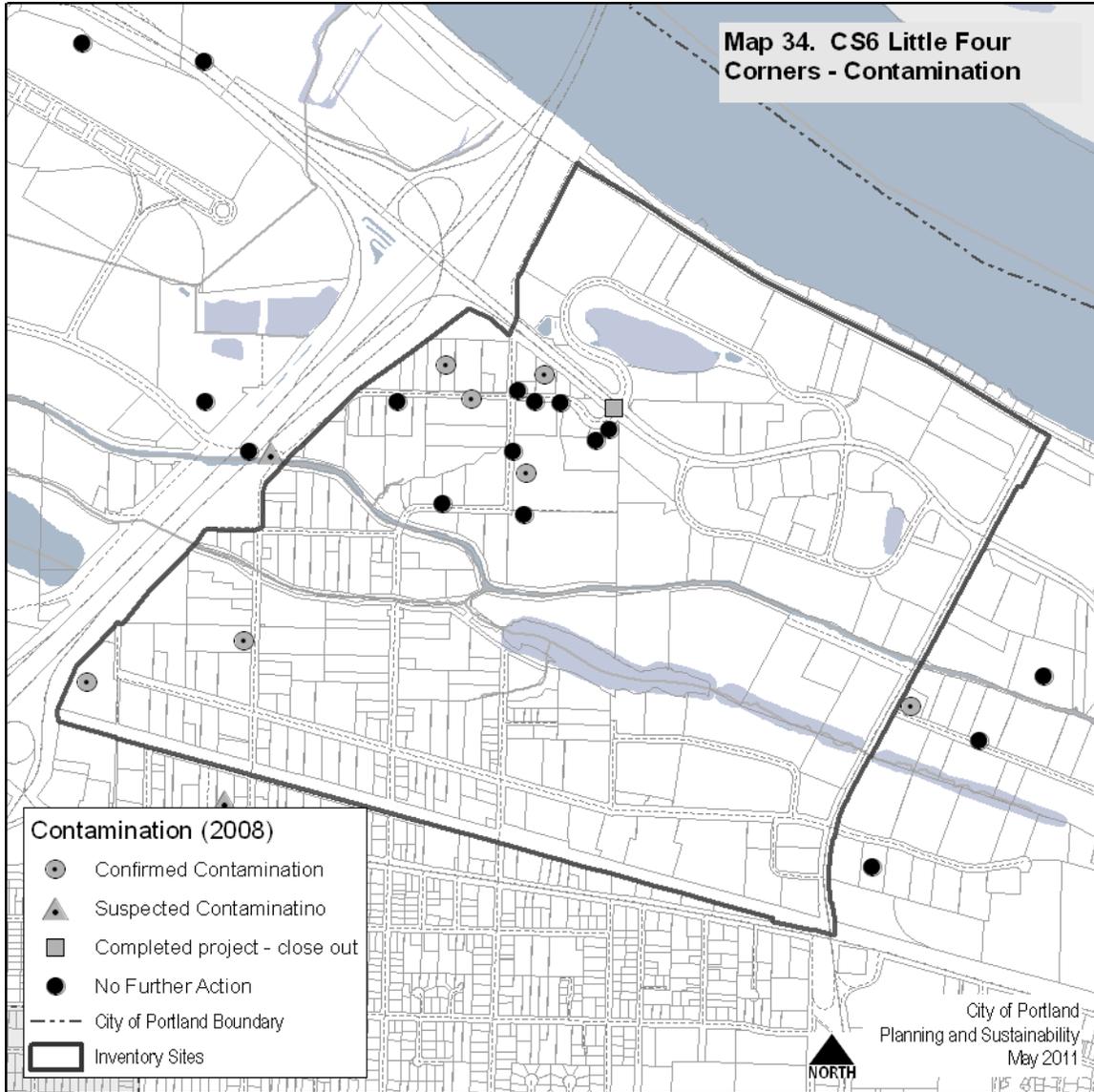
Vegetated areas at least ½ acre include approximately 26 acres of forest or dense tree canopy, 27 acres of woodland, 9 acres of shrubland and 56 acres of herbaceous cover.

The City of Portland Bureau of Environmental Services (BES) has conducted revegetation projects throughout the site. There are currently three active and four completed sites, and one prospective revegetation site. Much of the revegetation has occurred in riparian areas around the Columbia Slough and Prison Pond; some revegetation has also occurred around Mays Lake.

**Table 28:** Summary of Natural Resource Features in CS6: Little Four Corners

	<b>Study Area</b> (521 acres)
<b>Stream/Drainageway (miles)</b>	2.2
<b>Wetlands (acres)</b>	21
<b>Flood Area (acres)*</b>	39
Vegetated (acres)	16
Non-vegetated (acres)	9
Open Water** (acres)	13
<b>Vegetated Areas &gt;= ½ acre (acres)<sup>†</sup></b>	116
Forest (acres)	26
Woodland (acres)	27
Shrubland (acres)	9
Herbaceous (acres)	56
<b>Impervious Surfaces (acres)</b>	298
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the WHAT within the site.	
† 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 2006 aerial photography.	

The Oregon Department of Environmental Quality (DEQ) has identified confirmed and suspected contaminated areas within the site (Map 24). Soil, groundwater and surface water within the site contain contamination resulting from past and current activities including underground tanks, surface runoff from parking areas, draining of drums, lumber yard, equipment repair/maintenance, auto salvage and a VOC discharge. Types of pollutants found in the site included benzene, acetone, carbon disulfide, methyl ethyl ketone, vinyl chloride, diesel, PCB, lead, cadmium and chromium. Potential environmental and health risks are primarily due to groundwater migration because of the City of Portland's South Shore Wellfield, which is a back-up drinking water source for Portland. For more information regarding contamination, visit the DEQ website at <http://www.deq.state.or.us/lq/ecsi/ecsi.htm>.



## Natural Resource Description

The natural resources are described for sub areas of the inventory site (Map 35).



### Middle Columbia Slough

The site contains approximately one mile of the Middle Slough. The portion of the Middle Slough within the site is characterized by a low gradient channel and extensive macrophyte growth that impacts flow and water quality. The riparian area adjacent to the Middle Slough is generally two to three trees in width. These areas are generally bottomland hardwood forest comprised of black cottonwood and red alder. Other native vegetation species present include Douglas-fir, western red cedar, snowberry, red-flowering currant, red-osier dogwood, Indian plum, Oregon grape, Nootka and swamp rose, and vine maple. Invasive plant species found throughout in the riparian area include Himalayan blackberry, Japanese knotweed and reed canary grass.

The width of the Middle Slough waterway in this site is 30 to 50 feet and the average channel depth is six to eight feet. The Middle Slough is water quality limited for multiple parameters including bacteria, temperature, dissolved oxygen and biochemical oxygen demand (BOD), eutrophication (phosphorus, chlorophyll a, pH), heavy metals and total suspended solids. In general, the Middle Slough has better water quality than the Upper and Lower Slough. Water temperatures are generally cooler in the Middle Slough, due in large part to cool groundwater inputs.



The Middle Slough provides habitat for numerous fish and wildlife species including Willow Flycatchers, belted kingfishers, great blue herons, common merganser, river otter, nutria and beaver are some of the wildlife species that routinely use this riparian area.

Habitat in the Middle Slough is affected by nearby development. Industrial development, including buildings, loading areas and parking lots, encroach into the riparian area fragmenting habitat and reducing shade potential from riparian vegetation. Cornfoot Road, north of the Middle Slough between NE 47<sup>th</sup> Avenue and Alderwood Road, is in close proximity (between 25 and 100 feet) of the waterway and impacts riparian vegetation, wildlife habitat and water quality.

The Middle Slough in this area is part of the Special Habitat Area CS16:D South Arm Complex – Little Four Corners because it is an active groundwater upwelling area with visible springs; is surrounded by a bottomland hardwood forest; and provides a wildlife habitat connectivity corridor.

#### Whitaker Slough

Whitaker Slough is a southern arm of the Middle Columbia Slough. Approximately one half mile of the Whitaker Slough channel extending from I-205 to Little Four Corners is located in this inventory site. Whitaker Slough has significant areas of groundwater upwelling. The cool groundwater helps to moderate summer water temperatures. Cool water is a basic requirement for many aquatic species.



A narrow strip of riparian vegetation, two to three trees deep, surrounds Whitaker Slough. At Little Four Corners, where the main arm Middle Slough and Whitaker Slough join, the riparian area is wider with a closed tree canopy. The dominant tree species in the riparian area include black cottonwood and red alder along with a heavily mixed understory of planted native trees and shrubs. Species present include: Douglas-fir, western red cedar, snowberry, red-flowering currant, red-osier dogwood, Indian plum, Oregon grape, Nootka and swamp rose, and vine maple. Invasive plant species found in the riparian area include Himalayan blackberry, Japanese knotweed and reed canary grass. Leaf litter is the primary ground cover component with some grass, palmate coltsfoot, shining geranium, creeping buttercup, and ivy. The established tree canopy and overhanging shrubs shade the waterway in many places, reducing in-stream water temperatures during the summer and creating a localized microclimate affect that is beneficial for many wildlife species. The surrounding land uses are primarily industrial and commercial and are located in close proximity to the waterway.

Wildlife using Whitaker Slough and the riparian area include beaver, nutria, coyote, great blue heron, great horned owl, goldfinch, black cap chickadee, Oregon junco, robin, violet-green swallow, Cooper's hawk and American wigeon.

Whitaker Slough has been designated Special Habitat Area CS16:D South Arm Complex – Little Four Corners because it is an active groundwater upwelling areas with visible springs; is surrounded by a bottomland hardwood forest; and provides a wildlife habitat connectivity corridor.

#### Prison Pond

Prison Pond is a 14-acre open water wetland in the upstream portion of Whitaker Slough. The wetland pond is created by a water control structure at the terminus of NE 112<sup>th</sup> Avenue. Prison Pond features includes groundwater upwelling and visible springs. The riparian area is comprised of a cottonwood gallery forest with large dogwood thickets as well as Doug fir, Western red cedar, grand fir, black hawthorn and red elderberry. Understory is snowberry, Oregon grape, and sword fern with Himalayan blackberry, English ivy, butterfly bush, English laurel, and bird cherry present. There are several large Oregon white oaks near the Little Four Corners area. Near NE 112nd Avenue there is less standing water and more herbaceous vegetation; riparian areas are primarily shrubland vegetation with a high presence of invasive species.



A secondary drainageway crosses NE 112<sup>th</sup> Avenue and discharges into Prison Pond. The vegetation surrounding the channel is primarily black cottonwood with little understory other than Himalayan blackberry.

Birds observed at Prison Pond include: hooded merganser, starling, song sparrow, Anna's hummingbird, house finch, black-capped chickadee, downy woodpecker, and red tail hawk.

Yard debris dumping has occurred at the terminus of NE 112<sup>th</sup> Avenue and behind the prison. The pond is also impacted by the proximity of existing buildings, loading yards, parking lots and driveways.

Prison Pond is part of the Special Habitat Area CS16:D South Arm Complex – Little Four Corners because it is an active groundwater upwelling areas with visible springs; is surrounded by a bottomland hardwood forest; and provides a wildlife habitat connectivity corridor.

#### Mays Lake

Mays Lake is a six-acre pond located north of NE Airport Way and by NE Glen Widing Drive. There is a water quality facility east of the pond and a drainage ditch connecting the facility to Mays Lake. The pond is surrounded by woodland vegetation consisting of black cottonwood trees ranging from 6-18 inch diameter and an understory shrubs of red osier dogwood and snowberry, with the dogwoods mostly occurring in the shallowly graded east and west ends of the pond and the snowberry mostly resident along its northern bank. Himalayan blackberry is also a strong constituent in the understory of the woodland area as well as along the southwestern bank of the pond near its outfall. There are several large English walnut trees at the westernmost end of the woodland. Two weedy vines, Japanese honeysuckle and wild clematis, are also present in limited quantities. Herbaceous ground cover is patchy consisting primarily of cleavers, ivy, and reed canary grass.



The woodland provides cover, food and water for songbirds, amphibians and mammals. The site has potential for osprey roosting, perching, feeding and nesting due to its proximity to the Columbia River. Wildlife observed in spring 2009 at Mays Lake include: tree frog, scrub jay, stellar jay, bushtit, starling, robin, red-wing blackbird, Canada goose, ring-necked duck, Oregon junco, blackcapped chickadee, and song sparrow.

#### Ainsworth Wetland

Located along NE Ainsworth Circle, south of NE Airport Way, is a one-acre wetland and surrounding riparian vegetation. Historically this area was an oak savannah grassland. In past inventories the area was discussed as providing habitat for cavity nesting birds including great horned owl, American kestrels and northern flickers.

Currently, the small natural resource area is surrounded by parking lots, roads and buildings. The wetland vegetation is comprised of black cottonwood, Oregon ash and Pacific willow, with an understory of tall Oregon grape, swamp rose, Pacific ninebark, Himalayan blackberry, reed canary grass and poison hemlock. Some large snags are also present.



To the north of the wetland is a stand of large black cottonwood and Oregon ash trees with little understory. A potential wetland is located in the middle of the tree canopy; it is identified by the presence of cattail. The grassy field is maintained turf grass with a perimeter walking trail.

Birds observed in spring 2009 at the wetland and forested areas include: red-winged blackbird, brown creeper, American goldfinch, house finch, northern flicker, European starling, song sparrow, and Anna's hummingbird.

## 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 #). 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 the Methodology Overview section of this report and the *Natural Resource Inventory Update: Riparian Corridors and Wildlife Habitat* (City of Portland, 2008).

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 portions of the Middle Columbia Slough, Whitaker Slough, vegetated and non-vegetated flood area, riparian forest with associated shrub and groundcover, as well as other types of vegetation that contribute to the riparian functions as detailed in the natural resource description. These landscape features provide the following riparian functions:

- 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 assigned to the main and southern arm Columbia Slough, secondary drainageways and wetlands and portions of the riparian forest and woodland vegetation. Riparian forests and areas of dense tree canopy receive a high or medium relative ranks depending on proximity to open water. Medium and low relative ranks are generally assigned to lower structure riparian vegetation located proximate to the drainageways and wetlands. Other areas are assigned a high, medium or low relative rank depending on the proximity and extent of vegetation relative to the water body (CS6 Map 4).

### Wildlife Habitat

A wildlife habitat patch is, for purposes of the inventory model, defined as forest and/or wetland areas, 2 acres in size or greater, plus 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.

Based on the wildlife habitat model criteria, a medium relative rank is assigned to forested areas along the Columbia Slough and Whitaker Slough and to wetlands and associated forest vegetation, reflecting patch size, interior area and proximity to water and other patches.

### Special Habitat Areas (SHA) descriptions

SHAs 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 (CS6 Map 5).

The Little Four Corners area, which includes the confluence of the Middle Columbia Slough and Whitaker Slough, is designated a SHA because it is surrounded by bottomland hardwood forest, is a wildlife habitat connectivity corridor and is a significant area of groundwater upwelling. Little Four Corners meets the following SHA criteria: bottomland hardwood forest (B); migratory stopover habitat (M); wildlife connectivity corridor (C); resources or structure that provides unique habitat function in natural or built environment (U).

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 (CS6 Map 6).

**Table 29: Summary of Ranked Resources in CS6: Little Four Corners**

<b>Total Inventory Site = 522 acres</b>				
	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Total</b>
<b>Riparian Resources**</b>				
acres	57	20	14	91
percent total inventory site area	11	4	3	18
<b>Wildlife Habitat</b>				
<b>Wildlife Habitat**</b>				
acres	0	51	0	51
percent total inventory site area	0	10	0	10
<b>Special Habitat Areas**</b>				
acres	43			
percent total inventory site area	8			
<b>Wildlife Habitat - adjusted by Special Habitat Areas ***</b>				
acres	43	12	0	55
percent total inventory site area	8	2	0	10
<b>Combined Total*</b>				
acres	59	19	13	91
percent total inventory site area	11	4	3	18
** High-ranked riparian resources, Special Habitat Areas, and wildlife habitat includes the Willamette 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.				

**DRAFT**

## Site CS6 - Map 1: Little Four Corners

### 2007 Aerial Photography

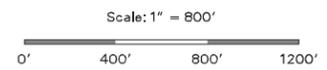
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary



**INFORMATION SOURCES:**

**Aerial Orthophotographs:**  
Natural color and color infrared ortho-rectified digital imagery from flight in June of 2007. Photography has been rectified to adjust for curvature of the earth. Not registered to taxlot base map.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.









## Site CS6 - Map 3: Little Four Corners

### Vegetation Features

#### Vegetation Types

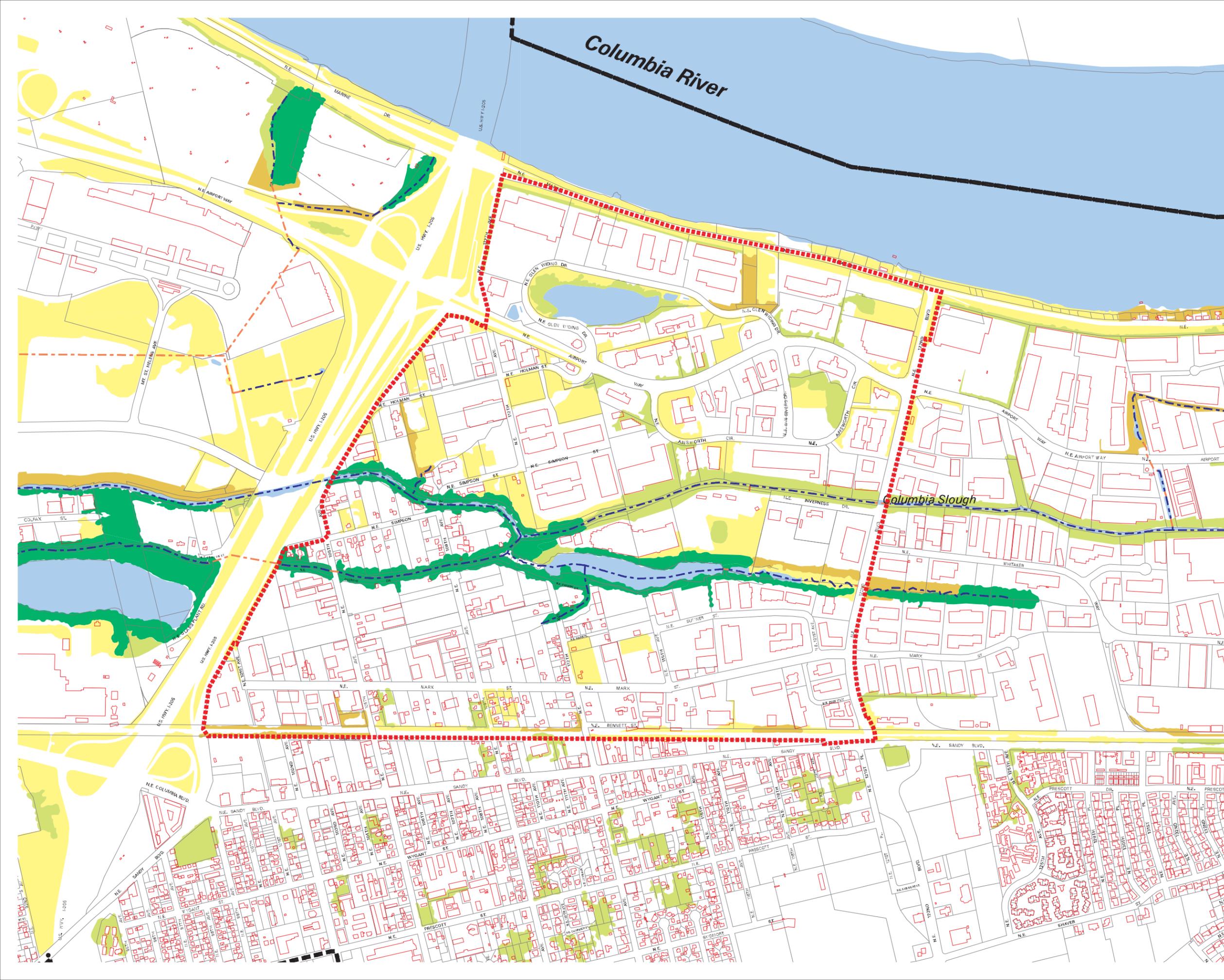
-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

Vegetation patches:  
Vegetation patches larger than 1/2 acre mapped by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, Parks and Recreation natural area assessments, and vegetation surveys along the banks of the Willamette and Columbia rivers. Vegetation patches are classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland. Updated through summer of 2004.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'  
0' 400' 800' 1200'





## Site CS6 - Map 4: Little Four Corners

### Riparian Resources Relative Rankings

- High relative rank
- Medium relative rank
- Low relative rank
- Stream/Drainage
- Culvert or Piped
- Site Boundary
- City Boundary
- Urban Services Boundary

#### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

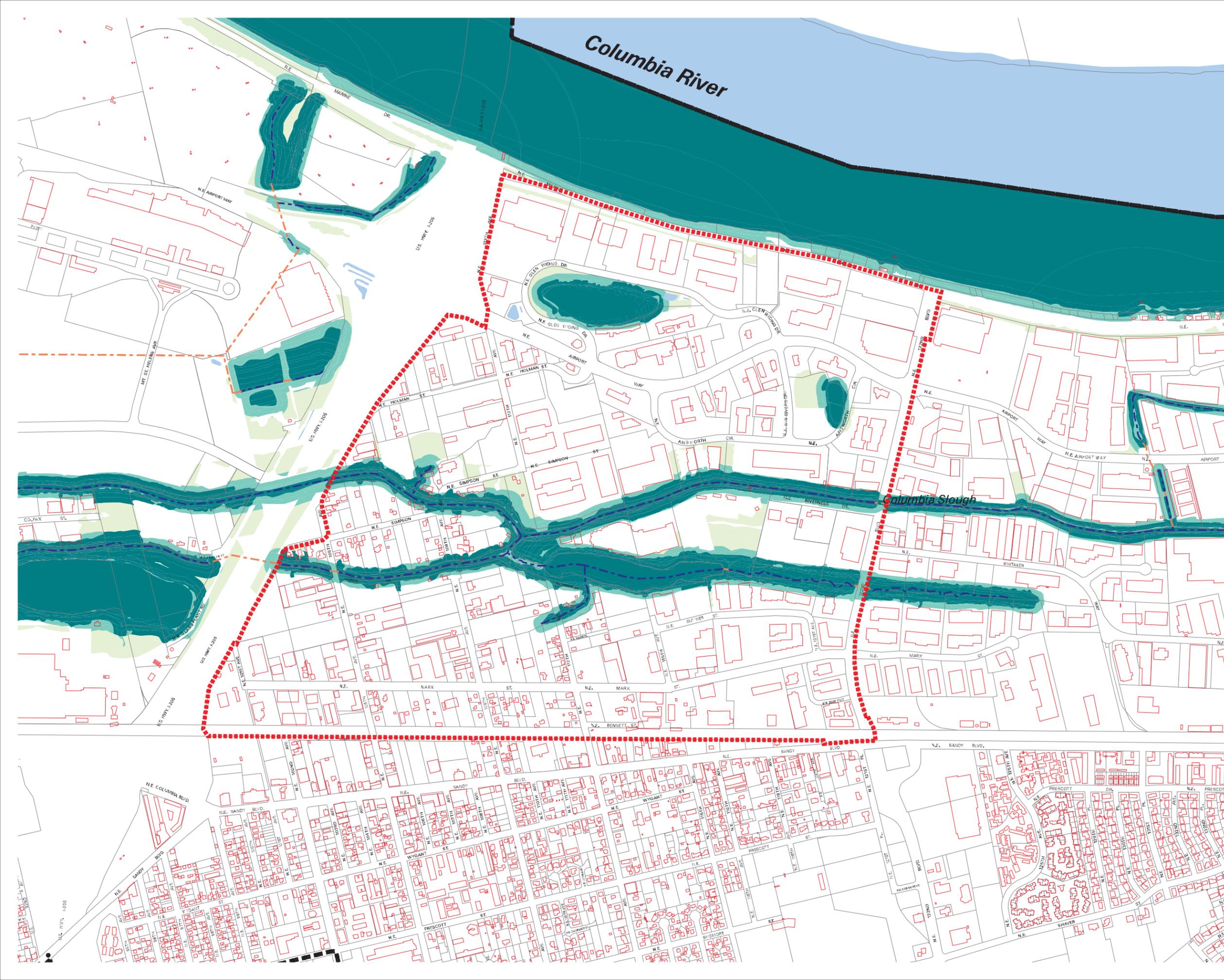
For more information, please visit our website:  
<http://www.portlandonline.com/planning/index.cfm?c=40437>

NOTE: Portland's resource inventory is still being evaluated for accuracy and consistency and should be considered preliminary. The inventory has not yet been adopted by the City of Portland.

All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS6 - Map 5: Little Four Corners

### Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative value
-  Medium relative value
-  Low relative value
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

**INFORMATION SOURCES:**

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

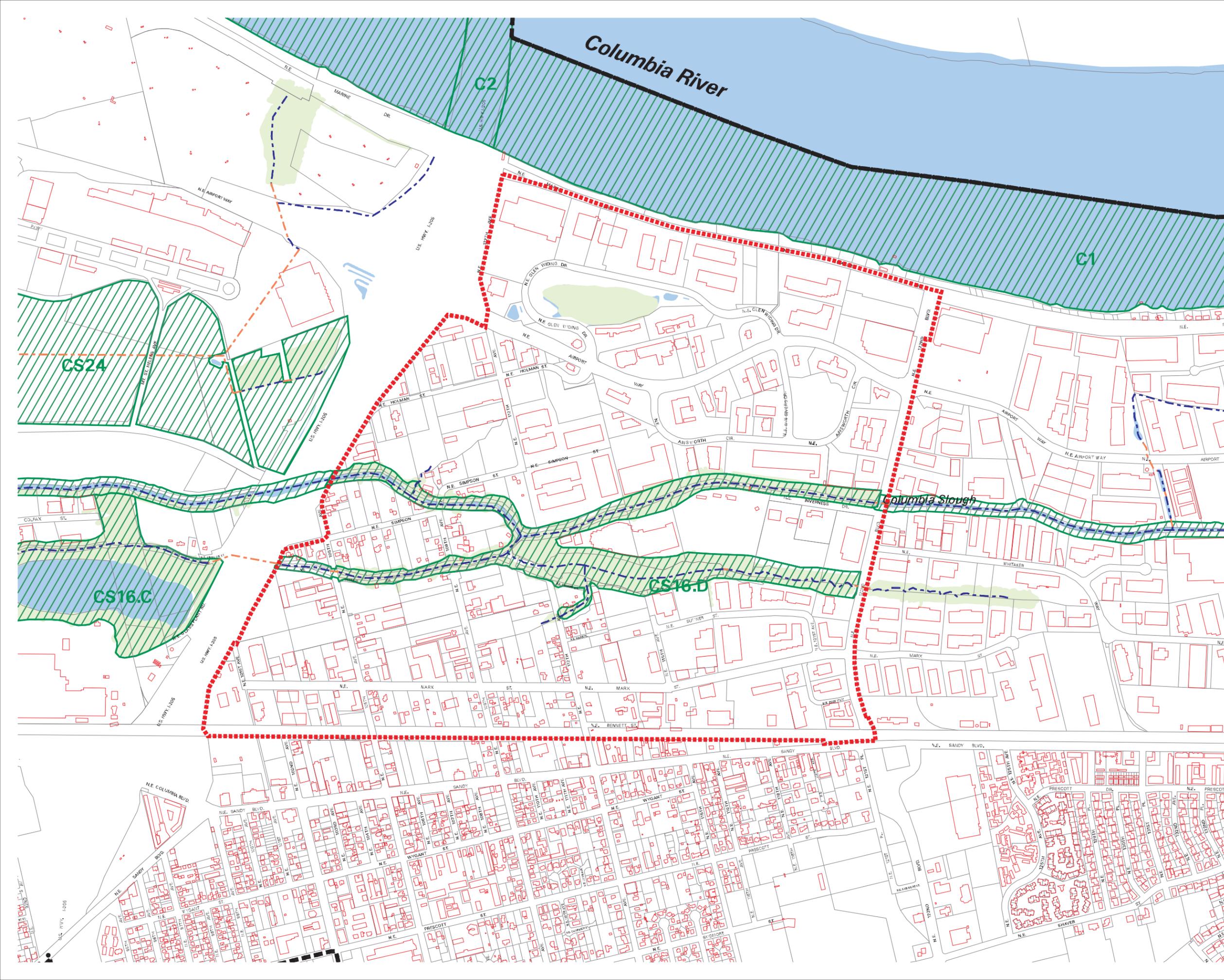
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All data compiled from source materials at different scales. For more detail, please refer to the source materials or City of Portland, Bureau of Planning & Sustainability.

Scale: 1" = 800'

0' 400' 800' 1200'





## Site CS6 - Map 6: Little Four Corners

### Combined Riparian / Wildlife Habitat Relative Rankings

-  High relative value - Special Habitat Areas \*\*
-  High relative rank
-  Medium relative rank
-  Low relative rank
-  Stream/Drainage
-  Culvert or Piped
-  Site Boundary
-  City Boundary
-  Urban Services Boundary

#### INFORMATION SOURCES:

The Natural Resources Inventory Update (NRIU) is a citywide project to revise and update existing natural resource inventories (of trees, streams, wildlife habitat, etc.) in Portland. The update is part of Portland's River Renaissance Initiative to ensure that the Willamette River and its tributary watersheds are clean and healthy.

\*\* SHA ranking supercedes lower relative values.

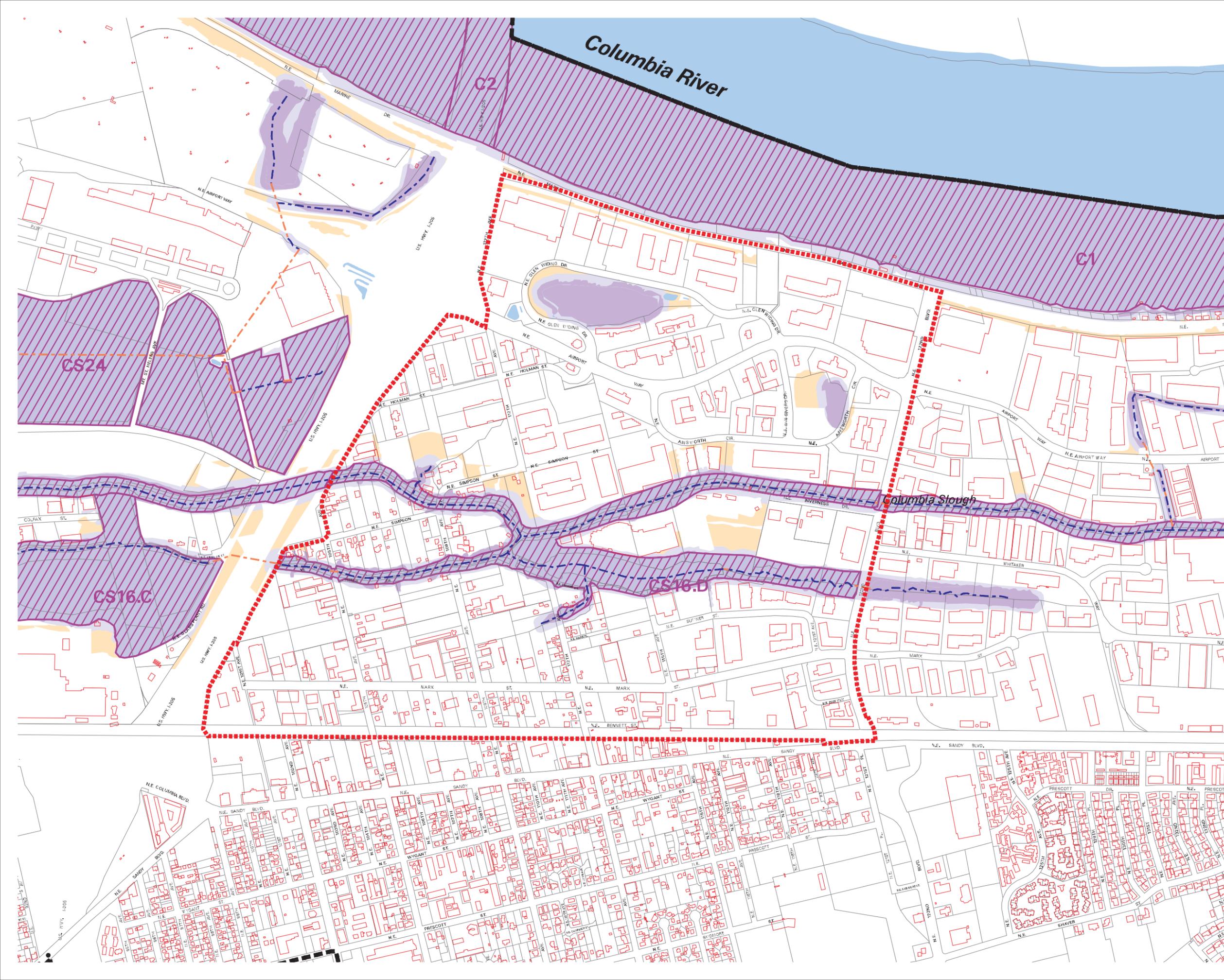
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Scale: 1" = 800'

0' 400' 800' 1200'





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